

# COVID-19 and Safety: A Theoretical Study with Applications

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**Abstract:** COVID-19 put people, organizations and societies under immense stress. That stress was related to fear. Fear meant trust was lost. When trust was lost, business and people were badly damaged, resulting in a massive societal disruption. The Old Normal from before the pandemic was based on presence at work, and the Pandemic Normal during the pandemic has been based on remote work; we believe that after the pandemic a New Normal based on hybrid work will be the dominant one. The three stages, Old Normal, Pandemic Normal and New Normal are all analysed from the perspective of the PPT (People, Processes and Technology) model of knowledge management (Edwards 2011). Underlying the analysis is the concept of safety as it refers to health, and especially *perceptions* of safety. Measures taken to prevent and/or mitigate the effects of COVID-19, such as lockdowns and compulsory wearing of masks, were completely beyond what most people, especially in Europe, Australasia and the Americas, had ever experienced. Assuming that government has a duty to ensure that its citizens feel safe, we look at both the pandemic period and the future in the light of this responsibility. The PPT model is used to consider various aspects of the situation, concentrating on the UK and Portugal as examples. The analysis includes what planning took place beforehand (if any), what preventative measures were put in place and when, how testing and contact tracing was organised and its links to the preventative measures, and the non-clinical aspects of vaccination and treatment. We consider what proved to be effective and what did not – at times a moving target; what lessons were learned during the pandemic; and crucially what lessons have been or should be learned for the future. Using the PPT terminology, the most critical area to get right seems to be the linkages from People to Processes.

**Keywords:** COVID-19, people, processes, safety, technology

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## 1. Introduction

As 2019 turned into 2020, humanity began to hear about a strange disease which had been spreading in the city of Wuhan in China. It was found to be a virus which spread at high speed mainly because for many people it was asymptomatic. In less than four months most of the world was under lockdown, frontiers were closed, and the world was “at war” (BBC, 2020). What happened after is well known. Firstly, governments tried to ensure a safe environment for their citizens by imposing rules on social distance and the use of masks. Secondly, governments also instituted gigantic programs of economic recovery to ensure that the slowdown would not have lasting effects on the well-being of citizens. Thirdly, world leaders made appeals to social solidarity, asking for compassion in troubled times. Last but not least, scientists battled to find vaccines in record time; by Christmas 2020 a dozen products were available; and afterwards, amid much economic and political wrangling, vaccination started; at the time of writing the virus has taken 6.1 million victims in 471 million cases; 64% of the world population has received at least one dose of a COVID-19 vaccine, 111 billion doses have been administered globally, and 16.69 million are now administered each day. Therefore, nowadays, people are trying to find a middle ground between the pre-COVID-19 way of life in 2019, the “Old Normal” and the lockdown due to COVID-19 way of life in the last two years, the “Pandemic Normal”. It may be that in 2022 a “New Normal” will surface, which will add some elements of the Old Normal (like the possibility of close contact) to some elements of the Pandemic Normal (like more agile processes due to the increased use of technology). We are writing this paper in March 2022; the situation may change by the time you read it.

For now, basic questions remain: should we still use masks, and when? should we relax social distancing? shall we go back into offices, or shall we work from home? will we need booster vaccinations every year? The way societies answer all these questions has wide-ranging implications: first and foremost because humans are “social animals” and social distancing is hard to take for us, individually and as a group.

Underlying the situation is the concept of safety. Humans, be they more or less risk averse, need to feel safe to live normally. Indeed, the Pandemic Normal existed because people needed to change their way of living in

order to feel safe. The feeling of fear led to a loss of trust in the practice of Old Normal actions, and the changes needed to install a new safe environment had drastic consequences, in psychological, social, financial, economic and even political terms. Knowledge is key to that feeling of safety.

This paper analyses COVID-19 in terms of safety and knowledge. What can be said? How? The text is comprised of four more sections. In the next section we review the literature on safety, and introduce the People, Processes, Technology knowledge management model (Edwards, 2011). In section 3 we analyse COVID-19 in Portugal and the UK. In section 4 we discuss our results. In the final section we present our conclusions and offer ideas for further research.

## **2. Literature review**

### **2.1 Safety and COVID-19**

The term safety refers to the protection of individuals, organizations, and assets against external threats and criminal activities. We also use this term when we refer to health. Although the feeling of being safe is an emotional aspect, this feeling can be destabilized by physical threats such as diseases. Since December 2019 the world had to learn how to deal with a new threat, called SARS-CoV2 or COVID-19 (strictly speaking, SARS-CoV2 is the virus and COVID-19 the disease it causes in humans), which became a pandemic.

COVID-19 belongs to the coronavirus family, known since 1960, and causing severe breathing problems. It is a complex virus (Rothan and Byrareddy, 2020, Wilder-Smith, Chiew and Lee, 2020) with high mortality for older people or those with chronic disease (Shi et al., 2020). Some countries already had a pandemic experience with H1N1 influenza, in 2009. About H1N1, Watkins (2020) reminds us that “the resulting UK influenza Pandemic Preparedness Strategy 2011 emphasised the need to maintain the continuity of essential services and continue everyday activities as far as possible”. However, this new health challenge was much more dangerous, and the rapid spread of COVID-19 turned it into a very real threat to humanity.

COVID-19 destroyed the meaning of safety, in relation to health. The feeling of being unsafe changes our social life, our day-to-day work and even our mental health. We stop working in our offices, we stop going to school. Many countries imposed strict preventative measures and adopted several safety protocols. Watkins (2020) pointed out that containment could only buy a limited amount of time in SARS-CoV-2, as happened with H1N1. In China, the measures taken to avoid the increase of the virus in other cities were testing and social distancing. But they were taken too late. A globalized world, with large flows of people, become the passport for a highly transmissible virus. We were living in a pandemic. The “lockdown” was the emergency measure adopted for the most part by countries all around the world. Some closed airports, borders and public services. People stopped working in offices and started to work at home. Students stopped going to school. All social life came to a halt. No sports. No parties. Governments told their citizens to stay at home and to avoid all forms of human in-person contact (Dwivedi et al., 2020a). Authors such as Cilhoroz et DeRuisseau (2021) believe that these safety protocols substantially reduced the risk of transmission. They also underlined the importance of universal mask wearing to stop the increase of pandemic case numbers.

The use of technology increased hugely as the only way to continue to work, to study or even to do sports. Dwivedi et al. (2020b) consider “the COVID-19 pandemic has forced many organisations to undergo significant transformation, rethinking key elements of their business processes and use of technology to maintain operations whilst adhering to a changing landscape of guidelines and new procedures”. But many health services were not prepared to deal with a pandemic. Health professionals and equipment were insufficient to face this crisis. The healthcare area has to be much more rational with resources targeted at those in most need (Watkins, 2020). Moreover, health workers were at high risk of exposure to the infection (Heliotero et al., 2020), as were firefighters and professionals of civil protection. A Portuguese study about post-traumatic stress in firefighters in COVID-19, recommended they have access to psychological support to reduce trauma symptoms (Guerra, 2020).

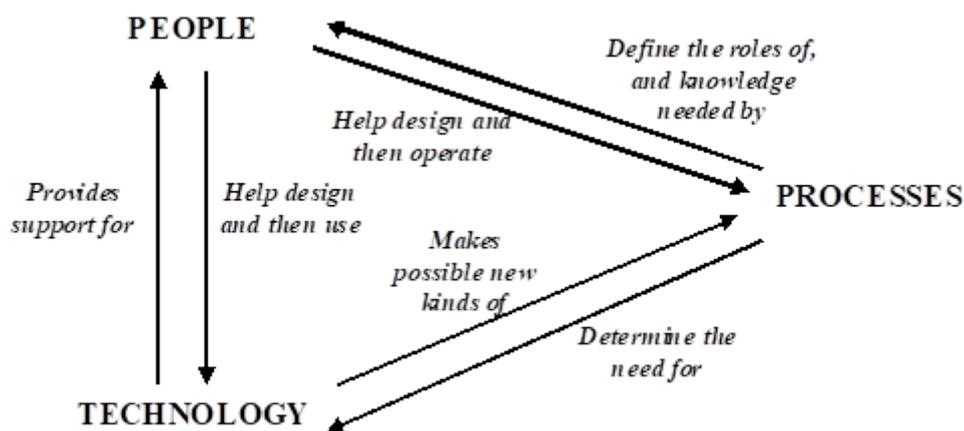
The pandemic and the subsequent economic downturn had profound effects on the human psyche health (Zandifar and Badrfam, 2020). Authors such as Roy (2020) remind us of a theory to explain people’s behaviour in this crisis. It has the acronym DABDA. This “grief theory” has five stages: denial, anger, bargaining, depression, and acceptance. In fact, many countries (such as Brazil) firstly denied the existence of this threat. Then adopting lockdown as a prevention measure made citizens angry: the loss of freedom and the feeling of being unsafe

contributed to this feeling. After those feelings, we had bargaining, depression, and acceptance. This last one came when citizens accepted vaccination as the solution to recover day-to-day life.

COVID-19 changed the way of living world-wide. The changes happened in work, school and social habits, facilitated by rapid evolution of technology. This legacy is the most positive thing that the world can take from this time. COVID-19 brought severe health consequences for those who were infected, for those whose work is helping them, and for the citizens who became “lonely animals”, instead of “social animals”.

## 2.2 Knowledge management: people, processes and technology

Edwards (2011) developed a model on the evolution of knowledge management (KM) (see Figure 1), indicating three phases, the first one guided by technology, the second by people and the third by processes. Crucially the phases produced better results in succession, because in any situation technology, people and processes have to co-exist. Crises (individual, organizational and societal) arise because there is a lack of technology, people or processes, or appropriate links between them. Finally, the solution of any crises requires the combination of technology, people and processes. Since we are analysing the COVID-19 crisis from a KM perspective, we choose the PPT model to explain the current state of affairs.



**Figure 1:** People, Processes and Technology (after Edwards (2011))

Sveiby (2012) used Polanyi’s (1962) definition of professional competence as the ability to make correct predictions about future events. He furthermore pointed out that a drastic change in context may render incompetent persons who were previously competent; horse-drawn carriage drivers became incompetent when cars appeared; and more recently the financial crisis happened due to the increase in derivatives and other collateralized debt obligations (CDOs) which fundamentally changed the banking and security markets and made persons who used to be competent in the previous context become incompetent in the new one. CDOs were extensively issued in the 2000s, generating the financial crisis of 2007/8.

This interpretation of competence is relevant for our paper because we are analysing a change in paradigm – namely the difference between the Old Normal (pre-COVID-19) and the Pandemic Normal (during COVID-19). Accordingly, we believe that the COVID-19 crisis also changed the context in which knowledge is managed, in which societies are governed, and in which businesses are formed and value is created. Indeed, one of the major problems of societies and organizations during the pandemic has been how to adapt processes in order to maintain wellbeing, profit and employment levels; and that adaptation was important because owing to the pandemic many workers and organizations faced the prospect of becoming incompetent, when before they had been competent. In consequence the solution for that competency problem has to be found within the PPT triangle defined in Figure 1.

## 3. The Pandemic Normal in Portugal and the UK

See Figure 2 for an approximate timeline.

### 3.1 Pandemic planning

Both countries were caught out by the change in paradigm, adopting a model as if it was an influenza pandemic. The UK explicitly regarded influenza as more likely to pose a serious problem than an infectious disease such as a coronavirus, for which the 2017 National Risk Register anticipated the consequences would be “several thousand people experiencing symptoms, potentially leading to up to 100 fatalities” (House of Commons, 2021). The influenza model meant that the plans turned out to be ineffective compared to those of countries (e.g., in Asia) that had taken more lessons from earlier outbreaks of SARS, MERS and Ebola.

### 3.2 Preventative measures

As with other governments around the world, both countries adopted restrictive measures (“lockdown”) to face the huge increase in cases. The UK was relatively slow, as it had been initially believed that the British would not accept a lockdown for a significant period. Only supermarkets and health services continued to operate, although with restrictive timetables. People were forced to work from home, to use masks in streets, and to stay in their home areas. These measures contributed to stopping the increase of numbers and gave hospitals some time to recover patients and beds. “The confinement resulted well in a rapid and substantial reduction in the transmission of the disease.” (Health Portuguese Report, 2021, p.35).

A second deadly wave of cases in the winter 2020/21 led to a second lockdown in Portugal and two more in the UK. Ironically, the UK dislike of lockdowns led to too-early relaxation of measures and probably caused the additional lockdown. This philosophy continued to drive UK government thinking, as witness the evident pride in the comment that “On 19 July 2021, the Government removed most restrictions in England ... and, in doing so, opened up earlier than many other comparable countries.” (UK Government, 2022) and the “Plan B” for the winter of 2021-22, which included compulsory mask wearing, voluntary working from home guidance and the use of COVID negative test certification – but no lockdowns.

Self-isolation caused particular issues in the UK. “...the problem of compliance with isolation instructions remains a challenge. We heard evidence that inadequate financial support was a barrier for some people, and that—until recently—the inability of contacts to be released from isolation if they tested negative contributed to lower compliance.” (House of Commons, 2021, p.7) British individualism probably did not help matters. On Hofstede’s national cultural dimensions, the UK scores very highly in individualism and low in uncertainty avoidance, whereas Portugal is the opposite (Hofstede Insights, n.d.).

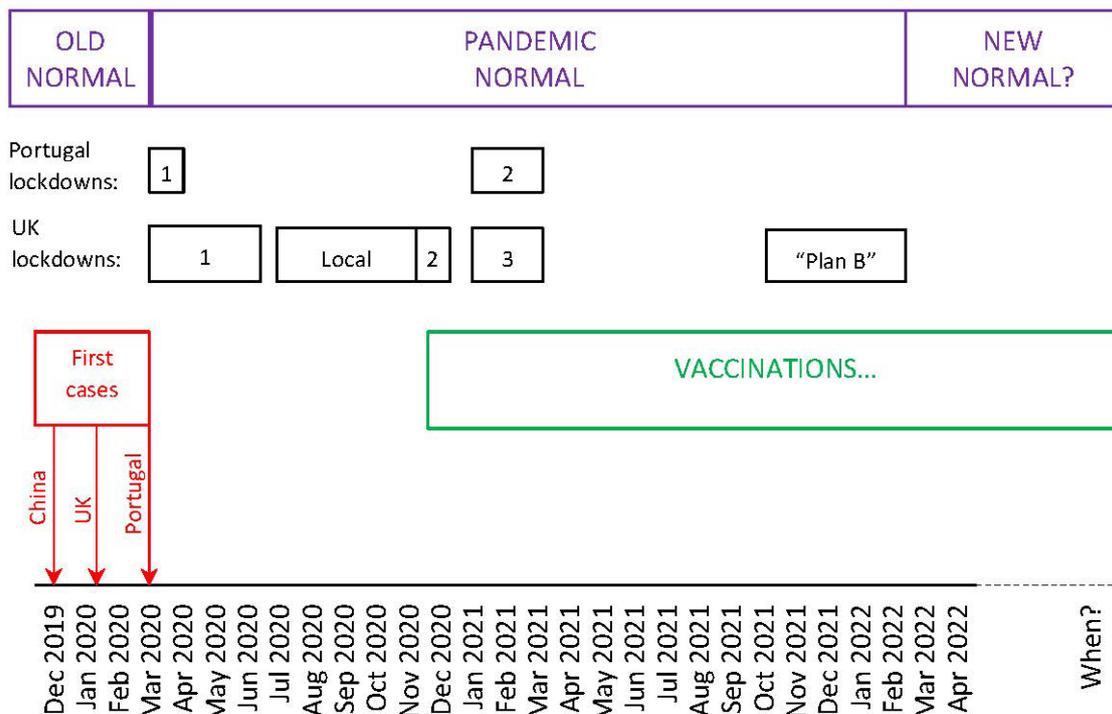


Figure 2: Approximate timeline for the pandemic in Portugal and the UK

### **3.3 Treatment**

The main principle was to separate COVID-19 cases from “clean areas” where no COVID-19 patients received treatment. Portugal installed field hospitals in universities, to help less serious cases and leave hospital beds free for the most serious cases with special care needs. The UK established the so-called “Nightingale” temporary hospitals, although these were never extensively used. There was an excellent response to appeals for former healthcare staff to return to work, but staffing remained the critical issue, with problems of staff burnout under the pressures, as well as the risks to healthcare staff from catching COVID-19 themselves.

This meant that both countries coped well with intensive care provision, but at the expense of treatment for non-COVID conditions. In Portugal, 540,000 hospital visits and 51,000 surgeries were not made in March/April 2020 compared to 2019 (Health Portuguese Report, 2021). Between January and November 2020, 121,000 fewer surgeries were performed. In the UK, attendance for essential non-COVID appointments dropped by between 25 and 75% depending on the condition and the region.

Although post-viral fatigue syndrome has been known since at least the 1980s, medical practitioners have given it low priority, even erroneously treating it as a psychological condition. The severity and extent of “long COVID” were unanticipated, and there are still no approved treatment options, other than rest (Ostojic, 2021). Recent UK estimates are that more than 1 in 50 adults say they have long COVID; 500,000 have had symptoms for more than a year (BBC, 2022).

### **3.4 Testing and contact tracing**

Initially, Portuguese with symptoms associated with COVID-19 had to contact health services by phone to do a PCR test. But when the numbers started to increase, these tests and the antigenic/lateral flow tests started to be sold in pharmacies. Later, testing was used to help life get back to normal. A negative test became an obligatory issue to participate in group events such as weddings, or public events such as film festivals.

In the UK, community testing was stopped early on because of lack of testing capacity. “A country with a world-class expertise in data analysis should not have faced the biggest health crisis in a hundred years with virtually no data to analyse.” (House of Commons, 2021, p.6) Eventually this was fixed, extensive lateral flow testing and PCR testing when necessary were provided free of charge, and as in Portugal the “NHS COVID pass” (in an app) was central in a return to something like the Old Normal.

UK contact tracing was initially based on a centralised model led by private sector companies, ignoring the expertise of local Directors of Public Health. The official report admits that it took a year to move to a much more effective strategy that was locally driven with support from the centre.

### **3.5 Vaccination**

This was the major success in both countries. A central part of the UK’s response was its role in the rapid development of effective vaccines. Key elements were early investment by government (even before the pandemic) and willingness of the regulatory authorities to allow results of clinical trials to be submitted on a rolling basis. Interestingly, the Vaccine Taskforce was set up outside the remit of the Department of Health and Social Care. British individualism had an adverse effect on take-up rates, as Table 1 shows. Even health and social care workers have not all been vaccinated. In late 2021, the UK government agreed measures to make this compulsory but backed down before the deadline for compliance was reached. More positively, large numbers of volunteers came forward to be trained to administer the vaccines, although in the end general practitioners and community pharmacists did most of the work.

Initially, Portugal also had difficulties in managing the process. But the Portuguese government then gave the responsibility of this process to a task force led by the military who organized everything, to get the majority of the population vaccinated. The communication between authorities and population became clearer and Portuguese people responded to the appeal. The military were extremely efficient. Portugal did not develop its own vaccine, but bought enough EU approved vaccines to guarantee the process. The Portuguese support for the vaccine was reflected in decrease in the number of hospitalizations and deaths by COVID-19 in hospitals, and these facts made Portugal an example to other countries that have lower vaccination rates (Table 1).

**Table 1:** Vaccination take-up by country (Source: Our World Data ,21 March 2022)

COUNTRIES	TOTAL DOSES ADMINISTERED (per 100 people)	FULLY VACCINATED PEOPLE (Millions)	%FULLY VACCINATED	TOTAL POPULATION (2020) (Millions)
PORTUGAL	225.45	9.42	93	10.31
U.K.	206.12	49.27	72	67.22
N.Z.	212.16	4.28	78	5.08
RUSSIA	111.06	72.39	50	144.1

### 3.6 Social care

This was the least effective area in both countries. Nursing homes were one of the main focuses of COVID-19, due to the combination of factors such as age, morbidities of nursing home users and the high concentration of people in a limited space. Initially, most of the COVID-19 deaths registered were people aged 80 years or more, users of nursing homes. The pandemic also showed that a measure such as social isolation could bring even more problems to elderly, sick, and alone people. Their social network was not as big as it could be, and old people were not supported in lockdown periods.

The UK made matters even worse with an early 2020 strategy of transferring patients from hospitals to care homes (to free up hospital beds) without rigorous testing. This was an alarming mistake, especially when countries such as Germany had already realised the problems it could cause “This, combined with untested staff bringing infection into homes from the community, led to many thousands of deaths which could have been avoided.” (House of Commons, 2021, p.8)

### 3.7 Organizational life in the Pandemic Normal

A lockdown presents a major challenge to organisations. In both the UK and Portugal, offices, schools and universities rapidly took to the internet, aided by online meeting tools such as Zoom, Teams and Skype. Families used them for social purposes, too. There was a huge increase in remote access to organisational systems. These changes led to temporary shortages of the equipment needed: everything from webcams to personal computers. However, the internet coped with the vast growth in traffic remarkably well. Supermarkets and other companies ramped up their online order and delivery operations by an order of magnitude. Of course, organisations whose services could not be delivered at home did not fare so well, those ranging from hairdressing through pubs and bars to entertainment having to close completely. Sports events took place with no spectators.

In the UK, government services were among the slowest to adapt to working online. Official registration of births and deaths became impossible for months: marriages would also have been impossible to register, but they could not take place anyway because of the restrictions on people meeting. Portugal fared slightly better, with scheduled openings for birth and death registrations (but again there were no marriages to register), and other services moving online.

Public transport services were drastically reduced in frequency as commuting ceased except for essential workers. At the time of writing, many UK services have been reinstated, but by no means all of them, especially buses. The Portuguese situation is again somewhat better.

### 3.8 Disinvestment in the public health service

The COVID-19 crisis revealed a big problem of disinvestment in public health services. According to the Health Portuguese Report (2021), it is necessary to recover from a huge disinvestment “in technical and technological requalification of public health services”(p. 72, 2021). It is also urgent to recover public health services to respond to non-COVID conditions, as quickly as possible. In the crisis the Portuguese government listened to health specialists before reaching a decision about necessary measures. And this is the main point that the report underlines: the importance of listening to scientific specialists before a decision in the Pandemic Normal.

Funding for the National Health Service has been one of the UK’s main political issues for decades: the pandemic changed the debate but did not resolve it. The country’s mood during the Pandemic Normal led to the introduction of a 1.25% tax on all employed and self-employed people, specifically to pay for (more/better)

health and social care – but not until 6 April 2022, by which time the country’s mood was turning against it. No new normal there, then.

### **3.9 Validation of the KM model**

We consider medical aspects and more general aspects of organisations and society separately, using the PPT lens from Figure 1 to summarise the Pandemic Normal. The knowledge map in Figure 3 shows the more and less successful KM elements.

Taking technology first, KM for new medical technology has generally been highly successful. Effective vaccines were developed. New treatment options were devised. Contact tracing apps had a more mixed outcome: not all of them worked, and there were issues about interoperability of competing systems. More generally, it was a case of a huge increase in the use of technology that already existed, with the internet playing a central role. Thus we see that technology – not always entirely “new” - making possible new kinds of processes has been central to the Pandemic Normal, the main KM issue being learning to use it.

New medical processes were crucial, especially those for the testing and approval of vaccines and treatments, that brought them into widespread use quicker than anyone would have thought possible. UK general practitioners even began offering consultations by phone or video, which had many benefits, particularly for patients with chronic conditions, though some of the UK newspapers campaigned against this from the start and the intensity of this opposition has increased as we head towards the New Normal.

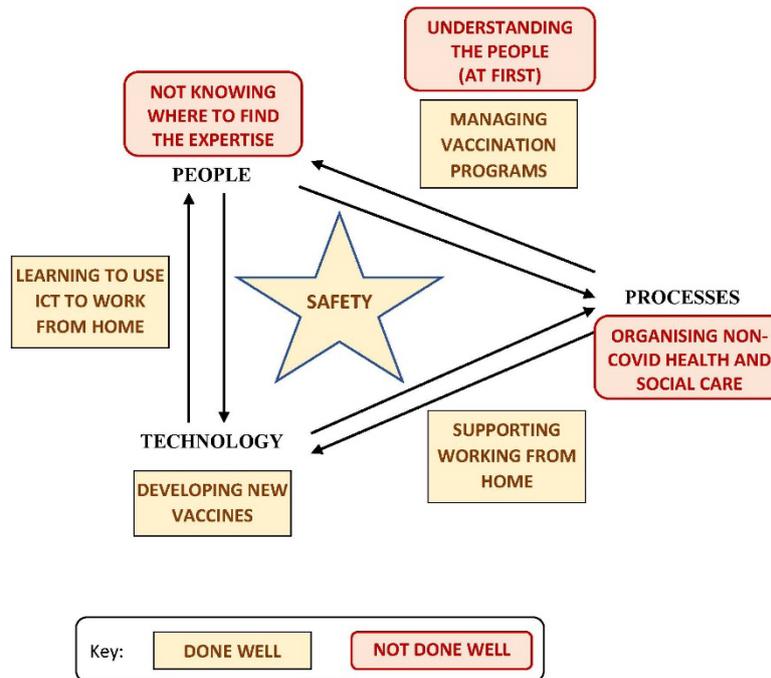
The online meeting and remote access tools brought their own KM process problems. Process changes had to be introduced at speed, often without the chance to carry out any form of pilot study. The digital divide worsened, between those who had the technology and also had somewhere at home to use it, and those who did not. Particularly for online office workers, a new phenomenon appeared – Zoom fatigue: stress resulting from too many online meetings, especially without breaks between them. Many managers were suspicious about how hard people working from home were really working – the managers feared that they themselves were becoming temporarily incompetent – and some organisations instituted more remote monitoring of computer use by their staff as a consequence (Marabelli, Vaast and Li, 2021).

Technology was the tool that humanity turned to in order to try to find some safety while keeping society functioning. Technology was fundamental to enabling people to work remotely; it was also technology that tried to prevent contacts with infected people, most noticeably with the “stayaway” app. Finally, it was a new-found technology, namely the vaccines, that reinstated safety and trust, trust being a central pillar of effective KM. Portugal is very interesting in this regard, because the rate of people with at least one full protocol administered is 93% which created an atmosphere of trust in the country.

People? Well, everyone has been affected in some way. Health and social care staff have borne the brunt of the burden, but it has also fallen on many other groups, including delivery drivers, utilities workers, postal staff, security staff, cleaners and (often unnoticed) IT staff supporting remote working. Few of these have been paid significantly more for their efforts, with the exception (in the UK) of delivery drivers. There is also evidence that the responsibility for schooling and entertaining children at home has fallen disproportionately on women. The UK Office for National Statistics found that women were more likely to be furloughed (laid off from their work), and to spend significantly more time on unpaid household work and childcare (Office for National Statistics, 2021).

There are very clear UK weaknesses (shown in Figure 3) in the people help design and then operate processes link from Figure 1: not involving the relevant people, and a disconnect between the government and the people.

In Portugal most people “ran scared” when the first lockdown was imposed. They felt the need to adjust to a completely different way of life, because they felt unsafe. They had to begin working differently and living differently – couples joked they spent too much time together, student missed friends. Safety concerns turned social life upside down. They also become scared of losing income and jobs – and welcomed all the government policies that supported income (moratoriums and support to wages) and jobs (layoff). After people who were tired of one year of COVID-19 had to endure a second lockdown, there was a massive influx of people to the vaccination centres and the big increase in cases in winter 2021/2022 was tackled with no need for lockdown, comparatively fewer deaths- and more confidence about safety: a clear success for KM.



**Figure 3:** Knowledge map for the Pandemic Normal

Returning to processes, a central feature of any process is the associated measure of performance. The UK government's headline measures of performance in the pandemic have been the number of deaths, and whether or not the National Health Service is being overwhelmed. The first of these has now been outdated by vaccination and improved treatments – not to minimise the effect of even one additional death. For the wider public, complications and long COVID are now surely more significant, so hospitalisations might be a better measure. As for the second, even in the Old Normal the NHS was overwhelmed (to the extent of cancelling routine operations) at some point during most winters in the past decade, so recovering from the strain of the focus on the pandemic will not be easy. As already mentioned, Portugal faces a similar challenge.

Finally, in both countries, people learnt new skills and competences in order to seek safety. That learning was in fact the mastering of new processes. This brings us into the territory of personal KM. That learning also drastically changed the outlook of the working situation of these people – on one hand it became possible for their employers to ask them to work from home, but on the other hand their employment prospects became better because they were able to master more skills and had more competences, leading to what some have called the Great Resignation. And all this was due to safety concerns.

The New Normal will look more like the Old Normal than the Pandemic Normal, but there will be differences. Portugal and the UK now have better plans for dealing with new viruses. The importance of locating expertise has been recognised. The shift online of retail business will not be fully reversed. Six months ago, three quarters of Portuguese companies stated they wanted to implement some form of hybrid work (Puga, 2021) This may have consequences for the whole landscape of city centres. Those who feel less safe will work from home if they can, and may choose to wear masks in crowded places, as many Asians have done for decades.

#### 4. Discussion

The analysis presented in the last section gives some hints for best ways of work for practitioners, in the sense that safety was found to be a major concern regarding Covid-19, and that technology should be aligned and convergent with people and processes in order to generate prosperity. Between the conception and completion of this paper, Portugal had an enormous increase in vaccination numbers, most people with three doses. This made people feel confident to return to normal life. The feeling of being safe had been recovered with vaccination and a huge help from social media information (increasingly important as a KM channel). Social life has become normal again. In the UK, with somewhat lower vaccination percentages, there is now a clear division between the majority of the population, who now feel safe enough to resume lives that are close to the Old

Normal, and a substantial minority (including those most vulnerable) who do not. Indeed in the last months, both in Portugal and the UK, there was an increase in cases, but because a sense of security had been installed, and the right processes were being applied by the right people and with the right technology, activity, in social and economic terms could continue.

## 5. Conclusions

We have described the Pandemic Normal, using Portugal and the UK as examples, and analysed the situation using the People, Processes and Technology KM lens. Most of the successes have been from technology making possible new kinds of processes, thereby providing support for people. It is striking that the major success in both countries, the vaccination programs that saw technology, processes and people come together, were organized by people from outside the health services sector. The major weaknesses have been in the link that *should* have seen the relevant people helping to design and then operate processes. At the time of writing, we have not fully reached the New Normal. Plans for dealing with future pandemics have been improved. At least one more booster dose of vaccine will be given. Online retail will continue to grow. Whether hybrid working will end up as a small change or a major alteration in the way we work and the structure of our cities needs further study. Finally data must be collected to illustrate the model defined in figure 3.

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