Corporate entrepreneurs and collaborative innovation in crisis: The case of the Covid-19 ventilator shortage

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Abstract
This teaching case focuses on corporate entrepreneurship and collaborative innovation during an unprecedented crisis – the shortage in mechanical ventilators when the Covid-19 pandemic began. Based on secondary data sources, the case outlines the challenges of designing and manufacturing mechanical ventilators and introduces four initiatives, consisting of organisations with often limited experience in medical device manufacturing that attempted to address the predicted shortage of ventilators. By comparing the approaches used in these initiatives, the case sensitises students to the challenges of pursuing opportunities outside a firm’s established domain of expertise and how inter-organisational collaboration affects such attempts. Although the case centres on an unprecedented event, the insights it develops make it suitable for a range of innovation and entrepreneurship-related under- and post-graduates courses.

Keywords
corporate entrepreneurship, intrapreneurship, collaborative innovation, Covid-19 crisis, resourcing

Introduction
Entrepreneurship contributes to economic prosperity and growth and can be essential when crises and other large-scale disruptive events occur (Dushnitsky et al., 2020; Korber and McNaughton, 2018). Although it is often associated with start-ups, entrepreneurial activities also occur within large, mature organisations (Burgers and Van de Vrande, 2016; Kazanjian et al., 2017; Kuratko et al., 2015). Most research on such corporate entrepreneurship (CE) focuses on firm-level activities that instigate innovation and renewal within, or to benefit, existing organisations (Burgers and Van de Vrande, 2016; Olson et al., 2020). While CE can be undertaken solely by the organisation, it often involves external partnerships or the creation of new ventures outside the organisation.

CE depends on the ability of established businesses to repurpose and recombine resources and capabilities to explore and exploit opportunities outside their core domain of expertise (Bierwerth et al., 2015). Those opportunities can be related to disruptions in the environment, including crises (Olson et al., 2020). An organisation’s ability to redeploy its resources and capabilities to develop innovative responses to disruptions can generate economic benefit and ensure the organisation’s survival or facilitate the response to disruptive change (Elsahn and Siedlok, 2021). Yet, when organisations act on opportunities in unfamiliar domains, especially when the market or technological complexity is high (Ehrenhard et al., 2014), they face significant challenges and must often coordinate and collaborate with other organisations (Boehme et al., 2021; Crick and Crick, 2020; Elsahn and Siedlok, 2021). This teaching case illustrates dynamics related to CE and collaborative innovation during an unprecedented crisis –
the ventilator shortage caused by Covid-19. When the pandemic revealed acute shortages of ventilators, diverse organisations responded to calls for help despite being inexperienced at medical device design and manufacturing. The organisations’ approaches varied significantly: some organisations relied on internal capabilities and underestimated the challenges of producing and designing ventilators. Others recognised their own limitations and collaborated with other organisations to overcome these gaps. This case introduces students to the complexities of ventilator production and outlines how four initiatives sought to repurpose and recombine resources to address the ventilator shortage. The insights developed to allow students to grasp the challenges of CE and collaboration in various contexts and offer valuable insights for managers considering whether to use their resources in new contexts.

CE and resourcefulness

CE refers to ‘entrepreneurial activities within the bounds of established, mature corporations’ (Kazanjian et al., 2017: 174). It rests on an organisation’s ability to recognise, assess and exploit existing or emerging opportunities (Kreiser et al., 2021; Kuratko et al., 2015). It is facilitated by factors that are located either in an organisation’s external environment or within that organisation (Burgers and Van de Vrande, 2016; Ireland et al., 2009). External environmental dynamics can be ‘triggering events’ (Schindehutte et al., 2000) for CE, such as changes in legislation, emerging technologies, shifts in socio-cultural values, or large disruptions (Dushnitsky et al., 2020; Elsahn and Siedlok, 2021; Kreiser et al., 2021; Osiyevskyy et al., 2017). Whether and how organisations exploit such opportunities depends, however, on intra-organisational factors, such as enabling structures and processes, a culture that encourages and rewards CE, or access to relevant competences and resources (Ireland et al., 2009).

Grounded in resource-based views of the firm (Kraaijenbrink et al., 2010), CE literature highlights the importance of an organisation’s resourcing strategies, its ‘ability to bring, create, combine, and/or deploy existing or new resources to seize and respond to opportunities’ (Elsahn and Siedlok, 2021: 192). Resources can refer to tangible (e.g. equipment and finance) and intangible (e.g. brand name) assets and specific competences (e.g. knowledge and skills) that an organisation can access. Resources are not intrinsically valuable or tied to particular opportunities (Gilbert-Saad et al., 2018). Rather, to realise value from CE, an organisation must ‘coordinate and deploy resources’ (Kazanjian et al., 2017: 174). It must assess its existing resources and competences, their relevance for emerging opportunities, and what resourcing strategy is necessary to overcome possible mismatches (Bierwerth et al., 2015; Elsahn and Siedlok, 2021; Kazanjian et al., 2017).

This assessment relies on interpretative frames (or mental maps) that guide decision-makers within organisations. Interpretive frames reflect collective knowledge, values and assumptions that focus attention on specific environmental dimensions and facilitate mutual understanding among individuals (Olson et al., 2020; Salvato et al., 2009). Overreliance on pre-existing frames can be problematic, especially during crises (Elsahn and Siedlok, 2021; Osiyevskyy et al., 2017). A strong commitment to entrenched frames can hinder decision-makers from considering alternative interpretations of problems and solutions. Regarding CE, this commitment might induce managers to overemphasise similarities between domains while ignoring important differences (Elsahn and Siedlok, 2021).

Ultimately, CE rests on an organisation’s ability to understand challenges and opportunities related to a new context and its capabilities to resource, deploy and combine tangible and intangible assets innovatively. Exploring opportunities in distant domains, where organisations lack necessary knowledge and resources, often requires collaboration. This observation holds especially true when new solutions must be developed and scaled quickly (Chesbrough, 2020; Von Behr et al., 2021). Collaboration with outsiders can challenge entrenched interpretive frames (Hibbert et al., 2014), enhance exploitation and exploitation of opportunities outside current domains of involved organisations, and overcome size-related liabilities (Ketchen et al., 2007; Tunstall et al., 2009).

Collaborative innovation

The increasing complexity and change in the competitive environment creates opportunities for and requires knowledge sharing and creation that spans firms, industries, and countries — an approach termed ‘collaborative innovation’ (Ketchen et al., 2007). Baldwin and von Hippel (2011) see collaborative innovation as a necessary paradigmatic change that will gradually replace single-producer innovation. Collaborative innovation is increasingly seen as necessary in addressing urgent and complex issues that a single organisation cannot solve (Blundel et al., 2018; Boehme et al., 2021; Crick and Crick, 2020; Deken et al., 2018). Despite the many benefits it offers for developing innovative solutions, however, there are significant challenges to successful collaborations (Coombes and Nicholson, 2021).

First, mutual understanding, trust and commitment influence the opportunities and willingness to collaborate. Willingness is affected by economic concerns, professional pride, cognitive factors, prior collaborative experience and the ability to recognise the value of and absorb new knowledge (Skippari et al., 2017). Second, successful
Beyond maintaining airflow, they rely on advanced sensors and algorithms, and they are highly complex machines. They include specialised parts, complex supply chains, and they must meet stringent quality standards that guarantee a device’s safety and adequacy. The extensive regulations are but one reason why ventilators and medical devices can take years to come to market (Margolis and Silver, 2020). Ventilator design and manufacturing must also account for other factors. Besides meeting the requirements of a busy hospital environment, such as limited space, they must work with other medical equipment (Somers, 2020). In addition, they must meet stringent quality standards for manufacturing (e.g. clean room facilities).

Before the pandemic, only a few specialised manufacturers produced ventilators. When the pandemic hit, these firms faced significant challenges to increasing production rapidly due to their size and limited manufacturing capacity. The pandemic also disrupted the specialised supply chain of ventilator manufacturing (Lee, 2020). Consequently, these firms could not scale production to meet the projected short-term demand. For example, one company that produced around 1000 ventilators a year estimated it would take at least eight months to sharply increase production ( Kliff et al., 2020).

Four distinct approaches to address the ventilator shortage

Early reports of a looming ventilator shortage and governmental calls (and incentives) that encouraged industry to help prompted a wide range of firms to repurpose and recombine existing capabilities and resources to develop and manufacture ventilator production ( Davies, 2020b). Some initiatives were driven by single organisations. Others involved several organisations that coordinated and collaborated. Below, we introduce four initiatives that adopted significantly different approaches to address this shortage.

Well-intentioned but overly optimistic: Tesla and Dyson

Some organisations, particularly Tesla (an automobile manufacturer) and Dyson (a household appliance manufacturer), pledged to develop and manufacture ventilators from scratch. They had well-known brands and access to complex supply chains, and they were generally regarded as highly innovative organisations. In press releases, they stressed the similarities between their current products...
and the key principles of ventilator design. For instance, Tesla Chief Executive Officer (CEO) Elon Musk tweeted:

Tesla makes cars with sophisticated HVAC [heating, ventilation and air conditioning] systems. SpaceX makes spacecraft with life support systems. Ventilators are not difficult [in comparison] but cannot be produced instantly.

Dyson explained that its CoVent design was:

made to achieve a high-quality air supply to ensure its safety and effectiveness, drawing on our air purifier expertise which delivers high-quality filtration in high-volume products. (Jebara, 2020)

Both firms developed functional prototypes in record development times. Dyson reportedly developed its ventilator in 10 days (Davies, 2020b) by repurposing their existing knowledge. Tesla explained how its engineers were repurposing auto parts, such as the Model 3’s touch screen, for ventilators (Valdes-Dapena, 2020). However, most designs failed to get regulatory approval and did not enter large-scale manufacturing (Davies, 2020a). These setbacks can be attributed to the organisations’ neglect of quality management in manufacturing (e.g. clean rooms), the machines’ limited precision, concerns about long-term servicing and maintenance, and little consideration for the demands of busy hospital environments.

Despite significant investments, these organisations soon abandoned their plans. For example, Dyson reportedly spent around £20 million to develop a ventilator design that the UK government rejected. To some extent, the projects were discontinued because of changes in specifications. For example, the UK Ventilator Challenge initially based its specifications on a design from the 1960s, which did not meet the necessary standards. It also became apparent that demand was overestimated as the medical response refocused on preventive measures such as masks and lockdowns. Nevertheless, many industry experts were sceptical that non-specialist firms could design and manufacture ventilators and called these attempts far-fetched, unrealistic and naive (Davies, 2020b; Lee, 2020).

We specialize in spacecraft, not medical device manufacturing. But excellent engineering, rigorous testing and rapid prototyping are some of our specialties. But building a medical device is new. It goes against our culture to do something quickly in a domain where we’re not experts. (Strickland, 2020)

Recognising its capability gaps, NASA collaborated from the start. It leveraged its relationships with the medical community and consulted experts who highlighted the challenges of obtaining regulatory approval (Somers, 2020). Second, it worked continuously with medical partners throughout the development process to build and maintain a dialogue between engineers, designers and visualisation specialists with doctors, nurses and respiratory therapists.

This effort resulted in a Food and Drug Administration (FDA)-approved low-cost, easy-to-build ventilator called VITAL, that addressed immediate needs. NASA recognised it could not produce the ventilators in-house and licenced its design for free. By August 2020, 29 manufacturers worldwide had been licenced to make the device (NASA, 2020), but it was unclear how many had been produced. Also, NASA’s effort did not resolve more substantial problems, such as the shortage of qualified staff to operate these ventilators.

Involuntary collaborators: General Motors and Ventec

A third approach relied on a consortium of companies that could leverage complementary capabilities across the partnership. For instance, General Motors (GM; one of the world’s largest automakers) and Ventec Life Systems (a leading medical device company) collaborated to rapidly scale the production of critical-care ventilators. However, this did not always happen voluntarily. In the United States, President Trump urged companies to engage in ventilator production on social media and compelled them to speed up their efforts by invoking the Defence Production Act. These partnerships accounted for the capabilities and resources of each partner. Ventec contributed an approved ventilator design that was simplified to accelerate production, the relevant licence and expertise in medical device manufacturing. GM contributed expertise in mass manufacturing and supply chain management, and purchasing power to secure needed raw materials. These consortia partners also mapped and accessed missing competences. For instance, partners acknowledged the importance of tacit production knowledge and relied on augmented reality to observe their partners’ production processes (Williamson, 2020).

Because regulatory agencies had approved these designs, firms could produce ventilators relatively quickly. Within a month, the first ventilators jointly produced by GM and Ventec were delivered to hospitals. By

Experienced problem-solvers: National Aeronautics and Space Administration

A second initiative, spearheaded by the US National Aeronautics and Space Administration (NASA), was more successful. NASA could draw on its prior experience in developing complex mechanical devices and established relationships with the medical community. NASA also quickly realised that it lacked the skills needed to produce mechanical ventilators. As one NASA engineer noted:
September 2020, GM had finished making the 30,000 ventilators it had contracted to produce. However, GM had little appetite for ongoing collaboration in these partnerships. First, the forecasted demand for ventilators had not materialised, leading to an oversupply and cancelled contracts. In addition, public attention had shifted to vaccine development and precautionary measures such as lockdowns and masks. Subsequently, GM announced its exit from the ventilator business.

Coordinated collaboration: The Taiwan ventilator team

A fourth initiative also relied on a consortium of organisations, but with the government facilitating coordination and access to required knowledge. With a long history of technology acquisition and dissemination and collaboration with industry partners (Chen and Chen, 2016), the Industrial Technology Research Institute (ITRI) in Taiwan worked with the industrial community to redevelop and build ventilators. The design was based on a prototype that was released under a royalty-free ‘permissive licence’ by a prominent ventilator manufacturer (Medtronic). Leveraging the experience of mobilising manufacturers and research institutes to rapidly scale face mask production (Elsahn and Siedlok, 2021), this approach acknowledged that the community possessed strong component-level expertise but lacked architectural understanding of the product. The partnership relied on ITRI’s R&D capabilities, its field research (e.g. biotechnology) to provide testing capabilities and its ability to coordinate complex supply chains. It took the initiative 17 days to upgrade the designs and build a prototype, which received Taiwan’s FDA approval. ITRI’s capacity to coordinate complex supply chains, engage with industry and integrate the capabilities of different partners was key to developing this prototype (ITRI, 2020). The Taiwanese government hinted that it might further support the integration of the supply chain and help the sector to enter the lucrative global market of medical devices.

The four approaches are summarised in Table 1, which highlights the key resources, competences and capabilities used to coordinate these efforts and the capabilities involved in sourcing, combining, coordinating and deploying resources.

Summary and learnings for the next pandemic

The case is an example of human ingenuity, resilience and collective action in response to an unprecedented crisis. It illustrates central aspects of CE, especially factors that enable or facilitate CE, significant challenges when opportunities in domains distant from core expertise are pursued and the importance of collaboration and coordination. Thus, while it is unclear whether these initiatives improved national responses to Covid-19, they offer lessons that can inform organisational and national preparedness and responses to existing (e.g. climate change) or emerging complex problems and disruptive events.

Questions

1. What factors promoted this diverse set of organisations to engage in CE and collaborative innovation?
2. What factors are responsible for the success or failure of these four initiatives?
3. What was the role of coordination in the success of these initiatives?
4. What can organisations and governments learn from this episode, and how can these learnings and experiences increase preparedness for future crises?

Teaching Note

Synopsis of the case

The case begins with some background on the challenges caused by the Covid-19 pandemic, with a focus on the shortage of (mechanical) ventilators early in the pandemic. To sensitise students to the complexity of this issue, the case discusses the basic functionality of two main types of ventilators (mechanical and manual) and the challenges associated with designing and manufacturing them (e.g. the importance of regulatory approval). The case then introduces four initiatives (consisting of various organisations) that sought to redeploy and combine their resources to address the ventilator shortage. For each initiative, the case outlines how challenges associated with ventilator production were conceptualised, whether and how firms collaborated to overcome gaps in resources and the success of initiatives. Many attempts to redeploy resources to manufacture ventilators failed because organisations overestimated the similarities between their established resources and this new context. Other initiatives were more effective because organisations realised the differences between their core domain of expertise and the new domain. These organisations also had more sophisticated capabilities to initiate and manage collaborations and better regulatory support.

The case ends with a set of questions focused on (a) understanding the elements that prompted initiatives to engage in ventilator production, (b) explaining successes/failures of the initiatives through relevant theory and (c) whether learnings from this case can generate broader insights.

Teaching objectives and target audience

The key objectives of the case are to understand the drivers of CE, to sensitise students to the need to reflexively assess opportunities and internal capabilities, and to highlight the
Table 1. Key features of four initiatives.

| Initiatives       | Dyson and Tesla | NASA | GM and Ventech | Taiwan Ventilator Team |
|-------------------|-----------------|------|----------------|------------------------|
| **Key resources and competences** | Strong brand, production facilities and competences in mechanical engineering. | Experience in design and development of complex devices; connection with the medical community; rapid prototyping. | Manufacturing and industrial engineering (GM); medical device know-how, design, and IP (Ventec). | Approved design and licence (Medtronic); manufacturing capabilities (industry); medical device research and testing facilities. |
| **Key capabilities** | Management of complex supply chain and manufacturing | Collaborative development of complex devices with the medical community | Management of complex supply chain. | Knowledge transfer and collaborative R&D (ITRI) |
| **Approach** | Reliance on in-house capabilities and resources. | Mainly reliance on in-house capabilities but continuous interactions with medical experts. | Consortium (initiated by the government) that leveraged capabilities across the partnership | Establishment of consortia that leveraged capabilities across the partnership; coordination from the government. |
| **Key shortfalls/ issues** | Neglect of critical issues around regulatory approval and manufacturing requirements. | Free licence of ventilator might have slowed manufacturing. Product only addressed issues marginally. | Little appetite for long-term collaboration. | Limitations of the licence; no experience in marketing medical devices globally |
| **Success** | Very limited. Devices not approved. Potentially reputational benefits | Limited. Device approved, but limited functionality and no evidence of large-scale manufacturing. | Yes. Devices approved and manufactured. | Yes. Devices approved and manufactured. Potential establishment of new industry |

NASA: National Aeronautics and Space Administration; ITRI: Industrial Technology Research Institute; IP: intellectual property.

need for an organisation to collaborate and coordinate when it explores and exploits opportunities outside its core domain of expertise. To ground the case in theory, key concepts related to CE and collaborative innovation are outlined at the beginning. It is useful to link the case to other instances when firms pursue opportunities outside their established domain of expertise. As such, the case is suitable for discussing central aspects of innovation, CE and strategy for undergraduate and postgraduate students.

**Teaching approach and strategy**

Consistent with the interpretive and dialectic nature of case teaching, the study questions are deliberately broad and will evoke a range of responses. The main theoretical points are related to CE, especially the challenges associated with entering a new domain, the challenges related to resourcing and to collaborative innovation. The case also enables students to apply theory to understand why organisations succeed and fail when they pursue new opportunities. Further, it illustrates how theoretical concepts can enhance the understanding of contemporary phenomena. Our suggested teaching strategy moves from observations and explanations that might be perceived as ‘obvious’ by students to a deeper exploration of the underlining dynamics and nuances. From our case teaching experience, this approach will maintain a high level of energy in the class and stimulate critical thinking and deeper learning due to the ‘Aha!’ effect it generates.

Depending on the class format and length, begin by asking students to read and think about the case (either at the start of or before the class) with a focus on the theory introduced at the beginning. A short introduction by the lecturer might then be used to introduce the key initiatives (e.g. utilising Table 1). After that, the lecturer might want to break up the class into groups with 3 to 5 students to discuss the questions from the perspective of a single initiative. Students can then be asked to report back and to integrate/synthesise insights by comparing and contrasting the four initiatives. To conclude the session, students should consider how the insights from the case can inform their future decisions and actions, either as a ‘normal’ entrepreneur or in corporate roles that deal with innovation and CE.

**Analysis and conclusions**

The case is more suitable for an in-class discussion (rather than a written assessment) where the lecturer can challenge students to go beyond surface-level explanations. This is reflected in the sample answers that move from straightforward aspects to less obvious issues and insights.

**Question 1: On opportunity emergence and identification.** To start the discussion, the lecturer can ask ‘which factors
promoted this diverse set of organisations to engage in CE?’ or simply ‘why did these initiatives do this in the first place?’ Students will quickly note that the Covid-19 pandemic gave rise to emerging problems/opportunities (higher demand for ventilators and lower demand for other products) and that a range of factors made organisations and decision-makers willing/motivated to exploit this opportunity. The more cynical students will identify a desire to generate positive publicity (arguably Dyson and Tesla) or a desire to remain operational as a business. Others will note a genuine desire to help (e.g. NASA) or governmental pressures along with profit motives (GM and the Taiwan Ventilator Team). Students who are less versed in theory might list these factors unsystematically. In reply, the lecturer can nudge students to utilise the outlined literature on CE to structure their argument (Ireland et al., 2009). Students should be able to differentiate between (a) broad environmental dynamics (e.g. novel problems/opportunities, public interest/demand and governmental pressures); (b) factors related to a specific organisation and its network ties (e.g. access to relevant resources and competences or a prevailing culture of innovation); and (c) more individual-level elements (e.g. CEO’s keen on publicity).

This discussion will highlight the importance of resourcefulness in CE, defined as a firm’s ability to bring, create, combine and/or deploy existing or new resources to seize and respond to opportunities (Elsahm and Siedlok, 2021).

**Question 2: On the reflective assessment of opportunities and resources.** To facilitate this discussion, the lecturer can use some common teaching frameworks that highlight the extraordinary challenges and benefits when there are substantial differences between a firm’s home and the target domain.

When answering question 2, students should articulate that Dyson and Tesla focused mainly on similarities (e.g. engineering airflows) despite having limited access to, or seeing little need for, capabilities that were crucial in the new domain: medical device manufacturing, relevant intellectual property (IP) or knowledge of the regulatory requirements. Similarly, NASA had access to a broader range of expertise (e.g. engineering and medical know-how), but not to large-scale manufacturing facilities and capabilities. The other two initiatives had access to the most relevant resources, which explains their more successful outcomes. Some initiatives clearly overestimated the relevance of their resources in the new context. This insight opens an interesting discussion on the rationality of decision-makers and the influence of interpretive frames that shape attention and world views (Tripsas and Gavetti, 2000). The instructor might want to use the analogy of camera lenses or Instagram filters to illustrate how the same ‘problem’ can be perceived differently depending on the lens/filter employed. The importance of interpretive frames reflects two aspects of the case.

First, many firms and governments focused on the need for ventilators and paid less attention to the need for masks. Indeed, the case mentions that ventilators were in oversupply by summer 2020 while there was still a shortage of N95 masks (Contrera, 2020). This illustrates how public discourses and governmental policies shape attention to specific aspects of a problem. Similarly, pre-existing schemas in high-technology engineering-based organisations presumably directed attention on the complex problems that are (supposedly) of a mechanical nature and away from the supposedly mundane task of N95 mask production.

Second, the case shows how pre-existing frames direct attention to aspects of the new domain (ventilator production) most like a firm’s established domain (e.g. ensuring airflow, rapid prototyping and engineering excellence) and away from critical differences (e.g. the regulatory aspects, clean production and characteristics of a busy hospital environment). Tesla and Dyson seem to have approached the task from the perspective of engineering-based organisations by focusing on the mechanical problems of airflows. NASA evaluated its limitations more clearly (due to its relationships with the medical community) but focused on solving the problem rather than on scaling the solution. Finally, GM and the Taiwan Ventilator Team proactively leveraged existing capabilities in their supply chains.

To summarise the key aspects of this question, use a simple framework to map the firm’s access to resources and competences and their reliance on pre-existing frames (Figure 1).

This framework highlights the need for collaboration and coordination in CE from two perspectives: First, interactions with a broad set of organisations allow initiatives to overcome entrenched frames. Second, collaboration enables initiatives to bridge gaps in resources and capabilities.

**Question 3: On dynamics and challenges of collaborative innovation.** After having established the importance of collaboration, the lecturer can highlight that not all initiatives approached collaboration similarly. In answering question

![Figure 1. Suggestive framework to address question 2.](image-url)
3, students should be encouraged to use theory to structure their arguments (see Table 2) and to illustrate the increased levels of complexity and coordination that collaborative efforts entailed (see Boehme et al., 2021)

- **Willingness and identification of relevant partners**: Apart from Dyson and Tesla, all initiatives recognised the need to collaborate. However, NASA relied mainly on its existing network while the other two engaged with a broader set of organisations.

- **Relevant capabilities and mechanisms**: Here, students should be able to recognise that willingness to collaborate is not enough to engage in productive collaboration (Coombes and Nicholson, 2021). Rather, theory suggests that collaboration should be conceptualised as a capability (Hibbert and Huxham, 2005) in which formal and informal mechanisms allow for sharing, learning and collaborating (Chesbrough, 2020; Crick and Crick, 2020). For instance, scaling the production of ventilators required mechanisms and tools that encouraged knowledge-sharing (e.g. GM/Ventec used augmented reality) while providing sufficient protection of IP (Contrera, 2020). The lecturer can note that IP issues were also blamed for the slow scaling of vaccine production.

- **Shared values and goals**: The initiatives that involved collaboration did not always approach the task from a perspective of creating shared value. For GM and Ventech, collaboration was driven by short-term goals and institutional pressures. In contrast, the Taiwan Ventilator Team focused more explicitly on long-term collaborative advantage and establishing a new industry.

**Table 2.** Table that captures the collaboration-related dynamics of the case.

| Initiative I (Tesla/ Dyson) | Initiative II (NASA) | Initiative III (GM and Ventech) | Initiative IV (Taiwan Ventilator Team) |
|----------------------------|----------------------|----------------------------------|---------------------------------------|
| Willingness to collaborate | ×                    | ✓                               | ✓✓✓                                    |
| Relevant capabilities and mechanisms | ×                    | ×                               | ✓✓                                        |
| Shared values and goals | ×                    | ×                               | ✓✓✓                                    |

NASA: National Aeronautics and Space Administration; GM: General Motors; IP: intellectual property.

- **Economic returns.** CE is usually associated with economic motives. For some initiatives, ventilator production perhaps qualified them as an essential business and enabled them to avoid costly shutdowns. Besides, even failed projects could offer companies a range of benefits such as positive media attention.

- **Capability building and access to new resources.** However, the benefits for companies might be broader. Many organisations might have benefited from learning to collaborate across industries and knowledge domains (see, e.g. Hibbert et al., 2017) or new relationships with organisations that they could leverage someday.

- **Enhanced reflexivity of decision-makers.** Decision-makers might be more reflexive about the potential limits of their frames in new contexts. Other than going with ‘gut feelings’, input from a wider range of stakeholders might be required (Crick and Crick, 2020). A structured approach of assessing and mapping capabilities (see question 2) can help managers think about the feasibility of future innovation initiatives, prevent firms from pursuing unrealistic or unnecessary goals, and direct attention to more relevant issues.

- **Learnings for policymakers.** For policymakers, the case highlights intellectual property rights as a factor that shaped the success and impact of responses. Although making IP available facilitated some sharing in the case of ventilators, a lack of similar measures led to acute shortages of medical face masks in many countries (Contrera, 2020). Similar issues seem to be affecting vaccine production, with the global pharmaceuticals unwilling to share access to their technology despite benefiting from public funding when they developed the vaccines. Ultimately, the case highlights that simple financial incentives from governments are often insufficient to produce meaningful outcomes during crises.

**Postscript and concluding the case**

The case can be a starting point for a group activity where students research and discuss how these insights are related to United Nation’s sustainable development goals (SDGs), which are often framed as complex problems that require collaborative and collective efforts. Indeed, SDG 17
explicitly recognises ‘multi-stakeholder partnerships as important vehicles for mobilising and sharing knowledge, expertise, technologies and financial resources to support the achievement of the sustainable development goals’. This will include efforts by established organisations to innovate in unfamiliar domains as well as relevant capabilities, processes and mechanisms that are needed to initiate, implement and enable multi-party collaborations.

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Note
1. The definition of CE has broadened in recent years and is often used interchangeably with the terms corporate venturing and intrapreneurship (see Sharma and Chrisman, 1999, for a review). For this case study, we focus on organizational process related to redeployment and recombination of existing competences and resources outside of the core domain of firms’ expertise in pursuit of new opportunities.

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