



# Innovation

**Abstract** The focus of this chapter is unpacking what is meant by the term ‘innovation’ and explaining how to optimise opportunities to innovate. As such, we explain the importance of culture, identify the main types of innovation, consider the significance of collaboration and team-building, and how to build a culture of innovation. The chapter draws on examples to demonstrate the importance of innovation when confronting a whole range of human issues, particularly the COVID-19 pandemic and climate change. The final section examines key factors that enable or inhibit innovation cultures, including physical and social spaces, incentives and creative constraints, and how to foster an environment that encourages risk-taking and experimentation.

**Keywords** Innovation process · Teams and team environments · Disruption and crisis · Collaboration · COVID-19 · Climate change

## INTRODUCTION: INNOVATION AND THE PROSPERITY OF NATIONS

It is conventional wisdom to most people that cultures that value and nurture innovation reap economic prosperity. While it is almost always spoken of in positive terms, the truth is that innovation has often been

discouraged, both overtly and subtly, throughout much of human history. There are two conflicting reasons for this. Firstly, innovation is typically associated with changes to the status quo in a process popularised by Joseph Schumpeter as ‘creative destruction’ (Dodgson and Gann 2010, 20). Secondly, societies are usually controlled by institutions that favour a ruling class, which is happy to maintain the status quo of extracting wealth from the many, while the many are discouraged from quelling their exploitation. For example, Pliny the Elder wrote about a man who demonstrated his invention of unbreakable glass to Emperor Tiberius, who asked if he had told anyone else about it. When the man replied no, Tiberius had him dragged away and killed, ‘lest gold be reduced to the value of mud’ (Acemoglu and Robinson 2012, 171). Aside from violence, what this demonstrates is the central role that governing bodies play in innovation. A ruling body may assist in the adoption of products that appear to pose little or no risk. For example, in Europe, opportunities for exploration and trade were opened with state support for the maritime industry, whereas in China, international trade was banned because emperors of the Ming Dynasty in the early fifteenth century viewed it as a threat to their rule (Acemoglu and Robinson 2012, 232). Similarly, Johannes Gutenberg’s invention of the printing press in 1445 was allowed to be replicated across Europe, which led to increases in literacy and education. However the Ottoman Empire banned or tightly regulated presses because their Emperors viewed losing control of knowledge as a threat to their authority (2012, 215).

These examples demonstrate that without central government support and the provision of a safe, stable infrastructure and environment for innovation to flourish, innovation-led prosperity is unlikely. This is still the case today in many countries. Innovation requires systems of government and economic institutions to reward innovators for their creativity, risk-taking and effort. As an economic system, the form of capitalism that is embraced by the majority in our contemporary world is one that encourages innovation. The system is fundamentally driven and entirely dependent upon innovation because the means of production and distribution are privately owned. As Schumpeter explains, the ‘fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers’ goods, the new methods of production or transportation, the new markets, the new forms of industrial organisation that capitalist enterprises creates’ (Schumpeter and Stiglitz 2010, 72–73).

In other words, innovation is not just necessary in the modern economy but critical to the prosperity of nations.

Niccolò Machiavelli, the Italian diplomat who is best known for his political treatise *The Prince*, recognised that a reformer's dilemma lies in resistance to change and the human desire to preserve the status quo. As he wrote:

[i]t ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things, because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new. This coolness arises partly from fear of the opponents, who have the laws on their side, and partly from the incredulity of men, who do not readily believe in new things until they have had a long experience of them. (Machiavelli 1998)

Machiavelli implies that humans are comfortable with familiarity and inherently suspicious of change. Although necessary, innovation can be uncertain, disturbing established relationships and dynamics of power. Machiavelli (1998) suggests that with experience, people may come to accept novel practices and ideas, especially if change occurs methodically in the fullness of time, enabling the new order to replace the old. A different temporal perspective is offered by Austin et al. (2020) who highlight the contextual nature of innovation and frame the need for change in relation to crisis and the urgency of survival. As they note with cogency:

Proverbial wisdom says necessity is the mother of invention. But crisis is at least a grandparent because it forces creative minds and bean counters alike to address necessity with fresh eyes. (Austin et al. 2020)

Therefore, fundamentally, innovation is understood quite simply as the creation of the 'novel' or something new. This is how creativity typically precedes innovation and creativity and innovation are often intertwined.

The history of human progress has been driven by the capacity for creativity and innovation. The link between creativity and innovation, reflected in the scale and rate of social and economic change, became evident over a century ago and has accelerated exponentially this century thanks to the integration of and increasing reliance on digital technology. The product of creative endeavour is an idea, a theory or artwork that

allows a patent, book, design or sculpture to be valued, such that it involves intellectual property rights, financial contracts and insurance. Some ideas can be implemented immediately while others take longer to develop. This process of converting creative ideas into viable—and often commercial—products, practices or services lies at the heart of innovation.

This chapter begins with the importance of culture, identifies different types of innovation, explains the significance of collaboration and team-building, and proposes some ways to build a culture of innovation. There are three different types of innovation, broadly referred to as incremental, radical and disruptive. As the process of innovation demands a broad range of specialist skills, and typically involves organisations, the innovation process relies on collaboration between people with different knowledge and skill sets. The chapter draws on examples to demonstrate the importance of innovation when confronting a whole range of human issues. As this chapter shows, combining different specialists brings diverse approaches and working styles to bear on the issue or problem at hand. Key factors that constrain or enable an innovative culture, including physical and social spaces, incentives and creative constraints, and how to create an environment that fosters risk-taking and experimentation, are also considered. We explore the relationship between innovation, disruption and crisis, particularly regarding the COVID-19 global health emergency and the discourse of climate change, both large-scale disruptive forces causing unprecedented levels of uncertainty. The final section of the chapter returns to how to build a culture of innovation by examining the key factors that enable or inhibit an innovative milieu, including physical and social spaces, incentives and creative constraints, and how to foster an environment that encourages risk-taking and experimentation.

### INNOVATION AS ‘NECESSITY WITH FRESH EYES’

Knowledge and ideas are synonymous with innovative practice, which typically incorporates new technology or new ideas in conjunction with economic, organisational and social dimensions (Meissner and Kotsemir 2016, 3). Dodgson and Gann describe innovation as “ideas successfully applied in organizational outcomes and processes” (2010, 14). On a practical level, as Dodgson and Gann note, innovation generates original products, services or organisational processes (2010, 14). According to Dodgson and Gann, innovation can also be conceptual, offering improved knowledge and judgement. At the same time, it has been noted that the

term ‘innovation’ is often overused and, as a result, has lost its significance. For example, American academic and author, Scott Berkun prefers the phrase “significant positive change” (2010, xvii).

The ‘practice’ of innovation can thus be deemed the application of necessity with fresh eyes, or significantly new ways of thinking and doing (Austin et al. 2020). We need to be aware, however, that most innovations are incremental rather than radical or disruptive. Dodgson and Gann describe incremental innovation as “ideas used in new models of existing products and services, or adjustments to organizational processes” (2010, 14). They suggest that this mode of innovation is demonstrated by updated editions of software packages or adaptations that are made to the composition of marketing teams. In contrast, radical innovations alter the character of existing services or products. For instance, the development of synthetic materials such as nylon or the promotion of open-source software radically change human practices. Transformational innovations would typically refer to ‘cutting-edge’ technologies like the Internet or the use of oil as a source of energy that have a far-reaching impact on human life (Dodgson and Gann 2010, 14).

Innovation process models have clarified our understanding of innovation and how it works. A key understanding is that rather than being an end point or a result, innovation is a process and flow of activities that aim to solve a known or unknown problem. As has been noted, the “problem, as well as its societal implications at different levels, may or may not be widely understood” (Meissner and Kotsemir 2016, 14). Innovation has typically been represented as a process involving specific activities. Linear models of innovation generally comprise a sequence of phases beginning with discovery or invention. The next step highlights utilisation and defines how the results of innovation can be applied. The final stages involve the development, design and practical use of the innovation.

Although equated with the outcome of a process, the trajectory of innovation is not necessarily linear. Whereas a typical sequence of activities is often involved, there are also feedback loops and diversions. As innovators define the problem and refine solutions, it is not unusual for them to move in a non-linear fashion between steps and activities. Studies reveal that attention has traditionally been given to activities in the latter rather than the earlier stages of the innovation process (Dziallas 2020, 502). Judgements about the success or otherwise of innovation characteristically occur later in the process when a product, service or idea has been developed and is ready to be trialled or, later still, as part of post-adoption

review. This is significant because the “front end” or early stages of innovation are now the subject of critical attention, and some organisations and companies are developing front end evaluation capacities.

The alignment of people and activities in the innovation process is reflected in the traditional distinction between invention and innovation. Whereas invention is usually associated with the generation of new ideas, innovation often relates to the conversion of ideas into marketable products, which are often commercially rolled-out, but not exclusively so. In accordance with this distinction, scholars who study invention have given attention to knowledge-based processes, such as factors that affect the production of new ideas, while those studying innovation have taken a management focus, prioritising resources, commercialisation and marketing (Vinokurova and Kapoor 2020, 2373–2374). Until recently, contextual factors such as human resources and company culture were not central to discussions about innovation. However, these are now primary facets of an open innovation paradigm. This paradigm posits that in addition to an organisation’s internal culture and resources, multiple external sources impact innovation, including the general public, customer feedback, published patents and a range of external agencies (Meissner and Kotsemir 2016, 14).

## THE INNOVATION IMPERATIVE

It has become accepted wisdom that our contemporary era is marked by uncertainty and peril. There is a prevailing sense that innovation is required for human and indeed, non-human survival. Yet, it would be imprudent to view innovation as a panacea or an alternative to individual and collective action for strategic structural and social change. We would be wise not to place unreserved faith in innovative technological solutions to global problems like the COVID-19 pandemic or climate change. Innovation is contextualised within, and responsive to, specific cultural, historical and environmental conditions. Arguably, in the present context, *all* innovation is anthropogenic in that to some extent it engages with or to some extent considers human-induced climate change.

The discourse of climate change tells us emphatically that our present world is contending with serious ecological challenges. The Australian scientist and regenerative farmer, Charles Massy, opines that “we have entered a new, dangerous era for life on earth. Human activity has begun to overwhelm the great forces of nature, placing virtually all

life – including that of humanity – at grave risk” (Massy 2019, 247–248). Another well-known Australian scientist, Tim Flannery, concurs and warns that we have been sleepwalking and that the “climate clock” is about to strike “a catastrophic midnight” (Flannery 2020, 179). Tamson Pietsch and Frances Flanagan (2020, 252) lament that while the primary “challenge of our era is to find ways to respond to the ecological, social and political breakdown our world is facing”, citizens may be ill-equipped to imagine an effective response. In this context, they suggest that historians can play a valuable role as “community builders” who can forge connections between the past and the present in ways that help preserve citizenship and democracy. They argue that there is no collective or authority with “a democratic mandate and the capacity” to direct us beyond the present malaise and to offer insight into how we might “live together in our common home” (2020, 252–235). In these circumstances, a contest emerges between fatalists who view the crisis as a “technocratic management problem” and those who are willing to envisage “alternative orders and versions of human subjectivity that may be brought into being at the speed and scale required” (Pietsch and Flanagan 2020, 253). We argue that what Pietsch and Flanagan describe in relation to the perils of climate change is the imperative to innovate. We must innovate toward sustainability, which involves conserving resources, caring for the environment and living within our means.

Against the backdrop of climate change, individuals and agencies are offering timely and compelling guidance for innovative change and action. For example, in Australia, the Climate Council released a series of reports that offer scientifically informed guidance: *Clean Jobs Plan* (2020), *Primed for Action: A Resilient Recovery for Australia* (2020), and *Aim High Go Fast: Why Emissions Need to Plummet This Decade* (2021). In *The Climate Cure: Solving the Climate Emergency in the Era of COVID-19* (2020), Flannery draws on Australia’s response to the COVID-19 pandemic in 2020, adding a hopeful rejoinder to public discussion at the time. Outlining a blue print for a climate cure, Flannery gives “a common-sense rapid pathway forward” and “deals with the full range of consequences that are upon us” (2020, 18). Among other things, he suggests that the pandemic has demonstrated our capacities to collaborate in times of crisis. Governments have shown they *can* act decisively upon scientific advice and, according to Flannery, must now apply this approach to climate change. Although the climate emergency is “slower burning” (2020, 151) than the pandemic, and its effects to

this point have generally been less obvious, he contends that Australians are increasingly cognisant of the gravity of the climate crisis and calls for urgent innovative action.

Similar support for innovative action is given by the International Energy Agency in its report *Net Zero by 2050: A Roadmap for the Global Energy Sector* (International Energy Agency 2021). This report, by the world's leading intergovernmental energy agency, provides stringent guidelines for the achievement of net-zero emissions by 2050, based on a transformation of the energy systems that currently sustain our economies (International Energy Agency 2021, 3). Clear milestones are outlined for the transition in the global economy from fossil fuels to renewable energy sources. In addition to innovation, emphasis is given to investment, policy design, technology, infrastructure and international cooperation. The report advocates for the global acceleration of innovation to assist these targets and advises governments to rapidly increase spending on research and development. While existing technologies can be deployed towards net-zero emissions between now and 2030, the report states that by 2050 “almost half the reductions come from technologies that are currently only at the demonstration or prototype phase” (International Energy Agency 2021, 15). Opportunities for innovation will be particularly strong in “advanced batteries, hydrogen electrolyzers, and direct air capture and storage” (2021, 15). Whereas large-scale innovation of this kind has a vital and clearly global reach, possibilities also abound for innovation on a smaller scale.

The discussion of innovation so far highlights the view that in these greatly contested times, from the individual to the local to the global, the mandate for innovation is not so much to *recast or remake the world* as to *become with it* to forge sustainable equilibrium. The question of whether this is achievable is the theme of a 2021 edition of the *Griffith Review* titled ‘Remaking the Balance’:

As the world teeters between old and new ways of doing, can we remake the balance between what we need and what we nurture? Can we forge a new equilibrium to sustain us into the twenty-first century? Having challenged so much – social practices and social structures, habits of mind and habits of leisure – will the pandemic leave a lasting legacy on how we shape the world? [This edition] examines how our natural, economic and cultural systems might be refashioned post-pandemic: will it be a return to business as usual, or can we reinvent our relationship with all that is animal,



vegetable and mineral to create a more sustainable future? (*Griffith Review* 71 ‘Remaking the Balance’ 2021)

The questions posed in this description are significant from the perspective of innovation because they provide cues for an unpretentious appraisal of the circumstances at hand, thus offering an important point of departure.

There are certain caveats that should accompany innovation. It is important, for instance, that innovation is ethical and, as far as possible, reflective of individual and public consensus. In fact, consensus may not be ideal for innovation since multiple creative options are needed to generate the diverse ideas from which the best innovations emerge. However, it is reasonable to expect that for innovation to work for the common good, it should represent the interests of all stakeholders involved rather than benefitting a privileged few. One obstacle that can arise when addressing pressing problems is that as crises deepen, public opinion tends to polarise and divide (Cunningham 2021: 129). According to Sophie Cunningham, we may be reaching the point where “the conditions for consensus will no longer exist” (2021: 129). Cunningham argues that we should endeavour to work together despite not always agreeing. This might involve big-picture points of agreement, such as the desire to protect our families, communities, lives and homes. Innovation can proceed ethically based on broad consensus. As mentioned previously, perhaps today we need an approach to innovation based on an ethics of care and connectedness, and the sustainable restoration of balance, rather than radical reinvention. In this regard, innovation might facilitate humanity’s *becoming with* the world instead of domination over or separation from it. Ultimately, this calls for innovation that is grounded in empathy, humility and self-awareness.

### SPECULATING THE FUTURE: INNOVATION AND IMAGINATIVE ENGAGEMENT

Science fiction novelists often imagine technologies and products long before the expertise and infrastructure are available to create them. Fictional speculation forges a productive alignment between reason and imagination, enabling expanded visions of our future. Historically, the genre has accurately predicted innovations and social trends. For example,

Edward Bellamy anticipated the credit card in the novel *Looking Backward* (1888). The Newspad, a foolscap-sized device that scans the earth's major electronic newspapers in Arthur C. Clarke's *2001: A Space Odyssey* (1968), is widely compared to a contemporary tablet personal computer. John Brunner predicted electric cars in *Stand on Zanzibar* (1969) and in *Cyborg* (1972) Martin Caidin imagined bionics (Contreras 2017). These and many other examples of speculative fiction encourage us to engage with and reflect on innovation and relevant social, political and ethical implications.

More recent examples of speculative fiction construct future social worlds beset by the effects of the COVID-19 pandemic or climate change. Often dystopian in nature, these texts imply the need for urgent innovative action *in the present*. Their exploration of themes such as climate change, contagion, species extinction, resource depletion and forced migration often suggests that existential peril may have been avoided or lessened through prior application of creative and innovative problem-solving measures. A prescient example is offered by science fiction author Kim Stanley Robinson in his novel *The Ministry for the Future* (2020) which documents a world where a climate catastrophe impacts key dimensions of life in India, including the economy and environment. In his analysis of the novel, science fiction researcher J. R. Burgmann contends that preparation for the future necessitates that we clearly and objectively perceive the present. As Burgmann explains, "Only then, by extrapolating the likely future of our planet, might we begin to imagine a better world" (Burgmann 2020). Science fiction can thus be construed as the 'realism of our time' (Robinson 2020), an emerging sensibility based on people's awareness that they are constructing human history through the shared practices of their everyday lives. In this context, it would be naïve to assume that innovation, technology or market-based solutions offer a panacea. Today, we are creating problems that will be impossible for coming generations to solve, as Robinson (2020) notes: "You can't fix extinctions or ocean acidification, or melted permafrost, no matter how rich or smart you are". However, as Robinson's novel attests, we are just as capable of solidarity and can work collaboratively and innovatively to review and reform ideologies, policies and public institutions. Samuel Alexander argues that the future will probably be fashioned by a combination of "design" and "disaster". Rather than waiting for the future to shape us, we should seek to "constitute the future" through planning and

collaborative action (Alexander, in Cunningham 2021: 125–126). Prioritising *design* reinforces the role of innovation in the creation of positive futures, both locally and on a global scale. Innovative steps that are tentative, grassroots and comparatively small can contribute to a sustainable world.

Authors of non-fiction also draw on speculative scenarios to accentuate problems requiring innovative solutions. They may choose illustrative fictional examples to refer to the prospective style of the science fiction genre. In Australia, the Climate Council is considered a leading organisation in the *communication* of climate change. Although predominantly scientific in emphasis, its report *Aim High, Go Fast: Why Emissions Need to Plummet This Decade* (2021) includes a section titled “Australia in a 3 °C World” (44–45), which anticipates life in Australian towns and cities if warming rises consistently above 2 °C and exceeds human control. It is sobering reading precisely because it encourages us to *imagine* the practicalities of life in an overheated environment.

Ethical entrepreneurship is another subject explored through creative and innovative speculation. Australian businessman and philanthropist Andrew Forrest gives a timely example of the connection between innovation and speculative fiction in his 2021 Boyer Lecture series: *Rebooting Australia: How Ethical Entrepreneurs Can Help Shape a Better Future*. Forrest argues that collaboration between business and philanthropy can drive positive change. In his second lecture, “Lighting Up Our Ocean”, he contends that unprecedented levels of philanthropic and governmental intervention are required to save the world’s seas from pollution, overfishing and deoxygenation. At the conclusion of his lecture, Forrest draws on the plot of a science fiction narrative recently developed by marine researchers who were speculating on prospects for the world’s oceans. In their story, a company has bioengineered a species called Super Tuna that is herded along migration routes by underwater drones. Forrest compares this dystopian image to the large-scale netting of wild baby Bluefin Tuna that are conditioned in floating farms in Australia for the export market. He cautions that innovation has brought us to this “absolute nadir of ocean exploitation” and suggests that it is now time to stop and reflect on ways we might act in the ocean’s defence.

Future projection is the defining characteristic of some of the world’s most significant innovations. Certain ideas are so complex or groundbreaking that no single individual could possibly bring them to fruition. Aviation is a prime example; it took millennia for the idea of flying to

be applied in practice. Four hundred years elapsed between Leonardo da Vinci's illustration of a flying machine and the innovative implementation of flight. The analogy of flight is aptly applied to the uncertainty of the present times by Hunter Clemens, director of meetings at the American Physical Society, who compares providing quality virtual experiences for scientists to "flying an aeroplane while you're building it" (cited in Remmel 2021, 186). Many specialist areas had to be developed before flying could become the global industry it is today. This demonstrates that innovatively engaging with complex problems involves multiple approaches and is often forged through the collaborative endeavours of people with diverse interests, experiences and expertise.

### INNOVATION, CRISIS AND CONTEXT

Crises bring change that encourages innovation. Over centuries, disruptive events have challenged social, political and economic stability and also stimulated progress. For example, although the Great Depression was a period of severe economic decline, for some companies, it presented opportunities for research and development that facilitated future success (Cervantes 2020). DuPont invented nylon and neoprene and P&G (Procter and Gamble) diversified its market, producing serialised daytime radio shows in the Soap Opera genre (Cervantes 2020, 44). Innovative responses to the September 11 (2001) terrorist attacks in the United States presented similar opportunities and hastened the development of some technologies that were already underway. For example, in the wake of the attacks, iRobot Packbots produced by DARPA were mobilised to help search for survivors in the rubble of the Twin Towers. Subsequently, Packbots and other remote control and semi-autonomous robots have been employed in military, crime-fighting and disaster situations, including in the aftermath of the Gulf oil spill (2010) and the Fukushima nuclear reactor meltdown (2011). Since 9/11, advances in social networking and crowd journalism have assisted with the rise of the digitally equipped citizen reporter, and innovations in automatic translation software have aided communication in the military field. Design adaptations have been made to multi-storey buildings and CT scanners for airport security (Eaton 2011).

More recently, the COVID-19 pandemic set a new benchmark for our collective understanding of global crisis (Chopra 2020). It is a "systemic jolt" that has intensified openness to innovation and compelled

innovators to “address necessity with fresh eyes” (Austin et al. 2020). Global responses to COVID-19 saw innovation occurring on an unparalleled scale, the supercharging of entrepreneurial activity and an easing of “bureaucratic, regulatory, and mental” barriers that encouraged innovations such as “remote medical visits and mass virtual work” (Austin et al. 2020). The need to adjust rapidly to changes in how we interact, work, learn and communicate has required people of all ages to engage with technology (Cervantes 2020). In terms of business and corporate culture, innovative output can be maximised during times of crisis. Companies are forced to prioritise and to redeploy their resources in targeted ways. Since time is short, and intensive problem-solving key, expertise is mobilised from across the workforce, which can result in enhanced collaboration, incorporating experimentation and diverse ideas.

For many, technology was already a well-entrenched aspect of daily life, and the pandemic created opportunities to learn new skills and refine existing knowledge. For others, the capacity to work and learn from home during the pandemic was less assured, making access to technology (including its supporting infrastructure) and technological skills a matter of social equity. The disruptive impact of COVID-19 is clear in transformations in professional practice and service delivery in medicine and public health. According to John Nosta, while the COVID-19 pandemic accelerated the rate of change, a dynamic of adaptive thinking is emerging in medicine, for example, that aligns with the development and use of technology. Nosta predicted that technological innovations and artificial intelligence would shift the emphasis of care, freeing physicians to engage with their patients and to “discover a richer and deeper relationship with medicine and mankind” (2020, 882).

Creative entrepreneurial responses to the pandemic abound, and current consumer behaviour is a useful indicator of prospective trends (Meyer et al. 2020). Companies around the world responded to the COVID-19 crisis by cutting costs and adopting innovative business strategies. For example, hand sanitisers were manufactured by distilleries in Australia, Canada and the United States. Protective gowns and various hospital supplies replaced haute couture and became a priority of fashion companies like Zara H&M, Hedley & Bennett and Trigma (Clark 2020, 511). Hospitals recruited airline staff and members of the Special Air Service, and companies like Philips and Draeger scaled up their production of ventilators to address a critical shortage at intensive-care units. At the same time, a group of businesses in the United Kingdom representing

the aerospace, automotive and medical sectors, collaborated to form the VentilatorChallengeUK Consortium. Businesses such as McLaren, Airbus, Ford, Rolls-Royce, Dell Technologies and Siemens were part of the consortium; their primary goal was to produce medical ventilators for the NHS (Walsh 2020; Ventilator Challenge UK 2020). There was a great demand across the world for personal protective equipment including face masks, and with disruptions to supply chains in some of the countries that produced the equipment, creative adjustments and innovation had to be mobilised.

The pandemic created an exciting landscape of possible innovative futures. It is likely that businesses will continue to explore innovative opportunities, projects and strategies that emerged during the pandemic. Meyer et al. observe that “reputations are built – and lost – during times of crisis, and that as the world moves on companies will be characterised and defined by the responses they took during the pandemic” (2020, 3). They suggest that the production of medical equipment could become standard practice for some automotive suppliers and that service providers will continue to “integrate new online interfaces with their traditional businesses” (2020, 4). Furthermore, Meyer, Pedersen and Ritter contend that it is possible that connections between innovation and citizenship forged during the crisis will be consolidated when the economy strengthens. Companies that have taken socially responsible actions, such as assisting in practical ways with shortages or making financial donations, will continue to develop strong relationships with customers. Similarly, firms that have supported their employees during the crisis will attract and retain talented and dedicated staff. A global wave of people choosing to resign from their jobs at the height of the pandemic in 2021–2022, dubbed ‘The Great Resignation’, is often associated with firms who did not support their employees adequately or who did not innovate sufficiently.

Innovators should therefore keep in mind the power of crises like the pandemic to unsettle the normalised behaviours of consumers, whether individual customers or businesses. For example, consumers have embraced online ordering and home delivery, which has implications in terms of customer attitudes and expectations (Meyer et al. 2020). Meyer et al. (2020, 5) maintain that many people have become familiar and comfortable with online work meetings and will expect greater amalgamation of virtual and face-to-face offerings in their workplaces. Employees

are also likely to want to capitalise on newly acquired technological skills and to develop this expertise within their work environments.

Meyer, Pedersen and Ritter predict that the post-pandemic world will be distinctive and are encouraged by contemporary evidence of entrepreneurial spirit and ingenuity. Fundamental shifts in business practices, incorporating virtual forms of communication and working from home, have been paralleled by dedicated problem-solving and a commitment to creating innovative solutions. For Meyer, Pedersen and Ritter, at a time of crisis, this combination illustrates corporate citizenship and the willingness of many businesses to prioritise social good over financial profit. It also demonstrates resourcefulness through creative engagement with challenges and the inventive application of limited sources. Importantly, citizenship and resourcefulness can be the basis of “socially aware entrepreneurship” (Meyer et al. 2020, 5).

Social awareness underpins ethical dimensions of innovation in the present crisis. Whereas innovation implies adaptation, and the adoption of new directions, ethical responses can reflect the consistency of enduring principles. Daniel Fleming argues that a time of crisis is “not a time to invent a new ethics. A time of crisis is to hold true to the principles that we think are most important and let them guide us” (Fleming in Carleton 2021). From the perspective of economics, Paul Romer notes that “a crisis is a terrible thing to waste” (cited in Meyer et al. 2020). Recognising and honouring the complexity of the relationship between crisis and innovation involve multiple facets, including values and ethics.

## INNOVATION AND VALUES

Clearly, innovation can unsettle what we assume to be true and cause us to reassess our values. Furthermore, different kinds of innovation can prompt different responses from people at different times (Roberts 2019). This section considers three contemporaneous examples that challenge understandings about innovation and ethical problem-solving: the COVIDSafe mobile phone app (or application), recent developments in model human embryos and drone technology. These examples illustrate the ethical complexities of innovation, highlighting how it can function as both a productive response to particular social circumstances and a challenge to prevailing interests, values and ideals.

The COVIDSafe mobile phone app was introduced in Australia in April 2020 and promoted by the Australian Government as means of

decelerating the spread of the virus and assisting manual contact tracing processes. Smartphone users were encouraged to download the app, which utilises Blue Tooth technology to compile a log of other COVID-Safe app users. When another app user was encountered, the COVIDSafe app logged and securely stored the encrypted reference code as well as the date, time and length of contact. This information remained on the phone for twenty-one days before being deleted, a duration that encompassed the fourteen-day virus incubation period, and the time needed for diagnosis (Australian Government Department of Health and Aged Care 2020). In March 2021, a review of the COVIDSafe app at a senate estimates session revealed that the app, which had cost approximately six and half million dollars by January 2021, had identified eighty-one close contacts in the state of New South Wales, seventeen of whom would otherwise not have been found.

Initially, the app did not work well on Apple iPhones and many Australians who were concerned about security chose not to download it. Downloading the app was voluntary and data was not collected about the users' locations. The Department of Health (Australian Government) assured the Australian public that their personal information and privacy would be strictly protected, and in May 2020, the Privacy Amendment (Public Health Contact Information) Act was passed by the Parliament to further strengthen security measures. Despite these assurances, public uptake of the app was slower than expected, perhaps due to Australia's comparatively low level of infection or the fact that during periods of lockdown, many people resided with others they knew and did not feel the need to trace external contacts (Kelly 2021). Some private companies developed their own contact tracing apps with features specific to their needs. For example, it was reported that resources company BHP introduced the C-19 Tracer mobile application for use in its global operations. The app augmented existing strategies such as physical distancing, temperature checks and hygiene measures. In the case of infection, it was designed to identify the movements of employees, enabling the rapid isolation and sanitisation of specific work areas (Kerr 2020).

Ethical concerns were also raised about the creation of the world's first model of an early human embryo. Developed by an Australian-led international research team, this innovative work is celebrated in the world of medical science for the potential insights it will allow into early human development. Professor Jose Polo and his team from Monash University published the results of their pioneering work in the journal



*Nature* in mid-March 2021. The model human embryos are created from the skin cells of a human arm. Produced under laboratory conditions by researchers, the cells are programmed to replicate the first few days of human life. The model embryos attach to each other and begin to develop, much like embryos in the uterus; however, they are not natural embryos and do not follow the same trajectory of development. For this reason, these models cannot be considered artificial embryos.

Professor Polo describes the human genome as a library. He is interested in how changes occur in human cells beyond the fundamental structure of DNA and believes that “who we are is dependent on how the smallest, most fundamental pieces of our biology are able to open and close the great books of our genetic library” (Monash University 2021). This breakthrough research will shed light on the early stages of human development, which has been limited to this point because access to human embryos is highly regulated due to ethical concerns. These concerns can be allayed because laboratory-grown blastocysts are not the same as human embryos and, according to scientists, do not have the capacity to become fully formed (Subbaraman 2021, 510). In pregnancy, a blastocyst (an egg after it has been fertilised but before implantation in the uterus) implants in the wall of the uterus at around 7–8 days, the outer layer of cells giving rise to the placenta and the clump inside having the potential to develop into the foetus. While scientists have been able to study the later stages of foetal development using stem cell technology, legal regulations and guidelines from the International Society for Stem Cell Research restrict embryo development in the laboratory to 14 days after fertilisation (Subbaraman 2021, 511).

The benefits of this research will impact studies into infertility, miscarriage, birth defects, as well as those working in the field of IVF and those studying genetic diseases such as Cystic Fibrosis. Despite the distinctive benefits of this research, the innovative work of Polo and his team raises ethical issues that should be considered. Professor Polo is adamant that he has developed a “good model” rather than to intervene in the ‘creation’ of human life. However, the researchers are mindful that important community conversations need to occur about the status of these models and their ethical use in ongoing research. For instance, while it is the belief of the Catholic Church that life begins at the point of fertilisation, it is also vital to note that the iBlastoid models do not require fertilisation. The issue of how far the models can be used to “model biology” (Mannix

2021) is therefore of primary concern. Whether a model embryo is entitled to the same privileges and protections as a real embryo is another ethical question raised by the research.

Serendipity played a role in the production of the model human embryos. The cells created by Professor Polo and his team resembled blastocysts before their attachment to the uterus; however, “[t]heir development into model embryos was pure serendipity, followed by meticulous science” (Mannix 2021). The team had been working on the manipulation of skin cells to turn them into stem cells. A small percentage of the cells were not responding as predicted and lay dormant until placed together. Four or five days later, the research team noticed that the cells had self-assembled to form small balls. Examining the balls, they found a second smaller ball inside each structure: “the primitive endoderm and embryonic stem cells that would, in a real embryo, eventually become a human” (Mannix 2021). At this stage, Professor Polo stopped the experiment and contacted the university’s ethics board. The board deliberated for months before instructing Professor Polo to stop experimenting with the cells until a decision was made about how best to proceed. Mannix (2021) writes that “to many people, the study of human blastoids will be less ethically challenging than the study of natural human blastocysts. However, others might view human blastoid research as a path towards engineering human embryos. This will inevitably lead to bioethical questions”.

Further ethical questions are raised by the latest innovations in drone technology, specifically in the field of war. Michael Richardson describes a drone as an “unmanned aerial vehicle” that operates within an integrated system. Richardson’s collaborative research project “Drone Witnessing: Technologies of Perception in War and Culture” investigates “the ethical, political and cultural significance of drones” and the “impact of increased reliance on drones in war and culture” (UNSW School of the Arts and Media 2022). Richardson explains that drones have transformed how we *see* and *witness* the world, including “how we decide the events that matter and create our shared ‘truth’ of what happened” (Richardson 2020). Today, drones help determine the ways we perceive “war, climate change, political protest, and now the COVID-19 pandemic” (Richardson 2020). They also perform significant roles in policing, border surveillance and animal conservation (Richardson 2020).

Drones are “vision machines” (Richardson 2020) that hover in the air and direct images to a point of control. The images they transmit can

be optical or thermographic. Drones also collect data, especially information about altitude, speed and location. While they help to shape “the contemporary aesthetic of war”, they are also increasingly associated with “new modes of art, activism, and popular and promotional culture” (Richardson 2020). Richardson’s research indicates that the mixture of “aerial vision, remote control and data creation” is altering the way we engage with the world. While footage from police drones can be used in court against those who have allegedly broken the law, drones can also capture vision of state violence that may otherwise have gone undetected. For example, drones bore “witness” to conflicts between police and activists during the Black Lives Matter protests in the United States in 2020. Richardson adds that drone footage of open cut mining, the bleaching of the Great Barrier Reef and images of bushfires, floods and droughts contribute to a visual repertoire that is of national, cultural and environmental significance.

Richardson notes that during the COVID-19 pandemic, the surveillance role of drones has widened to include the policing of social distancing. At the same time, drones have allowed us to witness the pandemic in potentially unifying ways. They have given visual access to city spaces devoid of crowds, and in contrast to the continual regime of testing, statistics and logarithmic information have enabled us “to witness the uncanny, melancholic and strangely beautiful disruption to everyday life” (Richardson 2020). Thus, Richardson argues, drones provide a context for interpreting the “dislocations and anxieties of life under lockdown” (2020). In a particularly creative manoeuvre, a flotilla of drones was used in Seoul, South Korea, to convey aerial public health messaging.

Richardson argues that drones could be instrumental in opening the world to our shared perception in surprising ways as the threat of the pandemic recedes. As Richardson explains, “With millions stuck in lockdown and travel restrictions in place, drone footage shared online can help people experience distant places without leaving home” (Richardson 2020). Richardson cites the example of WeRobotics, who train local operators to undertake mapping and photography in Africa, Asia and South America. Acknowledging that drone technology can have complex social outcomes, Richardson recommends that we expand our engagement with the ethics of aerial vision as it pertains to drones.

Of ethical importance is the capacity of drones to diminish the boundaries between “war and domesticity” and “human and machine”

(Richardson 2020). Strategists generally view drones as having the potential to alter the ways modern war is perceived and experienced. Large drones like the Predator and Reaper “help the US exert power across the globe”. Equipped with high-tech surveillance equipment, these drones “can provide support for soldiers on the ground as well as launch their own strikes. And they can do all that without exposing their own crews to danger”. According to Richardson, some supporters of drone technology believe that drones help to create safer wars by making them “more technical and precise” (Richardson 2021). While this may be the case, he observes that in recent times, thousands of civilians have been killed in American drone strikes. In Afghanistan, Pakistan, Yemen, Gaza and elsewhere, people have lived with the constant threat of drone attacks and are never sure when the next attack will occur. Furthermore, there is evidence that the use of drone technology can alienate and in some cases, radicalise local people (Richardson 2021).

Concern has arisen in recent times about the ethical deployment of swarm drones. These small devices work in teams, following mission directives to achieve specific goals. At present, research is focused on the capacity of the drones to carry out directives and collaborate to fulfil objectives (West 2021). Surveillance is a concerning ethical dimension of swarm drone technology development, particularly as it relates to consent and the possible violation of individuals’ privacy. Ultimately, the technology is designed to act autonomously or without human control. This means that even in a surveillance context, the drones may act in ways that the operators do not anticipate. In future, there is also scope for the swarm drones to be weaponised in the theatre of war (West 2021).

Swarm drones are perfectly suited to mobilisation in high density urban areas. Some of the complexities of urban warfare in built-up areas could be addressed by drones that are deployed in between buildings or manoeuvring through open windows. The capacity of swarm drones to operate within confined physical spaces, to identify targets and to undertake precise offensive action, promises to reduce structural damage to the built environment. Broader ethical concerns relate to the ways new drone technology will support military strategies in the arena of war (West 2021; Richardson 2021). As older drone models like Predator and Reaper become obsolete, advances in computer processing, artificial intelligence and aeronautical design will facilitate a new era of drones better suited to the tactical ambitions of modern warfare. The integration of artificial

intelligence and augmented reality into the military context is well documented. It was recently reported that Microsoft will make thousands of “military-grade augmented reality (AR) headsets” available to the United States Army; these headsets are likely to include thermal sensors, simulation functions for training purposes and a digital display capacity to heighten “situational awareness” (Egliston and Carter 2021).

While much of this technology is yet to be fully developed, the realisation of these military adaptations is reportedly well underway. According to Richardson (2021), drone swarms with the capacity to “self-heal” or to adapt to losses during deployment are an emerging reality, and as Richardson observes, the availability of this military technology presents the potential for war to become increasingly clinical and detached. It also risks placing violent action and confrontation ahead of diplomatically negotiated solutions (West 2021). New drone technology accentuates the need for true social debate about “transparency, accountability and responsibility”, the nature of war and the “kinds of weapons we are willing to have used in our name” (Richardson 2021).

### INNOVATION AND THE EVERYDAY

COVID-19 draws attention to the role of entrepreneurship in a post-COVID-19 world. Dean A. Shepherd argues that the pandemic challenges the validity of assumptions that have been essential to innovation (Shepherd 2020, 1750). For instance, although it is commonly thought that entrepreneurs are the primary drivers of disruption, in the present context, the virus itself is the key disruptor. Shepherd considers how entrepreneurship, whether independent or corporate, will become a part of the so-called new normal. The virus unsettles the perception that technologies and markets operate in a relatively stable environment that is intermittently disrupted by extreme events. In actuality, the increasing regularity and severity of extreme events is a feature of the present context (2020, 1751). The pandemic also challenges the long-established view that entrepreneurs are unique individuals, distinguished by remarkable attitudes and skills. In reality, the pandemic reveals the entrepreneurial potential of “ordinary people” and shows that “entrepreneurial action is possible anywhere” (Shepherd 2020, 1751).

Throughout history, ordinary innovators have created strong links between cultural identity and place. In Western Australia, the WA Museum Boola Bardip features a permanent *Innovations* exhibition,

highlighting local examples of creativity and entrepreneurship in the sciences, art, music, medicine and fashion. In another collection, everyday ingenuity weaves through the historical narratives of individuals and their families. This collection showcases the adaptability and resilience of previous generations of Western Australians, including Indigenous Australians and immigrant families. The formative role of innovation is highlighted within the unique social and historical environment of Western Australia. In times of economic and social hardship, people ‘made do’ by creatively repurposing found objects. Scarce resources and isolation forced people to work collaboratively and innovatively. One compelling exhibit in the museum features the innovative repurposing of kerosene tins, drums and crates. Kerosene or ‘Kero’ is a fuel extracted from petroleum that is used for burning in lamps and domestic heaters as well as a solvent for greases and insecticides. The extreme hardships of the 1930s Depression, and World War Two, meant that Western Australians had to take particularly flexible approaches to the limited resources in their everyday environments. For example, many fashioned what came to be known as “Depression Furniture” from Kerosene packing crates and drums. Crates were used by inventive Western Australians in various ways, including to build lunchboxes, children’s toys and even houses. In the 1920s–1930s, Kerosene tin buckets were used domestically as well as in mining and agriculture (WA Museum Boola Bardip 2022).

In another context, Gabrielle Chan (2020) describes the nimble responses of people living in small communities in the foothills of the Upper Murray region in Victoria, Australia, following a bushfire. Prior to the fire, Josh Collings from Cudgewa in Victoria, and his fellow community gardeners, introduced a community food swap, which attracted interest from residents in the region. When bushfires swept through their community, the family’s cottage was destroyed. Returning to survey the damage, they noticed that the only part of their property that was unscathed was a small patch of zucchinis in the vegetable garden. As they moved through the district, this scene was repeated. Vegetable patches signalled life in the ruined landscape. Taking this as a sign of hope and resilience, Collings started the Acres & Acres Co-op, a combination of community and market gardens. Profits from the sale of produce paid the workers, with the remainder being divided between the cooperative and local initiatives (Chan 2020). More than just revitalising a community, the objective of the Acres & Acres project is to “use regenerative farming practices and world-class small-scale farming innovation to enable local

communities to grow their own food sustainably” (Acres & Acres 2021). The Acres & Acres initiative is part of a wider phenomenon that reflects the desire for everyday people to engage with sources of food production.

Everyday innovators and entrepreneurs unsettle the normalised association between entrepreneurship and isolation. This association is accentuated by the COVID-19 crisis. Entrepreneurs are often represented as solitary figures, while entrepreneurial careers can “generate loneliness” (Shepherd 2020). The pandemic draws attention to the common experience of social isolation. During periods of lockdown, many people have experienced loneliness and found creative ways to stay connected. According to Shepherd, the pandemic has also shed light on entrepreneurial failure. When innovative ventures fail, it is often attributed to the decisions and actions of individuals. In the context of COVID-19, however, some businesses have dramatically declined despite individual input (Shepherd 2020, 1752). The reverse is also true: the pandemic has created opportunities for other entrepreneurial individuals and businesses. In addition, crises encourage collective action, which is the antithesis of lone endeavour, and solidarity in numbers increases the likelihood of success.

Jesse Adams Stein (2017) describes how, in the context of Australian politics, the term ‘innovation’ aligns with principles of economic efficiency and entrepreneurship. Specifically, innovation “naturalises a way of thinking that valorises profit-making over other social, ethical and environmental considerations”. The examples Stein provides take innovation in another direction as well as focusing on innovation in the everyday. MakerSpace & Company promotes the benefits of making by building connections between people with differing levels of skill and experience in the design community. Participants are given access to professional facilities as they collaborate, learn and create (MakerSpace & Co 2021). Freecycle is a global non-profit movement of over nine million members who exchange and reuse items advertised through an online platform; those items might otherwise end up in landfill. Membership is free and people network in their local communities (Freecycle Network 2021). Orange Sky Australia is “the world’s first free mobile laundry service for people experiencing homelessness” ([orangesky.org.au/our-story/](https://www.orangesky.org.au/our-story/)). Initiated in 2014 in Brisbane Australia, Orange Sky now includes shower services and remote vehicles. As well as improving standards of hygiene and boosting the morale of people who are enduring hardship,

Orange Sky volunteers seek to dignify friendship and to challenge negative perceptions of homelessness.

Alternative forms of knowledge, understanding and inquiry are celebrated in the contexts of everyday entrepreneurship and innovation. The practical knowledge and experience of people in local communities can inform innovative responses to complex problems that have traditionally been reserved for science. Although local in focus, the application of this expertise can be global in reach. Environmental scientist, Jessica Reeves, uses the example of Lake Tyres in the East Gippsland region of Victoria to illustrate the importance of multiple approaches to knowledge when preparing to innovate (Taylor 2021). Reeves argues strongly for recognition of the epistemological value of local perspectives and experiences, including Indigenous custodianship, that fall largely outside the methodological parameters of formal Western science. She contends that a collaborative integration of diverse perspectives is needed for innovative engagement with natural systems that by their *nature* are highly interconnected and multi-layered. Essentially, Reeves highlights the importance of combining knowledge from science and art, as well as local and traditional expertise, to enrich collaborative and innovative practices (Taylor 2021).

## TECHNOLOGY IN CONTEXT: INNOVATION AT WORK

It is predicted that global innovation will increase to problem-solve in the context of the COVID-19 pandemic. As the world moves forward, Zahra (2021) suggests that, among other attributes, agility, risk-taking and proactivity will be valued as part of an “entrepreneurial orientation”. Digital technology will continue to facilitate innovation. For many, initiatives such as online ordering and home delivery are commonplace. Businesses are likely to continue to explore market opportunities based on digital technologies. For example, entrepreneurs from emerging economies have responded to the uptake of smartphones by developing a range of innovative products. Similarly, digital technologies have become central to the survival of “restaurants, retailers, banks, and book sellers” (Zahra 2021, 4).

Recent innovations in contactless technologies in the hospitality industry reveal the multiple dimensions of hospitality. Being hospitable implies the amicable reception of guests, clients and friends; however, the *experience* of hospitality need not rely on sharing physical space. It is possible to be welcoming and inclusive beyond the realm of the



face to face. Technology is being used to ensure safety and maintain consumer trust. Artificial intelligence, visual recognition, robotics and virtual reality are among the technologies transforming this industry and helping to hyper-personalise customers' experiences whilst retaining health security measures (Sanchez-Pardo 2020). Innovation managers are exploring the roles artificial intelligence can play in areas such as data analysis and the clarification of problems (Kakatkar et al. 2020, 178). Innovative technological approaches are being incorporated into standard service operations. Along with hand-hygiene, mask-wearing and physical distancing, touch-free and contactless technologies reinforce health measures and enable patrons to continue their lives with minimal disruption. If hotels are equipped with the appropriate software, clients are now able to access many aspects of the hospitality experience on their personal mobile devices, including "scannable QR codes, contactless hotel check-in capabilities, mobile room keys, touchless payments and in-app ordering" (Rahimizhian and Irani 2020).

Research conducted by Rahimizhian and Irani (2020) sought to discover how tourists responded to innovativeness in their experience of tourist activities during the pandemic. Innovativeness was also used to describe the level of receptiveness demonstrated by tourists to new technologies as part of the tourist experience. Innovativeness reflects the customer's desire to seek novelty, uniqueness and stimulation, as well as their willingness to act independently (Roehrich, cited in Rahimizhian and Irani 2020). Innovative customers are likely to be early adopters of innovative services and technologies (Hadi et al. 2020; Strutton et al. cited in Rahimizhian and Irani 2020). They are often adventurous and value being the first to enjoy novel tourist experiences. Innovativeness also plays an important role in influencing the "revisiting intentions" of tourists (Rahimizhian and Irani 2020). The researchers found that the COVID-19 crisis increased opportunities for innovation in the tourism industry, and that there were competitive advantages for businesses that sought out innovative solutions to the crisis and could transform innovative ideas into practical strategies of operation and management.

Although tourism and hospitality providers face a great challenge attracting travellers and clients to COVID-19-affected locations, Rahimizhian and Irani (2020) concluded that the adoption of innovative technological strategies, implemented in accordance with health regulations, allayed customers' fears and uncertainties. It was possible, therefore, for tourist destinations to continue to attract customers despite

COVID-19. The authors were particularly keen to understand how technology could be harnessed to increase the confidence of customers. They suggest that post-COVID-19, the development of a “touchless, adaptable and customizable automation platform featuring all front-office operations and answering particular business requirements” (Rahimizhian and Irani 2020, 294) could be a worthwhile point of departure and recommend that other innovative automated and contactless solutions could be deployed to reduce uncertainty for customers.

As a result of the pandemic, videoconferencing also became a major focus of contemporary communication practice and played a vital role in workplaces. Video conferencing is now a critical communication tool for hundreds of millions of people. The video conferencing platform Zoom capitalised on the dramatic changes in private and professional communication. The shift from physical workplaces to the virtual office had been anticipated for some time; however, with the arrival of the pandemic, Zoom became a leader in its field. The centrality of video meetings in our lives is reflected by the term ‘zooming’, which is now as familiar as ‘googling’ (Bailenson 2021). Zoom recorded a 325% increase in revenue in 2020 at the height of the pandemic (Kelly 2021). While Zoom would have lost market share from 2021, it remains the default videoconferencing platform for the near future.

The popularity of video conferencing brings advantages and risks. One study shows that videoconferencing is more than 10% more energy efficient than face-to-face meetings (cited in Bailenson 2021, 2). In terms of risks, security issues emerged early in the pandemic around the practice of ‘Zoom bombing’, uninvited participants joining Zoom meetings. The heavy reliance for some people on Zoom meetings has led to ‘Zoom fatigue’, another aspect of online videoconferencing that has drawn critical attention. Bailenson (2021) applies this term to the nonverbal overload that can result from extended periods of video conferencing. When conducting research into the condition, he selected Zoom for analysis because of its dominance: user numbers increased from ten million in December 2019 to more than three hundred million in May 2020 (Bailenson 2021). Bailenson’s research indicates that video conferencing can have psychological consequences, and that Zoom Fatigue is attributed to a combination of eye strain, cognitive overload, increased self-devaluation and reduced mobility.

Innovative approaches to integrating video conferencing and virtual meetings into evolving and future work practices will advantage many

professional organisations. Video conferencing was a successful practical technological response to unprecedented working conditions. Virtual meetings are likely to become an indelible signifier of the COVID-19 experience, characterising the pandemic for many individuals, as well as resonating in the collective imagination on significant sociological and communicative levels. Despite Zoom-fatigue and a reported desire for many employees to engage with colleagues in physical workspaces, there are advantages to virtual conferencing for researchers and businesses. A study conducted by the multidisciplinary science journal *Nature*, based on a survey of more than 900 readers, revealed that moving into the future, 74% were in favour of retaining virtual meetings, or meetings with a virtual component, in the sciences (Remmel 2021, 185). Readers identified flexibility and the opportunity to attend meetings from anywhere in the world as a major benefit of virtual platforms. Many also reported attending more conferences in 2020 than in previous years since it was possible to attend conferences without compromising ongoing work commitments or being disrupted by travel. Some academics reported that 2020 had brought increased opportunities to present their research, and for many, the appeal of lowering their carbon footprint was an added advantage. The lack of opportunities to network with colleagues was cited by respondents as the biggest drawback of virtual conferencing. Especially for graduate students, the relative lack of impromptu interactions at online events made it difficult to connect with future collaborators or mentors.

Innovative solutions to the management of virtual interactions will be the way forward in the context of hybrid work environments. The incorporation of video conferencing and other virtual workplace experiences are predicted to become standard features of blended workspaces in the transition to the *new normal* world of work. Having met the challenge of adapting to the virtual, conference conveners will need to explore creative and innovative approaches to integrating virtual elements into physical workspaces (Remmel 2021, 186). Mentorship programmes that connect early-career science researchers with established academics are being developed online, and virtual lobbies are occurring on conference platforms where attendees can interact with conference presenters.

Continued developments in ‘smart’ technologies can assist the transition to hybrid workplaces. Typically, these technologies have focused on analytics and the management of workforces; however, possibilities now emerge for products and systems to support the integration of workers with their work environments in ways that accentuate workers’

productivity, safety, collaboration and well-being, while also optimising the organisation's management of human capital and resources. Some recent examples include the use of thermal imaging technologies to detect high temperatures in workplaces that could be a risk to workers' health or encourage viral transmission. Infrared radiation is used in devices in the medical profession to effectively measure temperatures; however, advances such as the use of cameras in workplaces in conjunction with mobile apps enable swift detection of high temperatures that might indicate contagious illness and take it a step further to ensure effective communication.

Similarly, carefully integrated sensor technology can help to regulate the movement of people in larger workplaces. The desire to monitor the shared occupation of interior spaces and the use of lifts and transition spaces are heightened by the pandemic. Innovative use of technology to collect data, and assist reporting, can benefit workplace traffic management by indicating spatial occupancy patterns. The provision of "real-time proximity alerts" adds the advantage of live reporting to help maintain essential social distancing protocols. Other innovative strategies include touchless options to reduce tactile engagement in the work environment. The health risks associated with touching door handles and buttons can be reduced by incorporating sensors and mobile ID scanners. Integrated facial recognition technology and mobile identification devices can add a further dimension of assistance. Occupancy sensors mean that the cleaning of shared bathrooms, kitchens and office desks occurs at the point of need or usage rather than based on routine or schedule. To be sure, there are ethical risks associated with privacy invasion and the normalisation of everyday surveillance that come with the territory of technological innovations. These risks must be addressed carefully without necessarily curtailing innovation *per se*.

## CONCLUSION

The COVID-19 pandemic has drawn attention to a less grandiose yet no less significant mode of innovation relating to the experiences of the everyday, which is what the chapter has sought to portray and unpack. Many examples of everyday entrepreneurship emerged during the pandemic, often illustrating the temporal distinction between reactive innovation and proactive innovation that addressed longer-term and potentially more complex issues and problems. The pandemic

has required people to respond immediately to altering life circumstances and to be agile and precise when making changes in their lives. Accommodating uncertainty is a dominant aspect of everyday innovation and entrepreneurship. Simultaneously, innovation persists towards the achievement of broader and often longer-term objectives such as the development and dissemination of COVID-19 vaccines and post-pandemic restructuring and preparedness.

One of the most significant aspects of the pandemic from the perspective of innovation is the question of “*what happens next?*”. What are the roles innovation will play in shaping the future directions of the world and its inhabitants? Philosopher Danielle Celermajer connects some of the points raised in our discussion in this chapter with the complexities of human responsibility amidst crises. She explains that conditions for both Australia’s Black Summer mega bushfires of 2019–2020 and the pandemic “grew in the soil of humans’ rancorous relationship with the earth and other earth beings” (Celermajer 2021, 178). Celermajer wonders if it is now possible for us to tell new stories about responsibility; in particular, to “put our names to stories that both recognise the unevenness of culpability and its concentration in particular types of practices and arrangements” (185). This includes genuinely appraising how we are all implicated. Satyajit Das (2021, 439) writes that “[w]ithout drastic action, humanity faces a series of insurmountable challenges” and that ultimately, “everybody has to sit down to a banquet of consequences” (Das 2021, 297). The slow-burn effect of the climate crisis, alluded to earlier, exacerbates inactivity; delay and denial inhibit the adoption of effective solutions. For Das, “[d]isregard for truth, denial and a refusal to acknowledge limits to individual freedoms are at the heart of unwillingness to act” (2021, 433). As a result, advanced technological societies, along with those less advanced, have found themselves “humbled by a primitive organism”. Das contends that history offers limited evidence that society will adopt the “necessary corrective measures” and that, “[a]t best there will be adaptations to living under deteriorating physical conditions and constraints” (2021, 439). The key point here is that the first level of response when seeking genuinely effective and innovative solutions is a resoundingly honest engagement with all facets of the problem.

Innovation today needs to be an authentic investment in an everyday hope: that we *can* create equilibrium to sustain us into the future. Such a vision of innovation might allow us to constitute desirable futures

before *undesirable* futures constitute us. When innovating, we should aim to counteract fear without ignoring reality or placating uncomfortable truths. We must be sure to innovate in ways that reflect our changing relationship to the world's finite resources as well as those forces in the world such as our relationships with non-human entities that are less tangible and knowable. We must innovate ethically for social, economic and political equality, finding resolute and meaningful ways to engage with issues of social justice. Innovation should help us embrace uncertainty while placing us in the proximity of productive experimentation and risk. Innovation should allow us to access new worlds or be the portal through which we engage with our familiar but ailing world anew; it should be a medium through which we create sustainable options with the available resources or what we have at hand.

Perhaps most importantly, we should embrace innovation from the perspective that it is *in-process*, ongoing and necessarily incomplete. Dispelling binary positions, embracing transition and positioning ourselves *between* the *old* and the *new* world orders to which Machiavelli refers may provide the flexibility and courage required to innovate for a post-pandemic world.

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