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THE IMPACT AND CRISIS MANAGEMENT OF COVID-19: AN ANALYSIS OF LARGE MANUFACTURING FIRMS IN PENANG

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ABSTRACT

This paper examines the impact of COVID-19 and movement control orders on large manufacturing firms in Penang, a major industrial hub in Malaysia with notable participation in the global value chain. It also identifies the response strategies undertaken by these firms during the crisis. The study employs an exploratory qualitative research analysis based on purposive sampling techniques to gather data using online semi-structured expert interviews with 22 large local and foreign manufacturing firms in Penang. The findings suggest that most firms expected a loss of business revenue, disrupted supply chains, employee redundancies, and increased government support. The most popular measure taken by large manufacturing firms was the *persevering and innovation strategy*, with none choosing *pure persevering* as the sole strategy to combat the crisis. The study provides insights into the strategic responses undertaken by large manufacturing firms. It also includes government, industry, and policymakers' input to suggest policy interventions for future crisis management.

Keywords: COVID-19, crisis management, large manufacturing companies, Penang, supply chain

INTRODUCTION

Since the late 1960s, industrialisation has played a pivotal role in the economic growth of Penang. As the second-smallest state in Malaysia, Penang is a major industrial hub with notable participation in the global manufacturing value chain. The sector accounted for an average of 43% of Penang's GDP from 2015 to 2019 and has continued to record positive annual growth rates between 2.7% and 9.5% in the corresponding period.

Looking at the present state of Penang's economy, its GDP achieved the highest growth in Malaysia at 6.8%, surpassing the national GDP growth of 3.1% in 2021. The manufacturing sector was the main growth driver, expanding at 12.4%, with the electrical and electronics (E&E) sub-sector contributing more than one-third of its GDP. The E&E subsector also created the highest value added in Malaysia and recorded the largest salaries paid for each person engaged in this industry. The state's GDP per capita has also flourished by 6% in 2021 compared to the pre-pandemic level in 2019, from RM55,202 (US$13,495) to RM58,527 (US$14,044) in 2021.

The value-added of Penang's manufacturing sector grew by 8.8% annually from 2015-2017, surpassing the growth rate of 5.1% in Selangor and 6.9% at the national level. Furthermore, the importance of Penang's manufacturing sector is also reflected by the robust trade in goods undertaken at the entry points of the airport and seaport located in Penang. In 2020, Malaysia's exports of electrical and electronics (E&E) increased by 45.6% to reach RM386.1 billion. Exports from all of Penang's custom points recorded a 6.5% growth, reaching RM310.1 billion during the same period. Astoundingly, Penang's airport customs handled the highest export goods in Malaysia by value, growing by 9.9% in 2020 – the only trade channel in Malaysia showing a positive export growth rate during the pandemic. The exceptional performance is primarily attributed to the strong global demand for machinery and transport equipment. The diverse range of exported products cut across medium and high-tech range industries from E&E, medical devices, machinery, and equipment (M&E), and automation.

Penang has highly benefitted from the strong footprint of Penang-based foreign E&E manufacturers. The state's 50th year of industrial excellence has successfully transformed the local manufacturing ecosystem into globally important and robust semiconductor supply chains. This compelling advantage attracts foreign investors to continue investing in expanding the state facilities along with a strong talent pool (MIDA, 2022). In 2021, Penang registered the highest value of approved manufacturing investment at RM76.2 billion, despite the COVID-19 challenges.

Understanding how Penang's manufacturing firms have managed to remedy the business challenges brought on by COVID-19 provides lessons for individual firms in different industries in managing crises. It is imperative to study the unprecedented impacts on Penang's manufacturing sector, with a high concentration of high-tech E&E manufacturing industries in the country. It is the strategies that these firms undertake when tackling unprecedented business operation disruptions, supply chain distribution and employment realignment in the future. The questions to be pursued in this paper are: (1) What are the effects of COVID-19 on large manufacturing firms[1] in Penang? (2) What are the responses taken by these firms in the early periods of MCO in Malaysia?

[1] The definition for large manufacturing firms include: (1) firms with sales turnover exceeding RM50 million or with full-time employees exceeding 200 (as defined by SME Corporation), (2) entities that are public-listed on the mainboard of Bursa Malaysia, or (3) subsidiaries of multinational corporations (MNCs), government-linked companies (GLCs); Minister of Finance Inc., Malaysia companies or state-owned enterprises.

This paper examines the implication of lockdown policies on manufacturing firms using Penang as a case study. We investigate how firms respond to sudden lockdowns. Section 2 provides a brief literature review of the theoretical background of organisations' responses to crises. Section 3 presents the lockdown policies and the COVID-19 situation in Malaysia and Penang. Section 4 describes the methodology employed and data collection. Section 5 presents results with a focus on business challenges and crisis responses. Section 6 summarises and concludes by highlighting the implications of the results to future crises.

THE THEORETICAL BACKGROUND OF ORGANISATIONS' RESPONSES TO THE CRISIS

An organisational crisis refers to an event with a rare chance but high impact that threatens the sustainability of the organisation. These events are characterised by ambiguity in their cause, effect, and potential resolutions, requiring quick decision-making (Pearson and Clair, 1998). Wenzel et al. (2020) explained that a crisis can seriously affect the operations and survival of firms and industries, leading to massive job losses and social precarity. The COVID-19 crisis exhibits such characteristics. Responses to these crises are subject to the disparate governance regimes of the affected nations, states and regions.

According to Wenzel et al. (2020), the four strategies for crisis management include retrenchment, persevering, innovating, and exit. Retrenchment, or rationalisation, involves implementing cost-cutting measures that may reduce a company's business activities. Although retrenchment can be a short-term strategy with lower risk (Sternad, 2012), evidence of its long-term effects shows mixed results (Wenzel et al., 2020; Sternad, 2012; Santana et al., 2017). Negative effects may include the loss of synergies resulting from retrenchment.

Secondly, persevering refers to maintaining the 'status quo' of a firm's business activities in crises. Persevering is one of the most common approaches firms adopt (Do et al., 2021; Wenzel et al., 2020) and is a feasible choice for responding to a crisis (Wenzel et al., 2020). However, it may also involve a trade-off of pursuing organisational changes during a crisis. In a study of firms during the Asian financial crisis (1997/1998), Chakrabarti (2015) proposed that preservation allowed firms to survive better than using limited resources for restructuring, even when aimed at growth purposes.

Wenzel et al. (2020) noted that business innovation is a strategic response that could strengthen firms for the future and may have sustainable effects. Firms that innovate during crises are the most dynamic ones (as their survival depends on the continued renewal of products and services), and new innovators (with a likelihood of smaller or new firms that capitalise on the crisis to change their products and services) (Archibugi et al., 2013).

In a study by Kuznetsov and Simachev (2010) on determinants of innovation activities of Russian manufacturing firms during a crisis, they found that the impact of a crisis on innovation differs between industries. About 30% of manufacturing firms still pursued innovation during the crisis, which is not dependent on industry or financial position. However, this contrasts with Wenzel et al. (2020), which state that low liquidity might limit innovation.

The exit strategy refers to discontinuing a firm's business activities (Wenzel et al., 2020), portfolio planning, corporate restructuring and divestiture (Burgelman, 1996). The firm executives might be hesitant to pursue an exit strategy due to concerns about the associated stigma of failure or the perception that it reflects inadequate corporate management. However, an exit strategy can create

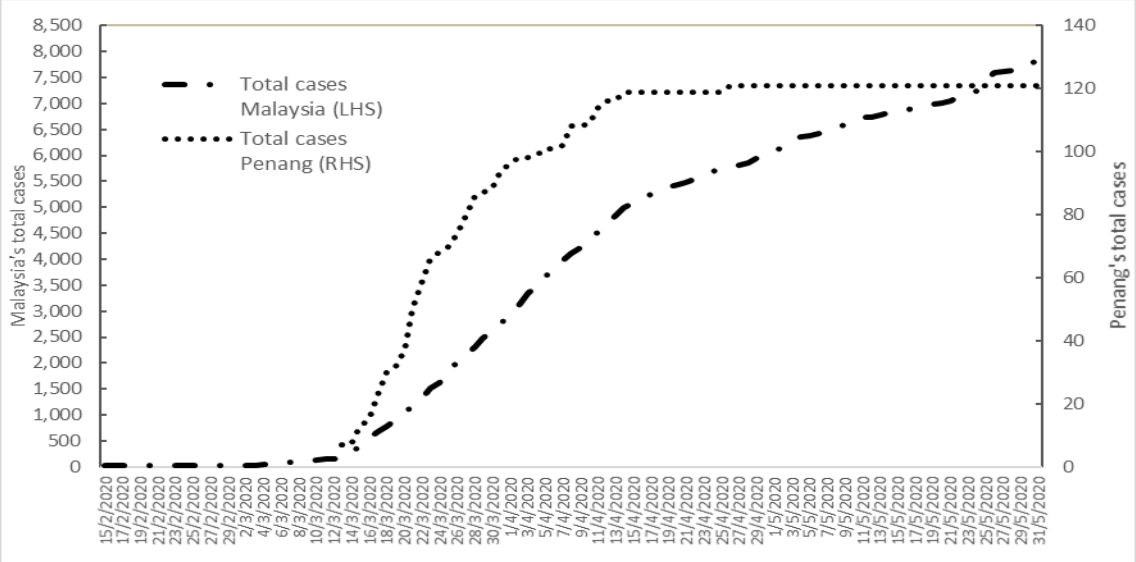
value for the company (Decker and Mellewigt, 2007) by freeing up resources that can later be reused to pursue crisis-induced business opportunities. The COVID-19 pandemic prompted firms to employ the exit strategy (Wenzel et al., 2020). Miyakawa et al. (2020) found that COVID-19 potentially increased firm exits by around 20% compared to the previous year, assuming the recent reduction in firm sales is temporary.

LOCKDOWN POLICIES AND THE COVID-19 SITUATION IN MALAYSIA

The surge in COVID-19 cases brought all positive growth to a standstill. Malaysia's first COVID-19 case was detected on February 15, 2020. The virus spread quickly and widely in early March 2020, surpassing 100 cases, and the first COVID-19 case reported in Penang was on March 13, 2020 (Figure 1). As part of containment measures, Malaysia implemented its first-ever movement control order (MCO) on March 18, 2020, suspending all economic activities except for essential services listed in Table 1. While some manufacturing activities listed in the essential sectors are allowed to operate, the lockdown has caused unprecedented challenges for manufacturers in logistics, material sourcing, and human resources. To fulfill the growing demand for electronics and medical products, manufacturers have adopted new operating strategies to tackle uncertainties and disruptions while adhering to the containment guidelines set by the Malaysian government.

Figure 1

Total cases of COVID-19 in Penang and Malaysia, February 15, 2020 – March 31, 2020



Source: Authors' compilation, based on data from the Ministry of Health, Malaysia.

Workforce disruption has contributed significantly to economic losses during the pandemic (Santos et al., 2022). As a result of business closures due to continued lockdown exercises to contain the spread of the coronavirus, workers faced redundancy. The travel and tourism industries were hit particularly hard, and non-essential manufacturing sectors such as textiles, furniture, wood and clothing were also affected. In Penang, over 10,000 workers lost their jobs in 2020, representing 1.3% of total employment. While the manufacturing sector saw the highest number of workers retrenched (5,219 workers affected, including 2,852 involved plants and machine operators and assemblers), the professional, scientific and technical activities were most affected, with 7.2% of Penang's employment in that sector becoming redundant in comparison to 5.1% from electricity and gas and

4.9% in information and communication technology. Interestingly, high-skill occupations (managers, professionals and technicians, and associate professionals) accounted for 48.3% of total retrenchment, compared to 43.5% for mid-skill occupations (services and sales workers, crafted and related trades work, clerical support workers, and plants and machine operators and assemblers), and 5.7% for low-skill occupations (elementary workers).

The biweekly extensions of the MCO intensified the disruptions in the local manufacturing supply chain, which had already been affected by the Wuhan lockdown in January 2020. Today's manufacturing value chain is fragmented into various phases in specific plants worldwide (Amador and Di Mauro, 2015). As more than one-third of Penang's economy is driven by E&E manufacturing, its activities were disrupted with permission to operate on a specific schedule. As a result, manufacturers in Penang faced delays in order fulfilment, fear of losing customers, and reduced business revenue (Ong and Lee, 2020).

Table 1

Details of MCO in Malaysia, 18-31 March 2020

Activities	**Details**
Activities that are prohibited and allowed	Essential services and sectors allowed to operate are: • Food and beverage items including imported items. • Agriculture and fisheries including imports. • Household products • Personal Protective Equipment (PPE) including fire safety equipment and medical attire, including face masks, rubber gloves, etc. • Pharmaceuticals – all chemical and drugs production • Packaging materials and printing including ink • Medical and surgical devices • Parts for medical devices, e.g. parts for ventilators Products that are part of the supply chain for essential goods are exempted from the restriction of movement: Oil and gas, petrochemicals, chemicals and chemical products, E&E including semiconductors. Services: Banking and finance, electricity and energy, fire, port, dock and airport services and undertakings, including stevedoring, lighterage, cargo handling, pilotage and storing or bulking of commodities, postal, prison, production, refining, storage, supply and distribution of fuel and lubricants, healthcare and medical, solid waste management and public cleansing, radio communication including broadcasting and television, telecommunication, transport by land, water or air, including e-hailing, water, essential services provided by the government, defence and security, industries and businesses related to defence and security, food supply, groceries, online services, e-commerce, wildlife, hotels and accommodations. All non-essential services and sectors not allowed to operate.
Percentage	• 50% or less workforce for essential sectors only is allowed to work at a premise. • Work-from-home, flexible or alternating working arrangements are encouraged

allowed to work	
Travel restrictions	Interstate and international travel prohibited

Source: Authors' compilation, based on data from the National Security Council.

THE IMPORTANCE OF PENANG'S MANUFACTURING SECTOR TO NATIONAL OUTPUT

Penang chartered its industrialisation journey under the leadership of Penang's second Chief Minister, Tun Dr. Lim Chong Eu, from 1969-1990, with close consultation with the Malaysian Federal government. In 1971, a Free Trade Zone (FTZ) was established through the gazettement of the Free Trade Zone Act. The state successfully attracted foreign direct investments (FDI) from eight companies: National Semiconductor, Advanced Micro Devices (AMD), Intel, Osram, Hewlett Packard, Bosch, Hitachi, and Clarion, into the Bayan Lepas FTZ (Athukorala, 2014). Penang is the regional hub for the E&E industry, with its FDI contributing over 80% of the state's total approved manufacturing investments.

Be it as it may, Penang remains vulnerable to fluctuations in global politics and economics. For example, during the 1997-8 Asian Financial Crisis, Malaysia's manufacturing sector, including Penang, contracted severely, with a negative growth of 13.4% in 1998 (Figure 2) due to the mismanagement of exchange rate policy and a diversion of manufacturing investment (Islam, 2001). Due to an industry-wide slowdown, the E&E exports from Malaysia, to which Penang largely contributes, were also subdued during the crisis (Rasiah et al., 2014).

The worst impact in history occurred during the 2008-9 Global Financial Crisis, with Penang experiencing an even deeper contraction than the national average, at 19.4% compared to 9% nationally in 2009. This was attributed to Penang's strong trade linkages to US companies, as many US offshore companies in the E&E industry are located in Penang. The local supply chain was disrupted, followed by employee redundancy.

While those were temporary economic bottlenecks, local industries also benefitted from FDI when many ancillary companies could meet major firms' supply chain demands in the 1970s and 1980s. Industries providing essential support to foreign direct investments (FDIs) encompass various sectors, such as manufacturers of stamped metal components, automation equipment, jigs and fixtures, machine tools, and molded rubber products (Athukorala, 2014; Rasiah, 2002). These supporting industries play a crucial role in facilitating and bolstering the operations of FDIs. The textile and garment industry also prospered, followed by the plastics and chemicals sectors developed in the 1990s.

In the past half a century of industrialisation, over 1,000 MNCs (Poh and Tan, 2012) and more than 3,000 supporting small and medium enterprises (SMEs) have chosen Penang as their investment and operations destination (InvestPenang, 2020). The manufacturing sector in Penang has been a significant contributor to Malaysia's growth and is recognised as a pillar of growth for the state. Since the 2000s, the sector has shifted towards higher value-added activities, including research and development (R&D), integrated circuit (IC) design, wafer fabrication, engineering support services, as well as digital consumer goods and low volume high complexity and high mixed products in E&E, aerospace and medical devices. In the Fourth Industrial Revolution (IR4.0) era, Penang is projected to focus on robotics, enterprise analytics, autonomous automation, process connectivity, and equipment efficiency optimisation (Penang Institute, 2017).

Being the largest E&E hub in Malaysia, the industry has transitioned from producing labor-intensive, low-technology, and low-value-added products to capital-intensive, knowledge-based high-tech products. To achieve this, the Penang Skills Development Centre (PSDC) was established in 1989 as a tripartite industry-led skills training and education center, with a joint effort between government, academia and industry. The center's goal is to produce a skilled workforce that caters to the needs of manufacturing industries in E&E and other support-related manufacturing services, such as automation, medical devices, and precision engineering.

DATA AND METHODOLOGY

Based on the research conducted in Penang, Malaysia, during March and April 2020, there was a pressing need to respond to the increasing number of coronavirus cases and the implementation of MCO. Throughout this period, manufacturing firms played a crucial role in providing real-time effects of the crisis, prompting the swift implementation of measures to mitigate its impact. Due to the imposition of the MCO and key management personnel's increased time and efforts to manage the situation, face-to-face interviews were not feasible, as Kraus et al. (2020) reported. Key management personnel are participants with the best knowledge of the study topic, as highlighted in Morse et al. (2002).

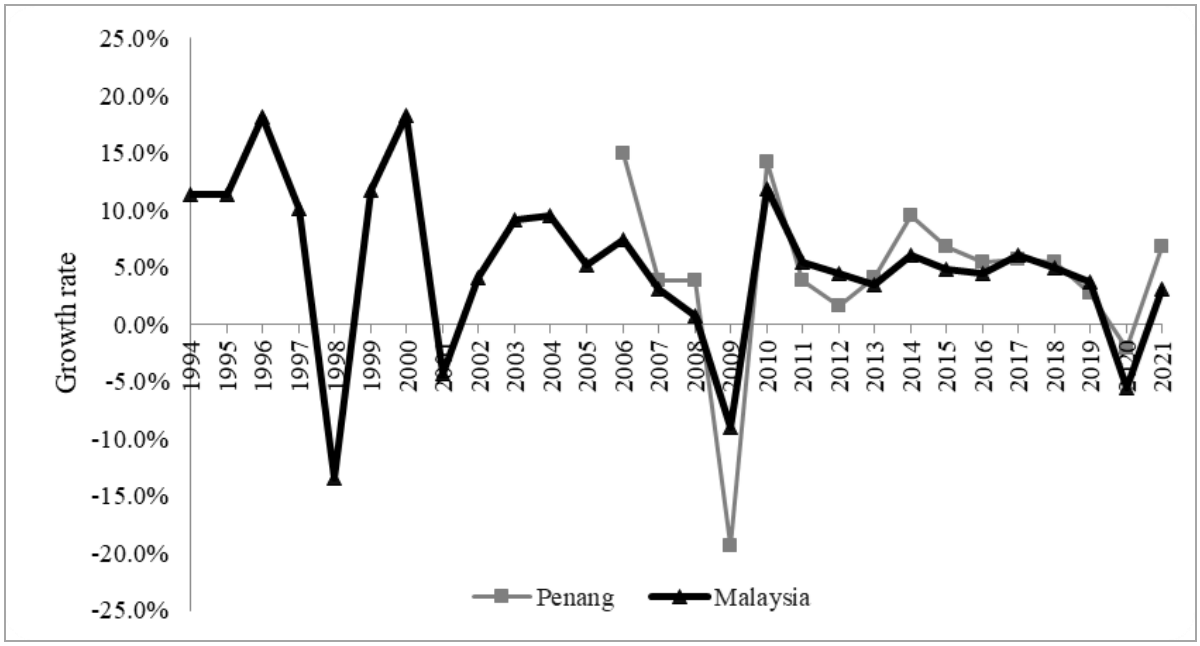
An online semi-structured expert survey was employed using a purposive sampling technique to collect the data (Robinson, 2014; Seawright and Gerring, 2008). A set of open-ended qualitative questionnaires was developed and disseminated to the key management team members of the large manufacturing firms in Penang through business associations (Federation of Malaysia Manufacturers (FMM) and Association of Malaysian Medical Industries) and government agencies (InvestPenang and Penang Institute). This approach allowed for maximum variation, following the principles of appropriateness and adequacy (Robinson, 2014; Seawright and Gerring, 2008). The questionnaire gathered firms' responses to the business, the operational impact of COVID-19 on the manufacturing supply chain and measures taken by firms, business projections, and their perspectives on government policy.

Similarities and contrasts of the respondents were analysed across industries. A total of 22 respondents were collected following the grounded-theory qualitative sampling by Creswell and Poth (2016) and Robinson (2014), representing large manufacturing firms in Penang, located in key industrial parks in Bayan Lepas Industrial Park (South-West district), Batu Kawan Industrial Park (South Seberang Perai district), Prai Industrial Park (Central Seberang Perai district), and Bukit Minyak Industrial Area (Central Seberang Perai district). The respondents were primarily headquartered in Malaysia (59.1%), followed by the United States (18.2%). Table 2 provides an overview of respondents' and companies' profiles.

The company's particulars, including firm size, headquarters, number of employees, year of foundation in Penang, and industry classification, were enquired and classified accordingly. Second, the responses were transcripts and data were independently coded and categorised. Data were iteratively analysed until common themes were identified. The identified themes were analysed in line with perspectives in the literature (Creswell and Poth, 2016), specifically in terms of analysing firms' strategic responses to crises based on the framework of Wenzel et al. (2020) and Kraus et al. (2020).

Figure 2

Annual percentage change of GDP for manufacturing sector in Penang and Malaysia



Note: The percentage rate of change for 1994-2000 was based on 1987 constant prices; the percentage rate of change for 2001-2005 was based on 2000 constant prices; the percentage rate of change for 2006-2010 was based on 2005 constant prices; the percentage rate of change for 2011-2015 was based on 2010 constant prices; and the percentage rate of change for 2016-2019 was based on 2015 constant prices.
Source: Department of Statistics, Malaysia.

Table 2

Overview of the firms' characteristics

Respondent	Company's headquarters	Industry	No. of employees	Year of foundation in Malaysia	Respondent's designation
R1	United States	Machinery & Equipment	200	1995	Finance Director
R2	Malaysia	Electrical & Electronics	650	2000	Managing Director
R3	Malaysia	Medical Devices	250	1973	Executive Director
R4	Malaysia	Electrical & Electronics	300	1990	Assistant Manager Human Resource
R5	Malaysia	Basic Metal products	65	1990	General Manager

R6	Malaysia	Electrical & Electronics	100	1984	Corporate Secretary
R7	Malaysia	Food Processing	100	1961	Executive Director
R8	Malaysia	Engineering Support	20	2001	General Manager
R9	Malaysia	Machinery & Equipment	150	2010	-
R10	US	Electrical & Electronics	700	2001	Director
R11	A country in central Europe[a]	Electrical & Electronics	250	2016	Managing Director
R12	United States	Electrical & Electronics	600	1988	Vice President
R13	Malaysia	Electrical & Electronics		1984	CEO, MD and Director
R14	Malaysia	Electrical & Electronics	500	1998	Managing Director
R15	Malaysia	Electrical & Electronics	650	1961	CEO and Managing Director
R16	Malaysia	Machinery & Equipment	80	1996	-
R17	Malaysia	Machinery & Equipment	140	1996	Managing Director
R18	France	Engineering Support	365	1989	General Manager
R19	US	Electrical & Electronics	180	1972	Senior Director
R20	Taiwan	Medical Devices	300	1998	Finance Manager
R21	Switzerland	Electrical & Electronics	150	2013	Representative from Finance Department
R22	Japan	Textile & Textile Products	1,300	1971	HR General Manager

Note: Given the limited number of companies from this country in Penang, the origin of this company is generalised to avoid individual identification to the respondent.
Source: Authors' compilation, data from International Trade Centre and Malaysian Industrial Development Authority

RESULTS AND DISCUSSION

This section presents an analysis of the major impacts of COVID-19 and MCO on manufacturers in Penang. These impacts are discussed in five dimensions: expected revenue losses, supply chain management, employee redundancy, government assistance, and expected recovery time. Additionally, the strategic responses of each firm to the COVID-19 crisis are characterised into three categories: persevering, innovation and retrenchment. Table 3 shows the results of the pandemic's impact on manufacturing firms.

The Impacts of COVID-19 on Manufacturers

(1) Expectation of Revenue Decrease

According to industry analysis, the textile and garments sector (R22) experienced the highest loss in revenue across all industries, with an estimated decline of 70-80%. As the tenth-highest export-earning industry, Malaysia's apparel market saw a double-digit drop of about 15% in revenue in 2020 (Kaniz et al., 2022). This decline was due to subdued demand for apparel and movement control measures. In Penang, two major textile companies reported closing down in Penang in 2020 (Penang Institute, 2021). This study also found that the medical devices industry was impacted during the MCO, with an expected revenue loss of over 50% (R3, R20). It is worth noting that Penang's medical device companies primarily focus on manufacturing orthopaedic and cardiovascular-related products (Lee, 2020). Manufacturing infectious diseases-related devices, especially personal protective equipment (PPE), is not a major focus of Penang's medical devices industry. During the MCO, demand for these products slowed down as non-urgent medical procedures were postponed to minimise the spread of the coronavirus.

Within the E&E sector, the estimated loss of revenue caused by MCO varied by types of manufacturing activities. Specifically, contract manufacturing, test and measurement, electronics components packaging, and communication equipment were the least-affected E&E industries, with less than 30% loss in business revenue (R10, R12, R14, R19). The manufacturing of precision machine components saw about a 30-50% decrease in their business revenue (R2, R4, R6, R11, R11). Meanwhile, manufacturing printed circuit boards and vacuum subsystems was the worst-hit industry (R15, R21), with an estimated 70% decrease in business revenue.

The severity of the business revenue loss depends on the duration of the crisis disruption impacting the operations and supply chain. R21 expects that "Business will be affected by 70% or more if MCO still restricts essential industries to operate at not more than 50% headcounts along with a halt of non-essential operations. The company will also be unable to operate due to supply chain breakdown." However, E&E manufacturing production ramped up quickly as the movement restrictions loosened, and the demand for electronic products such as tablets, laptops, smartphones and storage devices surged worldwide (Lynette and Toh, 2021).

According to the Ministry of International Trade and Industry (MITI, 2020), Malaysia's exports of E&E products rose about 16% in June 2020 (year-on-year). Its overall 2020 exports contributed the largest share of Malaysia's total exports at 39.4% or RM386.1 billion, with an increase of 3.5% compared to the previous year. Higher exports are seen in electronic integrated circuits, apparatus for transmitting or receiving voice and parts of electronic products that support work-from-home practices.

(2) Supply Chain Management

All respondents (R1-R22) reported that the MCO caused disruptions to their businesses' supply chain and operations. The sudden and unexpected lockdown in Malaysia fits the description of an organisational crisis in crisis literature. Although some sectors in the essential category, as specified by the government (Table 1), were allowed to operate during the MCO, the 50% maximum limit meant that disruption could not be avoided, even for medical devices and E&E industries. Even if operations were allowed to operate, all respondents underlined that their suppliers and supporting industries could not supply raw materials to them, except for R9, R10, R12 and R13. R9 highlighted that logistics during the MCO posed a challenge to the supply chain, as special logistics arrangements were required for raw materials from overseas.

China is a crucial raw materials supplier to companies operating in Penang, with most respondents stressing that the lockdown in China in January 2020 (prior to the MCO in Malaysia) did affect their raw material inventory levels. However, R7, R12, and R21 reported that they do not procure raw materials from China, while R8, R9, R10, R12, R16 and R19 shared that they are not heavily reliant on Chinese suppliers. Some respondents also pointed out that a significant amount of the raw materials supply is localised to domestic firms in Penang and Malaysia due to the pandemic.

Not all respondents were optimistic about the supply chain in the future. At least 17 respondents expected that there would be disruptions in the future due to prolonged MCO and new COVID-19 cases. On the other hand, R1, R5, and R8, all of which are in inter-related industries, are not expecting future supply chain disruptions other than the first MCO.

Table 3

Impact of COVID-19 and MCO and strategic responses of firms to the COVID-19 crisis

Case	Type of company	Business revenue affected	Impact of Covid-19 on					Strategic responses		
			Sales orientation	Supply management	Production management	Logistics management	Business diversion	Persevering	Innovation	Retrenchment
Basic Metal Products - R5	Local	40 - 50%	.	.	.		.	.	.	.
Electrical & Electronics - R2	Local	30% - 50%	.	.			.	.	.	
Electrical & Electronics - R4	Local	30% - 40 %	.	.				.		.
Electrical & Electronics -R6	Local	Almost 50%	.	.				.		.
Electrical & Electronics - R10	Foreign	Around 25%		.			.	.	.	
Electrical & Electronics - R11	Foreign	53%	.	.			.	.	.	
Electrical & Electronics - R12	Foreign	10% - 15%	.	.			.	.	.	
Electrical & Electronics - R13	Local	30%	.	.				.	.	

Note: "." Represents the firm that experienced the corresponding impact(s).

(continued)

Case	Type of company	Business revenue affected	Impact of Covid-19 on					Strategic responses		
			Sales orientation	Supply management	Production management	Logistics management	Business diversion	Persevering	Innovation	Retrenchment
Electrical & Electronics - R14	Local	20% - 50%	.	.				.	.	
Electrical & Electronics - R15	Local	70%	.	.			.			.
Electrical & Electronics - R19	Foreign	More than 25%	.	.	.		.	.	.	
Electrical & Electronics - R21	Foreign	70% or more	.	.	.		.	.	.	
Engineering support - R8	Local	40%	.	.	.			.	.	
Engineering support - R18	Foreign	40% - 50%	.	.		.		.	.	
Food processing - R7	Local	30%	.			.		.	.	.

Note: "." Represents the firm that experienced the corresponding impact(s).

(continued)

Case	Type of company	Business revenue affected	Impact of Covid-19 on					Strategic responses		
			Sales orientation	Supply management	Production management	Logistics management	Business diversion	Persevering	Innovation	Retrenchment
Machinery & Equipment - R1	Foreign	N/A	.	.	.			.	.	
Machinery & Equipment - R9	Local	N/A	.	.		.		.	.	
Machinery & Equipment - R16	Local	More than 30%	.	.			.			.
Machinery & Equipment - R17	Local	20-50%	.	.	.				.	
Medical Devices - R3	Local	50% - 60%		.	.		.	.		.
Medical Devices - R20	Foreign	More than 50%			.			.	.	
Textile & Textile Products - R22	Foreign	70% - 80%	.	.	.	.	.		.	.

Note: "." Represents the firm that experienced the corresponding impact(s).

(3) Employee Redundancy

In this study, eight respondents stated that they would be laying off redundant employees as part of their response to the effect of COVID-19 and MCO. However, unlike other studies focussing on more heavily impacted industries, none of the companies in this study stated that they would be laying off 100% of their employees. Of the eight respondents who plan to lay off employees, only one did not mention accompanying measures. In contrast, other respondents are taking a more nuanced approach to the layoff decision, implementing measures such as allowing work-from-home policies, retaining employees who prioritise the company's sustainability, and strengthening retention policies.

On the other hand, some respondents did not plan to lay off any employees. Instead, they are reorganising their workforce to face the pandemic and MCO. This includes measures like allowing workers to work from home (eight respondents), incentivising workers that work on-premises during MCO (one respondent), re-skilling the workforce and accelerating digital transformation (one respondent), and rotating employee arrangements (one respondent). Although one respondent did not plan to lay off employees, they proposed that their employees take voluntary unpaid leave options. Overall, many large manufacturing firms in Penang have a lower tendency to lay off employees due to COVID-19 and MCO compared to those who plan to lay off employees.

(4) Government Assistance Required

About 12 respondents expressed satisfaction with the range of assistance provided by the government during the MCO and COVID-19, while others were dissatisfied and felt more should be done to assist businesses. Respondents argued that poor inter-ministry coordination caused confusion and anxiety among businesses. Businesses also expected higher financial support.

Table 4 summarises the fiscal and non-fiscal assistance requested by the respondents. Respondents hoped for mainly fiscal support, especially the provision of loans and financing facilities, and the reduction or waiver of corporate and income tax. Other fiscal assistance requested includes wage subsidy, rental subsidy, loan interest cover subsidy, utilities cost subsidy, incentives for no retrenchment policy, and waiver of foreign workers levy. Meanwhile, some suggested non-fiscal measures include a business matching programme to increase localisation and business opportunities, enacting regulation to allow deduction of employees' leave and waiver/reduction of employer's share of statutory contribution.

While the respondents in this study consisted of large manufacturing firms (MNCs or local), several respondents also highlighted that SMEs cannot persevere and stay afloat without government assistance. This response highlights the relationships between large companies and their SME suppliers in the complex supply chain.

"I am worried about the SMI/SME survival through this tough period. The government has to do more for businesses. If not, when companies shut down, there will be more problems. To sustain, the whole economy has to move forward, and people will need jobs." (R10)

(5) Expected Recovery Time

Four respondents expressed confidence that the recovery from the MCO and the pandemic will be instantaneous, resembling a V-shaped normalisation. These respondents consistently stated that their employees could work fewer hours during the MCO but must be ready to return to the normal pace when the MCO ends. At the time of the interviews, there was no clear timeline for how the pandemic would develop. However, the majority of respondents held a different view. Most argued that there

would be a prolonged economic slowdown, supply chain disruptions, and subdued consumer spending. The lockdowns occurring in most parts of the world are expected to cause a slowdown or even a prolonged economic recession. The extension of the MCO will further exacerbate the situation.

R7 discussed the expected recovery of the current pandemic compared to the severe acute respiratory syndrome (SARS) outbreak. "The recovery will not be a V-curve as experienced for the SARS outbreak, as it was Asia-centric, whereas COVID-19 is a global pandemic. Some countries may recover faster, while others will have a prolonged impact" (R7). Additionally, the reliance on the Chinese manufacturing supply chain was less significant today (R10). The manufacturing supply chain is dependent on Chinese suppliers and foreign suppliers located in China (R19). It is important to note that the pace of economic recovery is conditional not only on the domestic policy and production measures but also on the mitigation measures undertaken in partner countries (Kam and Tham, 2021), especially for manufacturing industries, where raw materials or parts of manufacturing products sourced from other countries. As the COVID-19 situation eases, the Malaysian government gradually reopens the economy, and businesses show signs of rapid recovery, especially E&E manufacturers. External demand caught up in the second half of 2020, narrowing the impact of the pandemic crisis on trade. E&E products remain Malaysia's most significant export, increasing by 3.5% in 2020 compared to the previous year. The sales value of the E&E industry surged by 14.4% in 2021 to RM483.2 billion.

Table 4

Fiscal and non-fiscal assistance requested by the respondents

Measures	Details
Fiscal	● Loans and financing facilities, ● Wage subsidy, ● Corporate and income tax reduction or waiver, ● Rental subsidy, loan interest cover subsidy, utilities cost subsidy, ● Incentives to employers for no retrenchment policy, ● Foreign workers levy waiver.
Non-fiscal	● Business matching programme between local and foreign firms (increase localisation); ● Regulation to allow deduction of employees' leave, waiver and reduction employer's share of Employee Provident Fund (EPF), Social Security Organisation (SOCSO) and other statutory contributions.

STRATEGIC RESPONSES TO COVID-19

The impact of COVID-19 and MCO on companies and industries varies. Companies in the E&E and medical devices industries experienced less impact or even growth during the study period, while companies in the textile and garment industry were hit the hardest. The research found that the crisis management mechanisms adopted by companies were related to three of the four strategies identified by Wenzel et al. (2020). Similar to Kraus et al. (2020), only some companies pursued an exit strategy,

including a textile and garment company (R22), which had the most significant percentage decline in sales revenue among the respondents. Most companies adopted multiple crisis management strategies, as shown in Table 5, adapted from Kraus et al. (2020).

The *persevering and innovation strategy* was the most popular crisis management measure, taken by 13 out of 22 companies. Companies across all industries adopted this strategy except textiles and garments. For example, R10 from the E&E industry allowed employees to work from home and incentivised those who returned to work during the MCO period. R2, R11, R13 and R21 from the same industry intended to strengthen employee retention policies. These companies continued to innovate in their business operations by localising and expanding supply chain networks and increasing stock buffers. While attempting to persevere and lessen the impact of the pandemic on the manufacturing supply chain and customer base, three companies cut their operational costs by laying off redundant employees. This happened in the medical devices (R3) and E&E industries (R4, R6). "We lay off part of the employees. But, we retain employees who can sustain and prioritise the business development of the company," (R6). These companies practised perseverance and retrenchment in response to the pandemic.

Engaging in all three strategies to combat the impact of COVID-19 may be less popular among the manufacturers. Still, it could significantly narrow the firm's short-term and long-term damages and increase its survivability. These companies came from two different industries: Basic Metal Products (R5) and Food Processing (R7). While retrenching some of their employees, adjustments were also made to the nature of reporting to work and the supply chain management (where R5 builds up multiple vendor sources and R7 stocks up raw materials for continued production).

Furthermore, only one company (from the textile and garment industry (R22)) embarked on a *retrenchment and persevering strategy*. As mentioned earlier, this industry had the most pessimistic outlook for business recovery across all industries. An L-shaped normalisation is expected to be seen in this industry, where it will take longer to revive. However, R22 remained optimistic about its supply chain and attempted to work closely with customers and suppliers for production and delivery rescheduling. Only three companies adopted a specific strategy as part of their crisis management measures. Two companies (R15 and R16) implemented a *pure retrenchment strategy*, which reduces operational costs in the short term by narrowing the scope of business activities (Do et al., 2021). One company (R17) embarked on a *pure innovation strategy*. According to R16, "We encouraged employees to take annual leaves and return when operations resumed."

In contrast, highly innovative and fast-growing new firms often adopt a *pure innovation strategy* (Archibugi et al., 2013). This strategy involves exploring new sources of revenue in the long run through research and development (R&D) activities. During the crisis, R17 focused on developing new products and invested solely in innovation activities. As part of the M&E industry, R17 recognised that a sharp decrease in demand would not rebound in a short period. This finding is consistent with Kuznetsov and Simachev (2010), which showed that the decision to innovate is independent of industry. None of the firms in the study adopted a *pure persevering strategy*. This suggests that perseverance is likely accompanied by other strategies in response to the COVID-19. Such responses are undertaken by companies that had sufficient liquidity before the crisis and do not require cost-saving measures while sustaining their scope of activities amid the health crisis (Kraus et al., 2020; Do et al., 2021).

Table 5
Strategic response of firms to the COVID-19 crisis

Strategic response	Number of companies
Persevering + Innovation	13
Retrenchment + Persevering	3
Pure Retrenchment	2
Retrenchment + Persevering + Innovation	2
Pure Innovation	1
Retrenchment + Innovation	1
Pure Persevering	None

CONCLUSION, IMPLICATIONS AND FUTURE RESEARCH NEEDS

This study is the first to investigate the impact of COVID-19 and lockdown on large local and foreign manufacturing firms in Penang, Malaysia. Penang's manufacturing sector significantly contributes to the national economy and has progressively placed Malaysia in the global value chain. Due to the strict lockdown measures, all manufacturing activities are affected, but the extent of the effect and responses taken by the firms vary. The pandemic and MCO have decreased revenue in different magnitudes and plan to reduce employees in other companies without an apparent association to an industry. This is in line with past studies such as Do et al. (2021) and Kraus et al. (2020). Manufacturing companies pay more attention to supply management due to the global supply chain disruptions and logistical disruptions impacted by the lockdown in some parts of China beginning in late January 2020. The supply chain disruption has caused challenges in importing raw materials and interruptions in the production of domestic suppliers.

Businesses are generally concerned about the adequacy of government assistance during the first lockdown. Fiscal and non-fiscal assistance should be made available to large manufacturing firms and also SMEs that support the large manufacturing firms. Most firms are not equally optimistic about the recovery, and a prolonged economic slowdown is predicted. A majority of them chose the *persevering and innovation* strategy. This suggests that manufacturing companies in Penang will withstand the impact of the pandemic and, at the same time, improve or create new goods and services that would enhance the company's growth in the future. However, eight companies would employ retrenchment as part of crisis management strategies in this crisis, where firms are keen to rationalise costs and operations in the short run to minimise the risk of a business crisis.

The findings of this study provide implications for key stakeholders in the manufacturing industries, especially manufacturing firms, government and policymakers. Although this study focuses on crisis management at the firm level, the findings have broader implications for policy interventions at industry and government levels. Increased government support in the form of financial assistance is needed to raise the resilience of the local supply chain ecosystem. This is particularly important to ensure the survivability of SMEs. The findings of this study alluded that large local and foreign

companies shift raw materials sourcing to local suppliers. To advance this, while firms must adapt their existing business models to unprecedented business operations, the government should urgently increase investments in the cloud and automation infrastructure to scale up local firms' productive capacity and minimise social contacts among workers.

Firms must expand their supply network to domestic firms in response to disruptions in the Chinese supply chain. Firms that have done supply network mappings before the pandemic should be more prepared at times of crisis – only a small number of companies globally had conducted this mapping before the crisis (Choi et al., 2020). An inventory of local suppliers is necessary before any turbulence emerges. Firms should use the supply maps as a guide to handle material sourcing issues during the crisis and as a reference for future crisis management strategies. This can develop from a collective effort by industry and business associations, with facilitation and support by the government, as a means to reduce the cost and time taken to develop the mapping. Therefore, a whole-of-industry approach is required to help reduce the impact of COVID-19 on business revenue and enhance the effectiveness in combating the pandemic at the industry level. Other manufacturing firms with similar financial capabilities and are in industries like the large firms studied in this research should consider applying the relevant strategies these firms take.

Policymakers should develop industry-specific strategic and complementary measures based on the *persevering and innovation strategy*; the most popular crisis measure undertaken due to the health crisis. This is vital for future preventive planning, government support measures and vaccination programmes. The lack of inter-government communication and professional deficiency in crisis management are the hurdles to effective measures undertaken by the government. In Malaysia, unnecessary control measures were implemented, such as prohibiting employees from taking rotating schedules when reporting to work, which resulted in internal disputes among employees. Some manufacturers were forced to implement unpaid leave and salary cuts following the government's guidelines, and employee redundancy was increased. To ensure effective and coordinated policies are conveyed at all levels, coherent and clear measures in the pursuit of industry interest are important. The role of state government and local authorities should be prioritised to facilitate and support the federal government by providing the latest COVID-19 situation and sanitisation services, as COVID-19 cases are still fluctuating.

This study focuses on the E&E manufacturing firms, and future studies may explore the crisis management and business resiliency of other manufacturing activities in Malaysia. Other key manufacturing industries such as petroleum, chemical, rubber, plastic, wood, furniture, paper and printing products may provide insightful crisis management comparison to this study. It offers different effects and responses to COVID-19 restrictions at the sub-national level. More time and resources are needed to increase the number of respondents in future studies to allow for advanced statistical analysis and to gather the perspectives of policymakers and academicians for more diverse opinions in crisis management.

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