

## How does Lean Six Sigma improve organisational resilience post the COVID-19 pandemic?

The COVID-19 pandemic has changed many aspects of our lives. People are being confined to their homes, and their movements are restricted as governments have stepped up social distancing to contain the spread of the virus. The lockdowns had severely disrupted both the manufacturing and service sectors causing the economic downturn in all industrial sectors including public and or third sectors worldwide. Though businesses had resumed their operations and some countries have begun to lax the COVID-19 regulations, undoubtedly the uncertainty remains, as the emergent of new variants has seemingly played catch up with the rate of vaccination. Countries that have been successful in their vaccination programme have turned their “wheel of the economy”; but for others, much about the COVID-19 virus remains unknown, causing the uncertainty and anxiety to continue.

For those who begin to leave the lockdown, entering the next phase, however, is a process, not a snapshot or an event. Businesses emerging from the lockdown mostly have strained balance sheets. Manufacturing industries will start from the state where they were left off before the lockdown. The tourism and hospitality sectors return to business with reduced workforce and service offerings. Airlines restart their operation burdened with far from foreseeable certainty. Many of the labour-intensive organisations must therefore radically rethink how they should operate in the new normal. With some physical distancing that will still be reinforced, the workforce will require extra space for movement, additional layers of processes to ensure safety, which subsequently adds time and effort to complete their tasks (Greenough and Tjahjono, 2007). Most importantly, however, maintaining the well-being of frontline health-care professionals and protecting the hospitals remain the top priority of the governments’ health policy.

Those who are adept in operational excellence and adapt to COVID-19, finding new ways of working and striving to become more efficient, will dramatically increase their chance to recover swiftly (Ferreira *et al.*, 2012). For some, however, the enactment of distancing and extra layers of safety protocol affects their ability to reaching a steady-state operation and attaining consistent outputs and the right level of productivity (Tjahjono, 2009), while at the same time cut waste and reduce process variability. These clearly pose a new challenge to the already complex decision processes involved (Blos *et al.*, 2018), including investment decisions, market penetration, capacity expansion and automation that are now simply prohibitively exorbitant.

The aim of this special issue is to offer an avenue for an academic discourse and to showcase empirical work that highlights some of the following questions pertinent to the organisational resilience post the COVID-19 pandemic:

- Q1. How do businesses operate in a realm of safe distancing and extra protective equipment? Can they perform at the highest productivity and efficiency levels to remain competitive as before?
- Q2. How do they embrace these new ways of working while continuously need to overcome immediate issues of process variability and waste, so as to remain efficient and effective?



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- Q3. How can Lean Six Sigma be used as a means to rapid recovery of service operations or ramp-up of production after the COVID-19 lockdown?
- Q4. Are there practical examples where Lean Six Sigma has helped supply chain, manufacturing and service operations to successfully respond to uncertainty and have now become more resilient?
- Q5. To what extent will supply chains be affected as manufacturers adopt radically new working procedures?
- Q6. Will the manufacturers see the lockdown as opportunities, e.g. more seriously considering the adoption of Industry 4.0 technologies, such as artificial intelligence, robotics, the Internet of Things and Big Data?
- Q7. Or should they look at new products, services or combined product–service systems in a radically new economy?
- Q8. If the second wave of pandemic occurs, then what would they need to prepare for future disruptions and how?

The papers in this special issue were solicited from an open call to various research communities using multiple communication channels. In particular, we invited contributions from international researchers whose countries have experienced the COVID-19 disruptions. We hoped to hear how manufacturing and service operations in those countries have been recovering from the shutdown; how they reorganised their production capabilities; how they ramped up service performance; and more importantly, how Lean Six Sigma has proven to be a powerful philosophy and business improvement strategy they can adopt to regain competitiveness ([Anthony and Antony, 2021](#); [Antony and Gupta, 2019](#)).

The paper by [Mishra \*et al.\* \(2021\)](#) explores the benefits and obstacles of the Lean Six Sigma implementation in Indian micro-, small- and medium-sized enterprises during or post COVID-19. They found that despite the obvious benefits in facilitating the improvement processes in manufacturing operations, quality improvements and productivity, the main barriers of implementation of Lean Six Sigma are notably related to costs, skill requirements and other infrastructural limitations. In particular, during the COVID-19 pandemic, Lean Six Sigma has not been considered a matter of urgency.

Within the health-care setting, [Iswanto \(2021\)](#) compares the impacts of Lean Six Sigma implementation in a pharmacy unit on the profitability of outpatient and inpatient care before and during the COVID-19 pandemic. His research points out the different impacts of the pandemic on the ability of Lean Six Sigma in boosting the efficiency at the entire hospital levels, which is apparent at various lengths of patients' stay.

[Raja Mohamed \*et al.\* \(2021\)](#) determine the key factors influencing the COVID-19 patients' satisfaction using the Six Sigma framework model. Using the framework, they indicate that process standardisation contributes the most towards the variation in COVID-19 patients' satisfaction, in addition to assurance by doctors, the interpersonal quality and waiting time, whereas cost was deemed less important by the patients.

[Hundal \*et al.\* \(2021\)](#) interviewed 21 experts to explore how Lean Six Sigma principles contribute to supporting health-care organisations operating in the era of COVID-19. Their study offers specific guidance for areas of health-care adoption of Lean Six Sigma techniques and tools that benefit patient safety that overall will increase the resilience of operations in the era of the COVID-19 pandemic.

[Julião and Gaspar \(2021\)](#) explore the use of lean thinking and digital transformation on services redesign within the context of a higher education institution. Their work aims to

incorporate new health and safety recommendations because of the COVID-19 pandemic, while at the same time, maintain process effectiveness and efficiency. They identify a set of requirements for improved online alternatives to face-to-face interactions between students and academic staff and clearly claim that the digital transformation of services is indeed driven by lean thinking.

Praharsi *et al.* (2021) demonstrate how the shipbuilding industry can become more resilient and maximise its performance during the COVID-19 pandemic by adopting the Define, Measure, Analyse, Improve and Control method to achieve supply chain resilience. They also share new insights on how Lean Six Sigma and resilience strategies can be integrated to absorb the disruptions by the pandemic.

The constructions sector is highlighted by Oey and Lim (2021) as one of the sectors that continues to face tremendous pressure due to the COVID-19 crisis. They present a case study investigating challenges and action plans within the real estate construction in several major cities in Indonesia by means of a questionnaire. The respondents provided a wide variety of responses representing a number of headings ranging from “let it go” or “do nothing” to “prepare and invest now to gain a competitive advantage” and “act now and become COVID-19 champion company”.

The COVID-19 pandemic has indeed caused disruptions to many businesses that are caught unprepared for this situation. To deal with this catastrophe, Demir and Turan (2021) propose a method to manage the COVID-19 pandemic crises, incorporating Lean Six Sigma strategies that have been weighted with the spherical fuzzy analytic hierarchy process, allowing a multi-criteria decision-making process to be implemented in a more effective and efficient manner.

We hope that the papers selected in this special issue represent a variety of significant contributions highlighting various endeavours pertinent to the adoption and application of Lean Six Sigma in achieving resilience in many areas of our lives.

**Benny Tjahjono**

*Centre for Business in Society, Coventry University, Coventry, UK*

**Jiju Antony**

*Professor of Industrial and Systems Engineering, Khalifa University,  
Abu Dhabi, UAE, and*

**Hui Ming Wee**

*Chung Yuan Christian University, Chungli, Taiwan*

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