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Workforce Capabilities using Automation to support/ensure Business Continuity

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Master's Degree in Computer Science and Business Management

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August, 2023

## **Workforce Capabilities using Automation to support/ensure Business Continuity**



TECNOLOGIAS  
E ARQUITETURA

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Department of Information Science and Technology

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## **ACKNOWLEDGMENTS**

Firstly, I would like to express my gratitude to my family and friends for their support throughout my academic journey. In special, I would like to express my appreciation to my girlfriend, for her support, understanding and patience, but also for her words of encouragement and motivation during the most difficult and stressful times.

Thank you to all my college colleagues at ISCTE, especially those who I teamed up with for college works, to my supervisor Professor Rúben Pereira, for his support, guidance and mentoring, that were vital for this research, and his continuous words of encouragement that led me to finish this research. Also, for his co-orientation throughout this journey, I give my thanks to Professor José Brás.

A special thanks to my work colleagues at Banco de Portugal, for letting me work on my research in between work and for trying to avoid not to bother me in those times, except for work emergencies. And, last but not least, I would like to express my deepest gratitude to all the experts participants in the questionnaires, who generously gave their time and effort, as their participation and feedback were crucial to the success of this research.

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### RESUMO

**Problema de Investigação:** As tecnologias estão a avançar, trazendo inconvenientes, desafios e riscos, à medida que indivíduos, empresas e negócios se tornam mais dependentes delas. Os cenários de catástrofe e respetivas estratégias de recuperação são variados. Nestas situações, as empresas precisam de abordagens inovadoras para responder e sobreviver. Uma dessas transformações empresariais é a automação, como a Automação Robótica de Processos (RPA), recurso inestimável para organizações adotarem novos métodos de trabalho, assegurando a Continuidade do Negócio (CN). No entanto, a RPA, tendência disruptiva, prevê robots físicos a executar tarefas humanas. Esta colaboração realça a necessidade de recrutar funcionários com capacidades que complementem essas tecnologias. Numa época de substituição de empregos por tecnologia, a força de trabalho qualificada é indispensável para acompanhar esta evolução. **Questões de Investigação:** (1) Quais são as capacidades da força de trabalho necessárias com a automação? (2) Quais são as capacidades da força de trabalho necessárias para a CN? (3) Quais são as capacidades da força de trabalho utilizando a automação para apoiar/garantir a CN? **Revisão da Literatura:** Os artigos desta revisão da literatura estão relacionados com as ciências empresariais e tecnológicas, direcionados para a CN e a Automação. **Metodologia de Pesquisa:** Esta revisão da literatura inclui 76 artigos de revistas, conferências, livros e literatura cinzenta, e um estudo Fuzzy Delphi para opiniões de especialistas em automação. **Resultados:** Entre 51 capacidades identificadas, 40 relacionam-se à automação e 44 à CN. Assim, 40 capacidades foram sugeridas no estudo Delphi como necessárias com a automação para apoiar/assegurar a CN.

**Keywords:** Continuidade do Negócio, Automação, Automação Robótica de Processos; RPA, Pessoas, Capacidade

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## ABSTRACT

**Research problem:** Technologies are becoming more advanced, while bringing many inconveniences, challenges, and risks, as humans, companies and businesses become more dependent of them. Disaster scenarios and their respective recovery strategies are various. In these situations, companies must have an innovative approach to respond/survive. One of these business transformations is automation, such as Robotic Process Automation (RPA), an invaluable asset for organizations to embrace new ways of working ensuring Business Continuity (BC). However, RPA is a disruptive trend, expecting the use of physical robots to perform human tasks undertaken by people. Having to work together highlights the need to recruit employees with capabilities that complement those technologies. Therefore, in an age where technology is rising and taking over human jobs, a skilled workforce is imperative to keep up with this evolution. **Research Questions:** (1) What are the workforce capabilities needed with automation? (2) What are the workforce capabilities needed with BC? (3) What are the workforce capabilities using automation to support/ensure BC? **Literature Review:** The articles in this literature review are related to business and technological sciences, directed to BC and Automation. **Research Methodology:** This literature review includes 76 articles from journals, conferences, books and grey literature, and a Fuzzy Delphi study to obtain the opinion of automation experts. **Findings:** From the selected articles, 51 workforce capabilities were interpreted, in which 40 were related with automation and 44 were related with BC. Thus, 40 capabilities were selected and suggested in the Delphi study as needed with automation to support/ensure BC.

**Keywords:** Business Continuity, Automation, Robotic Process Automation; RPA, People, Capability

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## **GLOSSARY OF ABBREVIATIONS AND ACRONYMS**

|      |   |                                                |
|------|---|------------------------------------------------|
| AI   | - | Artificial Intelligence                        |
| APIs | - | Application Programming Interfaces             |
| BC   | - | Business Continuity                            |
| BCM  | - | Business Continuity Management                 |
| BPA  | - | Business Process Automation                    |
| BPM  | - | Business Process Management                    |
| CN   | - | Continuidade do Negócio                        |
| DPA  | - | Digital Process Automation                     |
| DR   | - | Disaster Recovery                              |
| DT   | - | Digital Transformation                         |
| FDM  | - | Fuzzy Delphi Methodology                       |
| FL   | - | Formal Literature                              |
| GL   | - | Grey Literature                                |
| ID   | - | Identity Document                              |
| IPA  | - | Intelligent Process Automation                 |
| ISO  | - | International Organization for Standardization |
| IT   | - | Information Technology                         |
| ML   | - | Machine Learning                               |
| MLR  | - | Multivocal Literature Review                   |
| NLP  | - | Natural Language Processing                    |
| OCR  | - | Optical Character Recognition                  |
| RPA  | - | Robotic Process Automation                     |
| RQ   | - | Research Question                              |
| SE   | - | Software Engineering                           |
| SLR  | - | Systematic Literature Review                   |
| WEF  | - | World Economic Forum                           |

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

## **CHAPTER 1. INTRODUCCION**

Nowadays, we are living in the digital era, a time of fast technological change led by digital technologies. The new technologies are reshaping economies and societies, and they are holding great promises as governments and companies are increasingly adopting them to enhance human well-being, to stay competitive and to create new opportunities and pathways to boost economic prosperity [1]. But it can also bring us many inconveniences, challenges, and risks as humans [2], companies and businesses [3] become more dependent on these technologies.

The range of possible disaster scenarios and their respective recovery strategies in which companies are required to acknowledge, prepare and/or consider is not small [4]. In addition to a scenario of fire in a data center, companies must consider a wide range of possible natural disasters, including hurricanes, tsunamis, widespread flooding and wildfires and a wide of possible human-induced disasters like terrorist actions and global pandemics.

For all these types of disasters, companies must consider many factors when developing their contingency and continuity plans, including logistics and infrastructure. Business continuity (BC) planning and execution are essential to the vitality of any company with aspirations of surviving a disaster [4], because in the case of a global pandemic, like COVID-19, it can not only create an unplanned stress test for all companies (e.g., Government-imposed restrictions, sudden changes in the way of working impact an organization's performance goals, efficiency and reliability) but also leave them vulnerable due to the focus on pandemic containment and staff unavailability.

In these disaster situations, companies need to have a strong focus on activities that deliver real benefits and profit in order to provide full value to their key stakeholder groups: shareholders, employees and customers. It is imperative that companies need an innovative approach to respond / survive to the epidemic, including workforce empowerment, collaboration, communication, and business transformation [5].

To ensure BC in the event of a disaster, the current recommended practice, as suggested in business continuity management (BCM) standards (e.g., ISO 22301 [6]), is to periodically test BC plans frequently to ensure continuity in the event of a disaster. Only through proper testing of these plans can a company have high expectations in its ability to recover after a disaster. Planning for human-resource disasters has also become part of the regular BC plan [4] as such in 2018 the International Organization for Standardization (ISO) released a set of guidelines regarding the people aspects of BC (ISO 22330 [7]).

With digital technologies shaping competition in many industries [8] and the rapid growth in the importance of digital technologies in achieving the business goals of the organizations [9], predicting the future of potentially disruptive technologies becomes an essential task of business leaders concerned with the survival and success of their organizations [8].

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One of these digital technologies is automation, on the rise as the world witnesses the importance of adopting automation and robotic technologies, such as Robotic Process Automation (RPA) as an invaluable asset for organizations to embrace new ways of working [10]. While the robotization of production processes emerged in the 1950s, the robotization of business is still in the early stages of expansion and seems to have a potential for development in companies [9].

RPA technology is a disruptive trend and one of the most advanced digital transformation (DT) technologies that can be implemented by organizations to save time, reduce costs, maximize resources by automating repetitive tasks, and ensure BC during unprecedented and unexpected crisis events [10].

The global market size of RPA has grown from 2.09 billion US dollars in 2020 to 2.65 billion US dollars in 2021 and is predicted to grow to almost 23.9 billion US dollars by 2030 [11]. Just like RPA, BCM market size has also predicted to grown in future years (from 510 million US dollars in 2021 to 1.81 billion US dollars by 2030) [12] as an essential solution for all industry sectors to stay competitive.

However, RPA suggests the use of physical robots that take up office space and are expected to perform human tasks undertaken by people [9]. This leaves a feeling of fear in the company's employees, as technologies may become so advanced that they will not only replace human but also become so complex that no human mind will be able to control them (e.g., in the 1990s, Artificial Intelligence (AI) was considered a black box which could not be fully understood).

Humans and technologies will have to work hand in hand, which highlights the need to recruit employees with skills and capabilities that complement those technologies [13], because, in an age where technology is taking over human jobs, a skilled workforce is imperative to keep up with technology. The need for emotional and intellectual skills, such as complex problem solving, coordination and critical thinking, will always be high, as soft skills like judgment, empathy, creativity and the ability to motivate others will remain unique to humans [14].

This research aims to identify the people/workforce capabilities using automation to support and ensure BC, answering to the following research questions **(1)** “What are the workforce capabilities needed with automation?” **(2)** “What are the workforce capabilities needed with business continuity?” **(3)** “What are the workforce capabilities using automation to support/ensure business continuity?”, based on books, conferences, grey literature, and journals about the subject.

## **CHAPTER 2. BACKGROUND**

### **2.1. Disaster Recovery and Business Continuity**

Disasters are serious and unforeseen events/disruptions that have an impact on the operation of a critical business process of a company [15]. These disasters can be: technological (e.g., cyberattacks); of natural causes, such as hurricanes (e.g., Hurricane Katrina in 2005 [16] and Irma in 2017 [17]), tsunamis (e.g., in Indonesia in 2018 [18]), floods (e.g., Louisiana in 2016 [19]) and wildfires (such as those seen in Australia in 2019-2020 [20] and Amazon in 2019 [21]); human-caused, such as terrorist attacks (e.g., in New York in 2001 [22]); as well as other factors that influence company exposure and vulnerability, such as a global pandemic (e.g., COVID-19 since 2020 [23]) [4].

The level of readiness and the ability of the company to maintain and secure essential/critical functions during and after such a disaster is called BC [10]. BCM is a special management function that deals with continuity planning to ensure that the company does not go out of business in case of a major failure in one of its critical business processes [15].

For all the disasters mentioned above, companies must consider a number of factors, including logistics and infrastructure, to develop a variety of disaster recovery (DR) methods that can be part of a DR plan [4]. DR, which is the organization's method of regaining access and functionality to its IT infrastructure after disasters, is one of the aspects of BC.

In addition to IT infrastructure, BC plans must also consider the impact on human resources. Planning for human resource disasters, such as pandemics (e.g., bird flu), has become part of the regular BC plan [15], as such, in 2018 the ISO released a set of guidelines regarding the people aspects of BC (ISO 22330). ISO defines it as “elements associated with the management of people involved in, or affected by, an incident in order to minimize distress, maximize productivity and recovery, and achieve the recovery objectives of the organization's BC programme” [7].

BC planning and execution is essential to the vitality of any company with aspirations to survive a disaster. To ensure BC in the event of a disaster, the current recommended practice, as suggested in BCM standards (e.g., ISO 22301 [6]), is to periodically test BC plans in order to ensure continuity in the event of a disaster. Only through proper frequent testing of these plans can a company have a more or less realistic expectation in its ability to recover after a disaster [4].

### **2.2. Digital Transformation and Automation**

DT is the process of changing how a company leverages technology, procedures and people to improve business performance and embrace new business models. The most innovative organizations have pursued DT with the goal of creating new sources of value. This has occurred through a shift to more modern digital products, services, technologies and experiences [24], helping them increase their

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competitive advantage and improve the customer experience. As an added benefit, the pandemic revealed that DT efforts helped organizations improve their efficiency across the value chain [25] and improve resilience against market disruptions [24]. Therefore, DT has been advancing at a rapid pace across all industries [25], expecting to reach \$3.4 trillion by 2026 in terms of global spending on DT [24].

These expenses can be explained by digital technologies becoming the new standard, evolving to be more and more human like and to no longer being disruptive towards one another. Experiences with technical solutions are becoming more and more natural thanks to advances in AI, Natural User Interfaces and Mixed Reality. However, as this transformation is becoming a natural component of company cultures, technology training is needed to allay workers concerns about losing their jobs. These new or evolved technologies can fuel concerns, decreasing employee's happiness, productivity, and efficiency, as it affects all elements of the business (e.g., sales, marketing, operations, and customer service) [26].

One example of DT is automation, which means using technology to perform a task that would otherwise be done by a human worker [27]. In this sense, this DT method incorporates a very broad and diverse set of technologies [28] that contribute to the development and exploration of new types of intelligence, assembling available new innovations [29] (e.g., better hybrid cloud management tools [28], driverless cars and autonomous drones [29]).

Automation can be applied to a wide range of activities, from fully mechanical to fully virtual, and from simple to extremely complex [27]. It is primarily based on programming and relies on Application Programming Interfaces (APIs) and other integration solutions to assimilate different systems to perform scripted tasks [30]. These make it being better equipped to perform brainless tasks (e.g., data entry), being exponentially faster and more efficiently than humans and leaving higher value work for humans to execute [29]. Furthermore, automation has started utilizing AI, making it possible for machines to better mimic human tasks (e.g., visual perception, pattern recognition, decision making, speech recognition, and adaptability) [30]. Since the practical applications of automation in industry are so diverse [27], whether it's customer correspondence on mobile assistants or automated work across the enterprise, automation changes the way we live and function [29].

### **2.3. Business Process, Business Process Management and Business**

#### **Process Automation**

A business process, organizational process, or business method is the execution of a sequence set of activities or related structured tasks (e.g., recording a sale, calculating value-added tax, sending an invoice, packaging, and shipping product, updating inventory and accounts receivable) that produce a specific service or product for its customers [31].

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Business Process Management (BPM) software can encompass a broad combination of workflow engines, business analytics, web forms, business rules and collaboration tools that are combined to optimize business processes. BPM is used to support re-engineering process flows to connect systems, eliminate bottlenecks and increase productivity across the enterprise. For many years, BPM technologies have been a central part of many organizations DT strategies [32].

Business Process Automation (BPA) is employee-driven [33], aiming to reduce workflows, whether repetitive or time-consuming [34], by focusing on automating day-to-day IT processes and business functions [35] that result in efficiency [27], [33]–[35] and productivity gains [33], [34] between users and departments [33], by reducing costs and ensuring smooth operations [35].

BPA has a holistic [35] (meaning: does not focus on a single department or process, but on the organization as a whole [34]) and innovative approach [35] to identify, improve [34], optimize and automate business processes start to finish [35] from a central location [34]. Therefore, it often involves significant changes to a company's workflows because BPA implementation is a higher-level project that focuses on reorganizing and streamlining workflows [27].

### **2.4. Robotic Process Automation, Intelligent Automation / Intelligent Process Automation and Hyper-automation**

#### **Robotic Process Automation**

In terms of defining RPA, there was no consensus in the literature examined. However, it can be defined as a form of BPA [28], [34], [36]–[40] emerging technology [10], [36], [37], [41]–[51] software [27], [30], [34], [35], [37], [44], [47], [49], [52]–[55] that enables the construction [35], [47], [56], use [27], [30], [55], implementation [47], [48] and management [39], [47], [48] of bots [30], [31], [37], [39], [42], [49] or software "robots" [28], [31], [34]–[37], [39], [40], [43], [44], [46]–[50], [52], [55]–[57]. These robots can learn [35], mimic [28], [34], [35], [39], [41], [48] and execute [35], [42], [47], [53] business processes [10], [27], [30], [34]–[38], [40], [42], [46], [51], [54], [55] and tasks [10], [31], [35], [37], [38], [44]–[47], [50], [52], [54]–[57] that are predictable [45], [52], require a limited set of human interactions with digital interfaces [45] and that are normally performed manually by workers [30], [31], [34], [42], [46]. In this sense, automation transfers this time-consuming [34], [39], [52], [53], [57], intensive [34], [36], [57], repetitive [10], [28], [30], [37], [39], [41], [42], [44]–[46], [50], [52]–[54], [56], routine [30], [38], [40], [45], [46], [52], [57], mundane [39], [41], [50], [53], [54], tedious [42], [52], [53] and rule-based [10], [28], [31], [35], [44], [46], [48], [50], [57] work from people to robots [10].

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Despite implying the term "robotic", robots are neither humanoid [37], [54] nor physical robots [37], [49], [57], but instead robotic software programs [37], [54] that mimic [10], [28], [38], [40], [48], [57], emulate [37], [40], [47], [55] and integrate human interactions/actions associated with digital systems [37], [38], [40], [42], [47], [48]. Similar to a digital worker, [37], [40], [43], [54], [57] the digital systems allow the users to create [35], train [46] and program [46] robots, defining a set of rules [37] for them to observe [35], [38], understand [38] and implement [38] the human digital actions [35] to complete the task from start to finish [10], [54] and execute the process accurately [38].

Each robot is designed for a single specific task (e.g., creating a bot to log into a system, copy data, and then paste that data into a spreadsheet) [35], being able to capture [43], [47], [48], [51] and interpret [42], [43], [47], [48], [51] existing applications to process a transaction [43], [47], [48], [51]; identify [39] and manage data [43], [47], [51] trigger responses [42], [43], [47], [51]; understand what is on the screen [39]; and communicate with other digital systems [42], [43], [47], [48], [51], [57] in order to perform a variety of tasks [42] just like a human worker would [10], [27], [28], [39], [40], [43], [53] (e.g., such as data entry [28], [46], account opening, on boarding customers [27], [46] and data processing [46]).

Unlike most software applications, RPA solutions provides development environments that are typically code-free, drag-and-drop systems [52], so that they are accessible enough for people without coding expertise [28] to build the necessary processes. As an alternative method to doing workflows manually, many tools also provide the ability to record actions performed by a human within a software tool that can translate into workflows within the RPA products [52]. Virtual agents perform actions following these workflows both with and without human supervision or intervention [28], [44], [47], [49], [52].

RPA tools can be divided into two distinct modes of deployment: assisted automation [28], [38], [45], [46], [53] (also referred to as attended RPA [28], [38], [49]) and unassisted automation [28], [37], [38], [45], [46], [53] (also referred to as unattended RPA [28], [37], [38], [49], [53]). There is a third implementation mode, a hybrid RPA that combines the two modes described above [28], [37], [38], [49].

In assisted automation, RPA is automating applications running on a user's desktop [28], [38] or system [53] using robots to handle manual tasks along with human workers [38], [45], [46], [53], who oversee certain parts of the process [45]. This mode of automation aims to help the user complete the process in which they are involved in less time [28], [37], [38]. Since the robots must be activated by humans [37], [49], they are activated whenever they are needed to help the process and, therefore, attended bots can be used for front-office tasks, contact centers, field sales and as service engineers. For example, during a live customer call, a call center agent can use a real-time attended robot to extract customer data from one application and automatically enter it into a second application [37].

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In unattended automation, RPA is typically event-based (meaning: when a specific event occurs, RPA acts and launches a sequence of tasks), operating on the backend of the IT infrastructure, always running in the background [49] and without requiring any human intervention [28], [37], [38], [46], [49], [53]. Therefore, the software runs on its own, notifying the user only when something goes wrong, requiring only structured data and clearly defined rules to work properly (which may not exist in all cases) [28], [38].

Unattended automation can work with other digital systems [38] and work 24/7 [28], [53] or through a predefined schedule [37], [49]. They typically perform high-volume tasks [37], [38], [53], automate end-to-end processes [45], and can be used for back-office tasks such as intensive data processing, and documentation search and retrieval [37]. For example, in the case of a customer onboarding process, the goal of the onboarding process is to collect and evaluate customer data to provide better service and manage risk, here RPA can support the execution of tasks such as data reconciliation and verification and emailing (e.g., sending email requests for missing documents) [53].

Hybrid automation is probably the most common type of RPA adopted by companies [49] being the combination of assisted and unassisted robots that work together in automating tasks that cannot be done with only one type of robot [37], [49]. They are used in processes that include steps that can be automated with assisted robots and the remaining steps that can benefit from unassisted robots [28], [37]. Hybrid bots help automate end-to-end processes [37] and to perform more significant functions [49] (e.g., application processing, service delivery and employee onboarding), as well as, work with humans as a team [28], [37], [38] (they can even be working in different tasks at the same time [28]) to ensure that back-office and front office operations are completed efficiently [37], [38]. For example, an unattended bot could discreetly analyze data and subsequently present the findings to the user who, after analyzing the results, presses a button to trigger a sequence of actions [49].

Eventually, the software robot has the potential to replicate any human action executed on a computer system, whether it involves keyboard and mouse interactions or even voice control commands (e.g., opening an application [40], [53], [57], logging into the application [28], [39], [57], performing an action such as sending an email [39], [57], filling out forms [28], [39], [40], copying/pasting data [28], [40], [53], analyzing data [53], [57], extracting structured and semi-structured data from documents [40], [57] and scraping data [39]). However, unlike a human worker the bot does not need a physical screen to complete the task, performing instead the process steps of the task in a virtual environment [28].

Organizations are turning to RPA in an attempt to streamline processes [34] and operations [42], eliminating manual tasks [10], [34], [37], [42], [50], [57] to free up the workforce [10], [34], [37]–[40] and allow employees to save time and focus it on higher-value [34], [37], [39], [42], strategic [34], vital [38] and critical [34] tasks, thereby increasing employee engagement and experience [37].

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

In addition, RPA software can work 24 hours a day [48], [53], faster [40], [47], [48], [53], with fewer errors [47], [48], [53] and cheaper than human workers performing the same processes or tasks [48]. It is able to work simultaneously on multiple applications [48], [53] by combining companies unique business processes and workflows [48].

RPA enhances and helps businesses growth [52], resiliency [52], [56] and operational efficiency [10], [44], [52] by creating an agile digital workforce [37], [40], [43], [51], [54], [57] that helps improve efficiency [37], [39], productivity [37], [38], [47], [48] and quality; reduce costs; and improve customer experience [10], [37] by ensuring that customer service levels are not compromised. RPA allows an organization to take full control of tasks that would once be outsourced. This is ideal for peace of mind, as it ensures complete oversight of how their own data uses and processes [52].

RPA technology may be particularly important to ensure BC during unprecedented and unexpected crisis events, because is a disruptive trend and one of the most advanced DT technologies that can be implemented to create new sustainable practices (e.g., digitization and automation of individual operational activities and entire processes in a company) [10].

### **Intelligent Automation / Intelligent Process Automation**

As shown above, RPA is perfectly suited for automating routine tasks [33], on the other hand, it is too basic to drive automation for more sophisticated and complex tasks [29], [33], [46], [58] (e.g., automatic detection of objects on a screen [29]). However, if we add to RPA [45], [59], [60] recent technologies such as machine learning (ML) [27], [29], [33], [45], [46], [59], [61], [62], AI [29], [33], [45], [46], [59], [60], [62] and predictive analytics [33], [45], [63], automation becomes even more sophisticated, increasing human capabilities, improving decision making at all levels [27], [33], [39] and making it possible for machines to better and better at mimicking human tasks (e.g., such as pattern recognition, visual perception, speech recognition, decision making, and adaptability) [30].

Intelligent automation or Intelligent Process Automation (IPA) adds intelligence to existing automation to broaden the range of processes that can be automated within any business [33], [46] (e.g., answering customer questions in real time, improving regulatory compliance, and analyzing portfolio data to communicate with customers about their finances [46]).

It is a set of more advanced technologies that come together to manage, automate, and integrate digital processes [29], [60] and is used as a "human assistant" [29]. The key technologies that structure IPA include Digital Process Automation (DPA), RPA, and AI [39], [60], [61], where AI adds the data layer, RPA automates specific tasks and actions, and DPA acts as an orchestrator [39].

*Digital Process Automation* - agile set of smart process of automation technologies that have progressed from their foundations in BPM technology. DPA provides the agility and insight needed to enable a holistic approach to business process of automation, as it allows data flow to be managed, facilitates the identification of areas for improvement and the making of agile changes [60].

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

*Robotic Process Automation* - a software automation tool [29] that uses robots to perform rule-based tasks using structured data and mimicking human actions [46], [60] (e.g., reusing data from one system to another [60]). The robot has its own user identity document (ID) just like a person and can perform defined tasks (e.g., access email and systems, create documents, perform calculations and reports, and check files) [29].

*Artificial Intelligence* - is illustrated by machines [29] and contributes intelligence and decision-making by bringing another level of thinking to automation. It possesses the capability to analyze data in a manner that a human could not, identifying patterns in data and learning from past decisions to make increasingly intelligent choices [60].

Using these technologies together creates an intelligent business automation system, allowing the companies to automate repetitive tasks, analyze data, and gain insights into business processes [61] by connecting all the people, applications, devices, and disparate sets of information throughout the business on a single secure platform [39]. However, IPA still fully encompasses four more core technologies [29], [46]:

*Smart workflow* - a process management software tool that combines tasks performed by human and computer groups to design and monitor workflows that can be realized by automation technologies [46]. This allows users to initiate and monitor the state of an end-to-end process in real time. The program will manage transfers across diverse categories, including between robots and human users, and provide statistical insights concerning potential bottlenecks [29].

*Machine Learning/Advanced Analytics* - algorithms that identify patterns in structured data (e.g., daily performance data) through "supervised" and "unsupervised" learning and that improve their performance as more data is made available [46]. Supervised algorithms learn from structured datasets of inputs and outputs before making predictions based on new inputs [29] without requiring human intervention [61]. Unsupervised algorithms monitor structured data and begin to provide knowledge about recognized patterns [29].

*Natural Language Generation and Natural Language Processing (NLP)* - enables computers to understand human-like interactions [29] as text and spoken words as a human does [46] (e.g., broadcasters use this technology to write game stories in real time [29]).

*Cognitive Agents* - technologies that combine ML and NLP to create a fully automated workforce that can perform tasks, interact, learn from data sets and make decisions based on emotion detection [29] (e.g., customer support that can determine human emotions [46]).

Through various combinations of these seven technologies, IPA is able to expand its functionality. For example, it can combine RPA with NLP [29], [46], optical character recognition (OCR), and ML to handle complex and unstructured inputs that many real-world processes require [58]. Other example, for processes that require high functionality tasks such as analysis, creativity, problem solving and judgment, as well as learning how to change and improve the process flow to build an intelligent procedure as it is able to learn and develop over time due to ML and NLP [39], [46].

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

Briefly, IPA is a technology that mimics the human brain [45], makes sound judgments using intelligent decision making [33], [39] and considers the entire life cycle of an automated process through tools and functions regarding the overall complexity[33]. Therefore, unlike automated tasks that do not require thought, IPA decides how and in what way to automate business processes using simulated human thoughts, intelligence and analysis [45].

The main benefits of IPA are: ensures data privacy [45], near real-time communication across all business operations, error-free jobs at a lower cost and allowing people to focus on important tasks adding the benefits of RPA (e.g., automating repetitive [29], [59], [61], replicable [59], [62], routine [29], [59] mundane, non-value-added manual tasks [58]).

As such, companies in recent times already use IPA to solve a variety of business difficulties and needs in order to scale without cutting costs [45] (e.g., optimize legacy technology [58]) and increase profitability [62] by enriching employee activity and improving customer experiences [58] while enabling companies to be more competitive [29] and improve their efficiency [58] (e.g., allows healthcare organizations to respond more quickly to users, providing efficiencies and freeing up employees to focus more time on patients [64]).

### **Hyper-automation**

The workplace disruption caused by the COVID-19 pandemic has accelerated DT efforts in many companies. The massive shift to remote work has not only underlined the need to digitize manual processes, but also brought out the benefits of coordinating automation across companies. Hyper-automation is where advanced automation and AI tools can evolve [48] and unlock new capabilities and insights, and more impactful results [30], [53].

Hyper-automation, a Gartner coinage term, defined as "an approach in which organizations rapidly identify and automate as many business processes as possible. It involves the use of a combination of technology tools, including but not limited to ML, packaged software and automation tools to deliver work" [30]. It refers to the framework and set of advanced technologies needed to make a company automation scalable and strategic. The concept reflects on the realization that the current automation can be challenging to scale and is limited in the types of automation that it can achieve [28], [48].

The ultimate goal of hyper-automation is to intensify the automation process of a company, automating integrated processes and tools that enable people to better manage the operations of a business (e.g., converting RPA technologies into IPA technologies) [46]. In this sense, advanced technologies used to achieve automation at scale include the following: process mining tools, RPA [28], code-free/low-code development tools and platforms, integration platform as a service, intelligent document processing, and AI tools including ML and NLP [28], [53].

## Workforce Capabilities using Automation to support/ensure Business Continuity

Gartner projections anticipate a potential 30% reduction in operational costs for organizations by 2024 through the combination of hyper-automation technologies with redesigned operational processes [30]. Additionally, Gartner also predicts that the worldwide market for hyper-automation-enabling technology will reach 596.6 billion dollars in 2022, up from 481.6 billion dollars in 2020 and 532.4 billion dollars forecast in 2021 [28].

### Overview and differences

This section provided a detailed description of RPA as well as of IPA. To enhance the understanding of their distinctions, **Table 2.1** shows a comprehensive summary of the differences between RPA and IPA, divided and categorized by various topics.

**Table 2. 1** - List of differences between RPA and IPA

|                           | <b>Robotic Process Automation</b>                                                                                                                                                             | <b>Intelligence Process Automation</b>                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Human Involvement         | mimics human action through bots by training and rules [46] stipulated by humans [39] to work in place of a person or with a person to execute the technical elements of a process [29], [46] | Management of higher-level tasks that can function like human intelligence [46], learning to better execute complicated operations [29] and actions with more data and time, involving creativity, analytics [39], [46], judgement [39], [45], [46] and decisions in its execution [46], without the need for human intervention [39] due to AI, ML, predictive analytics, NLP and other technologies [29] |
| Implementation Complexity | it's very quick and easy to get a solution up and running [46]                                                                                                                                | more specifically used and deployed for defined purposes and complex scenarios, which may require additional configuration [46]                                                                                                                                                                                                                                                                            |
| Data Used                 | most suitable for a structured data-based ecosystem [38], [39], [46]                                                                                                                          | can handle both structured and unstructured data [39]                                                                                                                                                                                                                                                                                                                                                      |
| Task Complexity           | used to automate low-level [46], repetitive [39], [46], rule-based [29], [38], [39], [46] and simple tasks [38] or processes [29] with minimal variation [39]                                 | most suitable to optimize and perform complex business tasks and processes [38], [39], [45] that don't have to be strictly rule-based as the technology improve itself and its performance over time [39], [46]                                                                                                                                                                                            |
| Use Cases                 | focuses on checklists and individual tasks, tracking the closure process, timelines and approvals [38]                                                                                        | collect data from different sources and formats, collate and merge them, accelerate the process, be more accurate and require smarter ways of decision-making [38], [45]                                                                                                                                                                                                                                   |
| Business Benefits         | uses are wide-ranging [46] doing wonders for productivity and cost reduction in a short period of time [39]                                                                                   | offers a holistic solution to accelerate DT helping companies implement automation at scale [38] providing insights into process improvement opportunities across the enterprise, enabling them to transform the way employees work for long-term success [39]                                                                                                                                             |

In the overview, IPA proves to be superior because of its ability to integrate with other digital systems, tools, and other emerging technologies. It is adaptable to any workflow and business operations, compared to RPA.

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

### **CHAPTER 3. RELATED WORK**

The impact of automation on the workforce has been extensively studied specially in recent years due to advances in technology. The World Economic Forum (WEF) has been studying the future of jobs for many years, [65] is an important work that examines the impact of automation on the workforce. WEF predicts that automation and AI will lead to job displacement in many industries, including manufacturing, construction, and transportation. This report provides a comprehensive analysis of the trends and drivers shaping the future of work, including the impact of technological change and automation. The report emphasizes the importance of investing in workforce capabilities, such as digital skills and social and emotional skills, to ensure that workers can adapt to the changing nature of work. However, the report also highlights the potential for automation technology to create new jobs and opportunities, particularly in the areas of data and AI, in other industries such as healthcare and education.

Carl Frey and Michael Osborne paper [66] is another important work that looks at the impact of automation on the workforce. The authors suggest that a significant proportion of jobs are at risk of being automated in the future, particularly those involving routine tasks. The paper highlights the importance of investing in education and training to ensure that workers are able to transition into new jobs and industries.

Another important work is [67], the report discusses how automation is changing job roles and highlights the skills needed for employees to adapt and thrive in an automated environment. It analyses the automation's impact on the workforce revealing a significant shift in the demand for skills in various occupations. Higher-level social, emotional, and cognitive skills like creativity, critical thinking, and problem solving are identified as crucial for the future. The report underscores the importance of reskilling and upskilling to enable workers to adapt to technological changes and develop new skills, ensuring their relevance and employability in the future.

In addition to the articles mentioned above, a recent paper [68] emphasizes the importance of IPA in ensuring BC, particularly in times of crisis or disruption and identifies potential areas for future research at the intersection of automation and BC. The authors argue that IPA can help organizations maintain operations, reduce costs, and improve customer satisfaction, among other benefits, by automating routine tasks and streamlining processes, which can improve efficiency and reduce the risk of disruption. However, the authors, identifying several key related themes, while also highlighting potential areas for future research in this field, including the development of new IPA technologies and the identification of the best practices for implementation, but also highlighting the importance of developing the required workforce skills and capabilities to ensure that they can work effectively with IPA, particularly in support of BC.

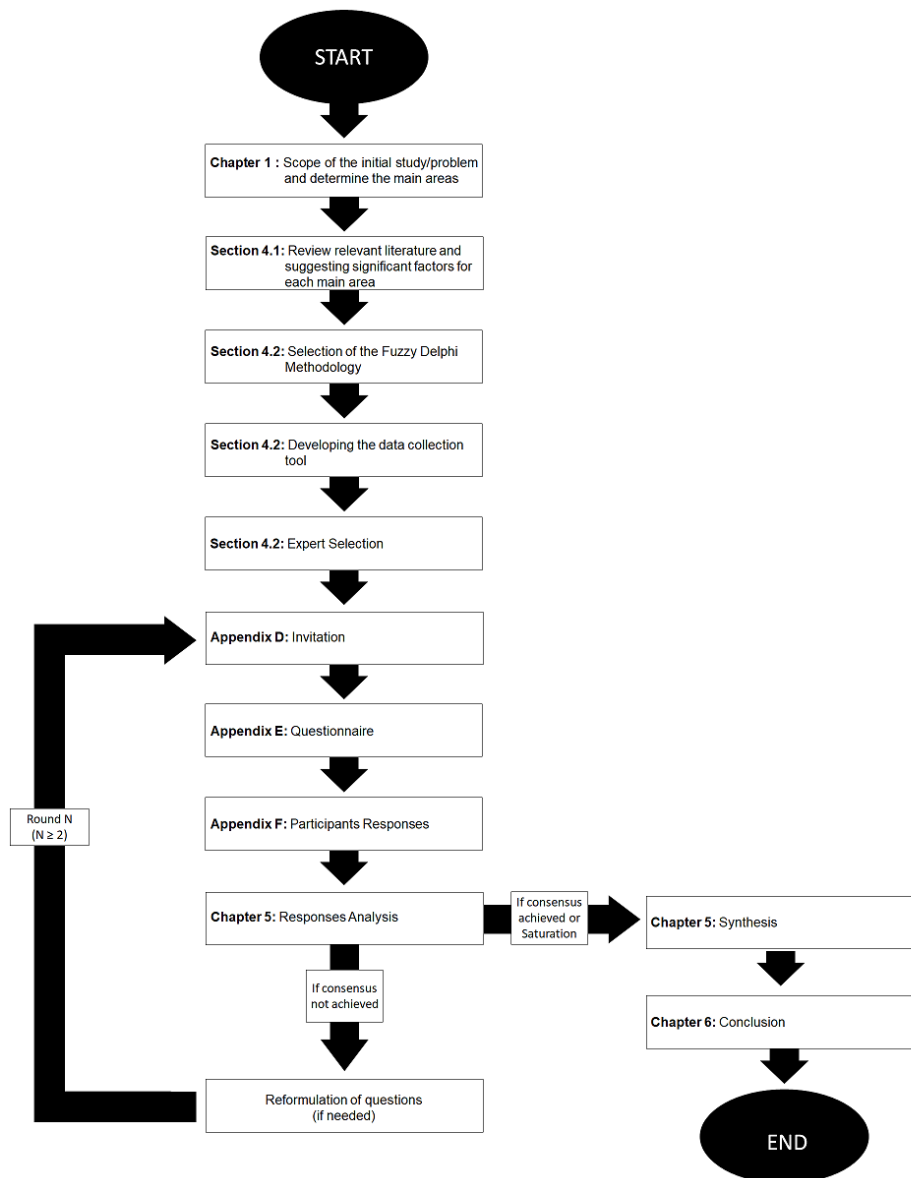
## **Workforce Capabilities using Automation to support/ensure Business Continuity**

Overall, the studies mentioned above suggest that automation will have a significant impact on the workforce, leading to job displacement in some industries and the creation of new job opportunities in others. Yet they also provide valuable information about that same impact and its potential to support BC. In order to remain relevant in the workforce, workers will need to adapt to new technologies and develop new skills just as organizations must ensure that their workforce has the skills and capabilities to work effectively with automation.

As suggested, more research on the interaction between humans and aspects of automation is needed to understand the long-term impact of automation on workforce capabilities, to develop effective strategies to support the transition to automation, and to identify the most important capabilities during this transition. This research builds on this knowledge by exploring the specific capabilities that are required for employees to effectively use automation technologies to secure BC.

## CHAPTER 4. RESEARCH METHODOLOGY

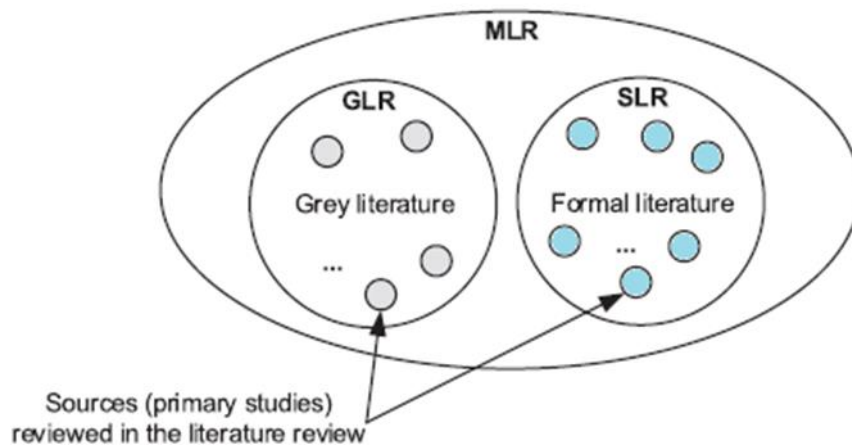
The **Figure 4.1** represents the study model adopted in this research. As mentioned in the Chapter 1, this research aims to investigate and identify the workforce capabilities required to support and ensure BC through automation, being the two main areas of automation and BC. To achieve this objective, due to the lack of scientific literature on the subject, it was conducted a Multivocal Literature Review (MLR) to identify the workforce capabilities needed with automation (**RQ1**) and the workforce capabilities needed for business continuity (**RQ2**) from the existing literature. After conducting the MLR it was selected to use Delphi Methodology, more specifically a subset of it, the Fuzzy Delphi Methodology (FDM), to collect experts opinions on which of these capabilities are needed in relation to workforce using automation to support/ensure business continuity (**RQ3**).



**Figure 4. 1** - Study Model (adapted from [69], [70])

### 4.1. Multivocal Literature Review

A MLR aims to incorporate Grey Literature (GL) (such as blogs, videos and webpages) in research reviews, not overriding the published (peer-reviewed) writing like journal articles and conference papers [71]. These GL are typically produced by Software Engineering (SE) practitioners outside academic forums [72]. Therefore, the MLRs are a kind of Systematic Literature Review (SLR) [73] important to the expansion of research by including literature that would not normally be taken in consideration due to its “grey” nature [74], as show in **Figure 4.2**.



**Figure 4. 2** - Venn diagram showing the relationship of SLR, GLR and MLR studies (adapted from [71]).

The MLR planning phase involves two phases: determining the necessity for an MLR in a given topic; and determining the MLR’s goal, raising its RQs. Once the MLR is planned, conducting the review takes five phases: search process for FL or GL, normally by using defined search strings; source selection, that usually includes determining the selection criteria and executing the selection process; study quality assessment of sources, which determines whether a source is valid and/or free of bias; data extraction design forms, logistics and procedures, with possibility of automated data summary and extraction; and data synthesis with chosen quantitative and qualitative techniques. Last but not least, the reporting phase of an MLR is similar to the SLR guidelines of Kitchenham and Charters [75], summarizing the extracted data from the selected literature and report findings. The MLR Methodology steps adopted to support this research are represented in the **Table 4.1**.

## Workforce Capabilities using Automation to support/ensure Business Continuity

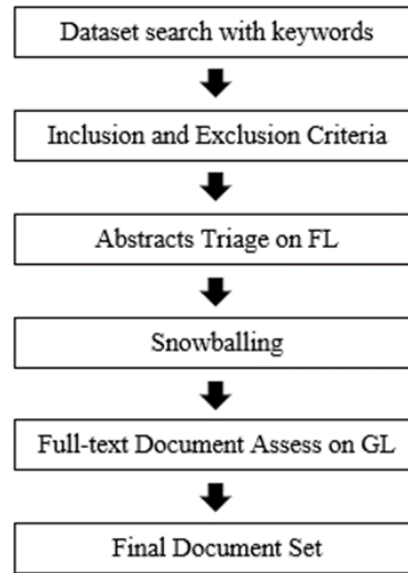
**Table 4. 1** - Multivocal Literature Review Methodology

| 4.1.1. Planning the Multivocal Literature Review                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4.1.2. Conducting the Multivocal Literature Review                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5. Reporting the Multivocal Literature Review                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• <b>Establishing the need for an MLR</b><br/>Technologies such as automation, are becoming more and more advanced, and with this advance human beings need skills and abilities that complement these technologies, otherwise they will leave a feeling of fear as machines will not only replace human beings, but also become so complex that no human mind will be able to control them.</li> <li>• <b>Defining the MLR's goal and raising its research questions</b><br/>Identify the workforce capabilities needed with automation and business continuity, their definitions and differences.                             <ul style="list-style-type: none"> <li>○ <b>RQ1:</b> What are the workforce capabilities needed with automation?</li> <li>○ <b>RQ2:</b> What are the workforce capabilities needed with business continuity?</li> <li>○ <b>RQ3:</b> What are the workforce capabilities using automation to support/ensure business continuity?</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>Search process &amp; source selection</b><br/>Includes search keywords on chosen search engines and having a pool ready for inclusion/exclusion criteria</li> <li>• <b>Study quality assessment</b><br/>Apply inclusion/exclusion criteria</li> <li>• <b>Design of data extraction forms</b><br/>Attribute identification and generalization</li> <li>• <b>Data extraction</b><br/>Starts the systematic mapping</li> <li>• <b>Data synthesis</b><br/>Returns MLR results (answers to RQs)</li> </ul> | <ul style="list-style-type: none"> <li>• <b>Summarizing the extracted data from the selected literature</b><br/>Organizing retrieved data into consumable from in charts, tables and lists.</li> <li>• <b>Report findings</b> <ul style="list-style-type: none"> <li>○ Writing the report</li> <li>○ Elicit the workforce capabilities needed with automation and business continuity, their definitions and differences</li> </ul> </li> </ul> |

### 4.1.1. Planning the Multivocal Literature Review

This section corresponds to the planning phase of the MLR methodology process mentioned above. The complete MLR planning is illustrated in **Figure 4.3**.

## Workforce Capabilities using Automation to support/ensure Business Continuity



**Figure 4. 3** - Complete MLR planning phase performed in this research

The research process was done manually based on Formal Literature (FL) such as journal articles, conferences, and book chapters and based on GL such as blogs, technical reports and lectures in the list of datasets from **Table 4.2**.

**Table 4. 2** - List of used Datasets for this literature review

| ID | Dataset         | Link                                                                            |
|----|-----------------|---------------------------------------------------------------------------------|
| 1  | ACM             | <a href="https://dl.acm.org">https://dl.acm.org</a>                             |
| 2  | EBSCO           | <a href="https://search.ebscohost.com">https://search.ebscohost.com</a>         |
| 3  | Emerald Insight | <a href="https://www.emerald.com/insight/">https://www.emerald.com/insight/</a> |
| 4  | Google Search   | <a href="https://www.google.com">https://www.google.com</a>                     |
| 5  | IEEE Xplore     | <a href="https://ieeexplore.ieee.org">https://ieeexplore.ieee.org</a>           |
| 6  | Scopus          | <a href="https://www.scopus.com">https://www.scopus.com</a>                     |
| 7  | Springer        | <a href="https://link.springer.com/">https://link.springer.com/</a>             |
| 8  | Web of Science  | <a href="https://apps.webofknowledge.com">https://apps.webofknowledge.com</a>   |

For the search strategy, several keywords and a string were used to find the specific content to write this literature review, that keywords are listed in **Table 4.3**.

**Table 4. 3** - List of used Keywords for this literature review

| ID     | Keywords                                                                                                                                                                                                                                                                            |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| KW1    | Business Continuity                                                                                                                                                                                                                                                                 |
| KW2    | Robotic Process Automation OR RPA OR Intelligent Process Automation OR IPA OR Automation OR Robotic Automation OR Intelligent Automation                                                                                                                                            |
| KW3    | People OR Workforce OR Capabilities OR Skills OR Functionalities OR Features                                                                                                                                                                                                        |
| STRING | ("Business Continuity") AND ("Robotic Process Automation" OR "RPA" OR "Intelligent Process Automation" OR "IPA" OR "Automation" OR "Robotic Automation" OR "Intelligent Automation") AND ("People" OR "Workforce" OR "Capabilities" OR "Skills" OR "Functionalities" OR "Features") |

## Workforce Capabilities using Automation to support/ensure Business Continuity

Python code (source code in **Appendix A**) for obtaining Google search results (adapted from [76]) is the code used to facilitate searching and collecting high volumes of GL in order to construct the data into a CSV file. Therefore, obtaining clean generic results, not specific for the user, solving the problem of consistency in the returned results. This is important because Google returns are results custom-made to each user, based on their previous search history and preferences. In conclusion, this code helped to obtain the results needed, gathering them into a spreadsheet file for easy integration in the MLR process.

In terms of literature selection, the following quantitative filters (inclusive and exclusive criteria) were applied, presented in **Table 4.4**.

**Table 4. 4** - Inclusion / Exclusion criteria used for this literature review

| Formal Literature                            |                                                  | Grey Literature                                                  |                                                                           |
|----------------------------------------------|--------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------------------------------|
| Inclusion                                    | Exclusion                                        | Inclusion                                                        | Exclusion                                                                 |
| Articles in English                          | Not in English                                   | Literature in English                                            | Not in English                                                            |
| Articles from Journals, Conferences or Books | Not Articles from Journals, Conferences or Books | Literature from Technical reports, Lectures, Data sets and Blogs | Not Literature from Ideas, Concepts, Thoughts, Advertisement and Job post |
| Free to access content                       | Paid content or Advertisement                    | Not Duplicates                                                   | Duplicates                                                                |
| Not Duplicates                               | Duplicates                                       | Publication date                                                 | No publication date                                                       |

Gathering the keywords and quantitative criteria mentioned above the following list of search strings (in **Table 4.5**) were created and used.

### 4.1.2. Conducting the Multivocal Literature Review

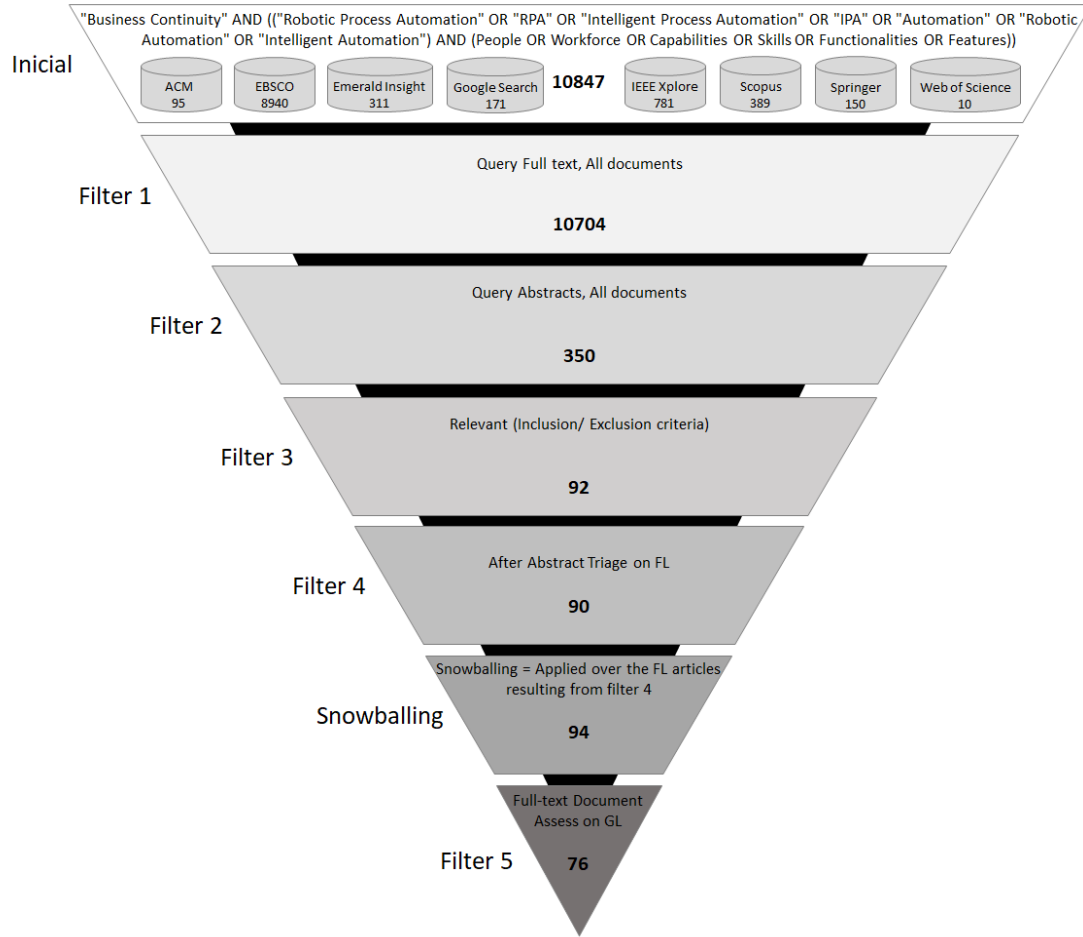
This section corresponds to the conducting phase of the MLR methodology process mentioned in **Table 4.1**. After the search process using the search strings above and some more filters, 76 papers were identified to write the literature review about the workforce capabilities needed with automation and with BC, this search was conducted in October 2022.

## Workforce Capabilities using Automation to support/ensure Business Continuity

**Table 4. 5** - Search Strings used in Datasets to obtain the articles

| DB | Search using a complex Query and exclusions                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | [Abstract: "business continuity"] AND [[Abstract: "robotic process automation"] OR [Abstract: "rpa"] OR [Abstract: "intelligent process automation"] OR [Abstract: "ipa"] OR [Abstract: "automation"] OR [Abstract: "robotic automation"] OR [Abstract: "intelligent automation"]]] AND [[Abstract: "people"] OR [Abstract: "workforce"] OR [Abstract: "capabilities"] OR [Abstract: "skills"] OR [Abstract: "functionalities"] OR [Abstract: "features"]]  |
| 2  | AB "Business Continuity" AND AB ( "Robotic Process Automation" OR "RPA" OR "Intelligent Process Automation" OR "IPA" OR "Automation" OR "Robotic Automation" OR "Intelligent Automation" ) AND AB ( "People" OR "Workforce" OR "Capabilities" OR "Skills" OR "Functionalities" OR "Features" )                                                                                                                                                              |
| 3  | abstract:"Business Continuity" AND (abstract:"Robotic Process Automation OR RPA OR Intelligent Process Automation OR IPA OR Automation OR Robotic Automation OR Intelligent Automation") AND (abstract:"People OR Workforce OR Capabilities OR Skills OR Functionalities OR Features")                                                                                                                                                                      |
| 4  | ("Business Continuity") AND ("Robotic Process Automation" OR "RPA" OR "Intelligent Process Automation" OR "IPA" OR "Automation" OR "Robotic Automation" OR "Intelligent Automation") AND ("People" OR "Workforce" OR "Capabilities" OR "Skills" OR "Functionalities" OR "Features")                                                                                                                                                                         |
| 5  | ("Abstract": "Business Continuity") AND ("Abstract": "Robotic Process Automation" OR "Abstract": "RPA" OR "Abstract": "Intelligent Process Automation" OR "Abstract": "IPA" OR "Abstract": "Automation" OR "Abstract": "Robotic Automation" OR "Abstract": "Intelligent Automation") AND ("Abstract": "People" OR "Abstract": "Workforce" OR "Abstract": "Capabilities" OR "Abstract": "Skills" OR "Abstract": "Functionalities" OR "Abstract": "Features") |
| 6  | ABS ( "Business Continuity" ) AND ABS ( "Robotic Process Automation" OR "RPA" OR "Intelligent Process Automation" OR "IPA" OR "Automation" OR "Robotic Automation" OR "Intelligent Automation" ) AND ABS ( "People" OR "Workforce" OR "Capabilities" OR "Skills" OR "Functionalities" OR "Features" ) AND ( LIMIT-TO ( LANGUAGE, "English" ) )                                                                                                              |
| 7  | "Business Continuity" AND (( "Robotic Process Automation" OR "RPA" OR "Intelligent Process Automation" OR "IPA" OR "Automation" OR "Robotic Automation" OR "Intelligent Automation") AND (People OR Workforce OR Capabilities OR Skills OR Functionalities OR Features))                                                                                                                                                                                    |
| 8  | ((AB=("Business Continuity")) AND AB=("Robotic Process Automation" OR "RPA" OR "Intelligent Process Automation" OR "IPA" OR "Automation" OR "Robotic Automation" OR "Intelligent Automation")) AND AB=("People" OR "Workforce" OR "Capabilities" OR "Skills" OR "Functionalities" OR "Features")                                                                                                                                                            |

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**Figure 4. 4 - MLR process used (adapted from [71])**

**Table 4. 6 - Filter Application used to obtain the articles**

| DB    | Keywords        | Initial | Filters |    |    |    |             |    | Final |
|-------|-----------------|---------|---------|----|----|----|-------------|----|-------|
|       |                 |         | F1      | F2 | F3 | F4 | Snowballing | F5 |       |
| 1     | KW1 & KW2 & KW3 | 95      | 94      | 0  | -  | -  | +4          | -  | 0     |
| 2     | KW1 & KW2 & KW3 | -       | 8940    | 10 | 2  | 1  |             | -  | 1     |
| 3     | KW1 & KW2 & KW3 | 311     | -       | 0  | -  | -  |             | -  | 0     |
| 4     | STRING          | 171     | -       | -  | 83 | -  |             | 69 | 69    |
| 5     | KW1 & KW2 & KW3 | 781     | 639     | 5  | 2  | 2  |             | -  | 2     |
| 6     | KW1 & KW2 & KW3 | 389     | -       | 8  | 3  | 2  |             | -  | 2     |
| 7     | KW1 & KW2 & KW3 | 150     | -       | -  | -  | -  |             | -  | 0     |
| 8     | KW1 & KW2 & KW3 | 10      | -       | 6  | 2  | 2  |             | -  | 2     |
| TOTAL |                 |         |         |    | 92 | 90 | 94          | 76 | 76    |

**Legend:** - = filter/search method not available/applied; F1 = Query Full text, All documents; F2 = Query Abstracts, All documents; F3 = Relevant (Inclusion/ Exclusion criteria); F4 = After Abstract Triage on FL; Snowballing = Applied over the FL articles resulting

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The procedure required an extraction of relevant information from the mentioned data collected and comparing the articles with the related study. This extraction will help find out the workforce capabilities needed with automation and BC, outlining their definitions and differences. In **Appendix B** are the FL and GL articles chosen for the literature review about the workforce capabilities, identified by the ID, dataset and year of publication. This shows that in terms of datasets 76 articles were selected from Google Search, 2 from IEEE Xplore, 2 from Scopus, 2 from Web of Science and 1 from EBSCO.

Once the FL articles were selected, they were sorted by type, number of citations and qualitative rank (when assigned), as **Table 4.7** shows, from these articles 5 were selected from conferences, 1 from books and 1 from journals. **Table 4.8** shows that 56% of the FL articles selected are from journals and conferences with reputable ranking.

**Table 4. 7** - FL Articles sorted by type, number of citations and qualitative rank

| ID   | Type       | N° Citations | Rank                   |
|------|------------|--------------|------------------------|
| [5]  | Conference | 5            |                        |
| [77] | Conference | 0            |                        |
| [78] | Book       | 28           |                        |
| [15] | Conference | 17           | B3 - Qualis            |
| [79] | Conference | 18           | B1 - Qualis            |
| [4]  | Journal    | 2            | Q1                     |
| [80] | Conference | 2            | A - ERA<br>B4 - Qualis |

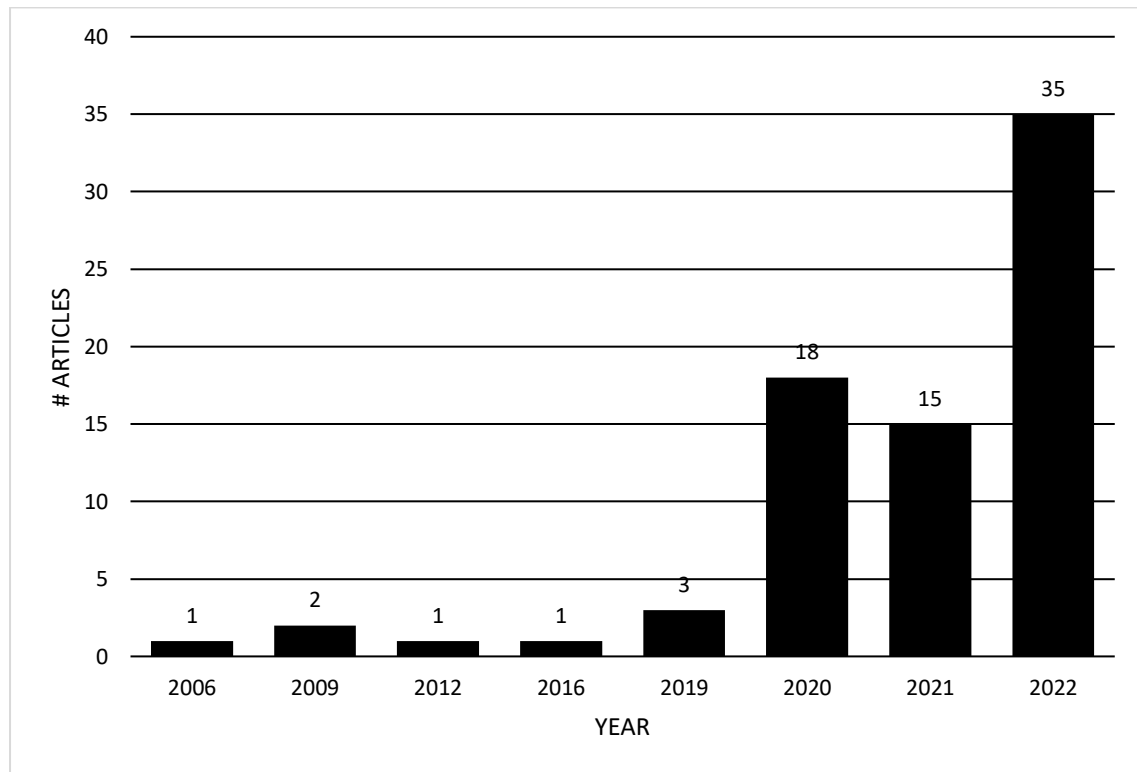
**Table 4. 8** - Journals and Conferences Ranks

| Ranking     | Number of Articles | Percentage |
|-------------|--------------------|------------|
| B1 - Qualis | 1                  | 14%        |
| B3 - Qualis | 1                  | 14%        |
| B4 - Qualis | 1                  | 14%        |
| Q1          | 1                  | 14%        |
| Total       | 4                  | 56%        |

**Appendix C** shows that, regardless BC and automation, eight concepts were identified to group the different literatures. These concepts are key factors found in the literature about automation and BC, regarding the workforce capabilities.

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**Table 4. 9** - Articles distribution by Year



**Table 4.9** showed that the number of articles about this topic has been increasing since 2020, mainly due to the Covid 19 pandemic. The virus created an unplanned stress test for all business enterprises as the focus on containing the pandemic left companies and business vulnerable through staff unavailability. However, it had an additional boost to automation and was a turning point to accelerate the adoption of automation technologies.

### 4.2. Fuzzy Delphi Methodology

The Delphi Method has been used and accepted to collect data for an expert-based study [81], as it helps in evaluating and rating items from a given set of items through questionnaires that collect the opinion of experts on the subject.

There are some characteristics that distinguish this method from other traditional qualitative methods, such as interactivity, controlled feedback and anonymous responses, in addition to not requiring very large samples of participants. However, the calculation of consensus in the Delphi method can be extensive because as it is carried out in each round, the opinion of each expert on each item may vary, which may result in many rounds. As the rounds increase, the drop rate of the participants may increase too, making the Delphi results less substantial.

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Thusly, it has been chosen the FDM because it is a method that allows an easier way to deal with the consensus between each item and translate the subjective evaluation into a quantitative measure [70]. FDM is based on the modification of the Delphi Method combining the traditional Delphi method (Classic) and the numbering of the Fuzzy Set Method or Fuzzy Set Theory [81], in which, unlike the classic Delphi Method, each item is evaluated independently, and so, it can help the researcher to discard an item when consensus is obtain in it without passing that item through another round, allowing an easier way to deal with the consensus between each item [70].

The Fuzzy Set Theory is a tool to deal with the ambiguity of human subjective opinion and works as an extension to the classic set theory, in which each element of a set is evaluated based on a probability distribution ranging between zero and one, with the closer the value is to one the greater its degree of belonging [81].

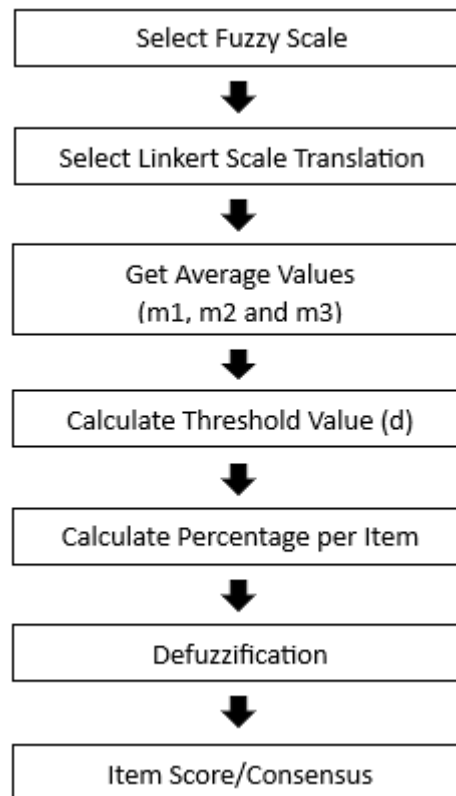
In order to apply the FDM, the panel of experts selected needs to have interest in the defined problem or decision, which it should be clear, well-defined, specific and relevant to the topic in study. The objective for this Fuzzy Delphi investigation is to obtain consensus from the panel of experts about the workforce capabilities required to support and ensure BC through automation.

After defining the problem and suggesting the capabilities through the MLR, it was necessary to select a tool to collect the data. In this research it was used the questionnaire as an instrument to obtain the quantitative data. The questionnaire (**Appendix E**) meted the criteria and conditions of using the FDM technique (mathematical formula in order to obtain the consensus of the experts) as it consists in a multiple questions assessment, in order to evaluate the importance of each capability using the application of the five-point Likert scale (**Table 5.2**), which participants need to answer based on their experience.

Based on their experience in the field of automation, more specifically in RPA and/or IPA, 28 experts were identified and selected to inquire about the capabilities. This selection was based on the opinion of [82] which states that for the realization of the FDM the number of participants has to be between 10-50 people. In order for the communication with these experts to remained anonymous (a requirement of a Delphi study) invitations (**Appendix D**) were made via email or private messages through Facebook and/or LinkedIn with a brief summary of the study along with the starting date of the first round.

It was also defined that each round would last approximately 1 month, in which the experts have 3 weeks to respond to the questionnaire with the last week for processing and analysing of the participants answers (**Appendix F**), each round aiming to reaching group consensus. The steps of the response analysis process are shown in **Figure 4.5** and explained in **Chapter 5**.

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**Figure 4. 5** - Consensus calculation steps for Fuzzy Delphi (adapted from [70])

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### CHAPTER 5. FINDINGS

According to [80], a capability can be defined as "a distinct set of human resource-based competencies, orientations, attitudes, motivations and behaviours that have the potential, in appropriate contexts, to contribute to the achievement of specific activities and influence business performance". They can be "developed through the combination of resources and denote high-performance business processes that are repeated over time to perform business tasks" [83] but also be "the ability of the firm to use resources, usually in combination, using organizational processes, to achieve a desired end. They are information-based processes, tangible or intangible, that are firm-specific and are developed over time through complex interactions between firm resources" [80].

Based on the 76 articles from the literature review, it has intended to answer the research questions proposed in the structure of this research. From the selected articles, 51 workforce capabilities were interpreted, as shown in the **Table 5.1**, in which 40 of these capabilities were related with automation and 44 were related with BC. As such, 40 workforce capabilities were selected and suggested as needed with automation to support/ensure BC (**RQ3**).

The process of selection for these 40 capabilities, chosen from the 51 obtained through the MLR to answer **RQ1** and **RQ2**, aimed to increase the response rate of the Delphi study. By reducing the number of capabilities to 40, it was sought to enhance participation engagement and ensure that the selected capabilities were most relevant to the objective of the **RQ3**. This approach was adopted to mitigate potential survey fatigue that could arise from an excessively lengthy questionnaire. By narrowing down the number of questions, it was anticipated that participants would be more willing to complete the survey, thus enhancing the overall response rate.

This process involved several criteria, including: selecting all the capabilities that were interpreted as necessary for both automation and BC in which 31 capabilities were obtained (C1-C4, C7, C10-C14, C16-C26, C29, C31, C32, C35-C37, C39, C40, C43, C44); excluding the capabilities that were less interpreted, in which 6 capabilities were excluded (C46-C51), and selecting additional capabilities that were deemed more important in the context of BC in companies with automation mechanisms compared to those with only human employees, in which 9 capabilities were obtain (C5, C9, C30, C33, C34, C38, C41, C42, C45).

Through this process, some of these capabilities were excluded because they were too specific and, therefore, less comprehensive than the ones that were selected for the Delphi study. In this manner, capability C20 was deemed redundant because it could be included in capability C45, while capabilities C8 and C6 could be integrated into capability C26, as capability C15 could be combined with C16.

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**Table 5. 1** - List of Capabilities identified by the ID, description and the FL and GL articles that mention them.

| ID  | Capabilities                            | Description                                                                                                                                                                             | A | B | A/B | Articles                                                                                                                                                  | #  |
|-----|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| C1  | Customer Focus/Feedback                 | to be able to understand and meet customers needs and expectations, and to collect and incorporate customer feedback in order to continuously improve products, services and processes. | • | • | •   | [4], [5], [15], [24], [25], [29], [30], [32], [33], [35]–[47], [52], [53], [56], [59]–[61], [64], [77]–[80], [84]–[98]                                    | 48 |
| C2  | Business Acumen/Literacy                | to be able to understand the financial and operational aspects of an organisation and use that knowledge to make informed decisions.                                                    | • | • | •   | [24], [25], [29], [30], [32], [33], [35]–[39], [41]–[46], [52], [56], [57], [59]–[61], [63], [64], [84]–[95], [98]–[102]                                  | 43 |
| C3  | Continuous Learning                     | to be able to continuously acquire new knowledge and skills in order to adapt to changing circumstances and improve performance.                                                        | • | • | •   | [4], [5], [15], [33], [36], [41]–[45], [53], [57], [60]–[62], [64], [77]–[79], [84], [85], [93]–[99], [103]                                               | 29 |
| C4  | Preparation and Planning                | to be able to anticipate future needs and plan accordingly to achieve the objectives.                                                                                                   | • | • | •   | [4], [5], [15], [27], [30], [32], [33], [35], [40]–[44], [47], [48], [53], [54], [64], [77]–[80], [84]–[86], [96], [97], [103], [104]                     | 29 |
| C5  | Decision-making                         | to be able to make informed decisions based on data, information and common sense, considering the impact on stakeholders and the organisation as a whole.                              |   | • | •   | [5], [15], [28], [30], [32], [33], [36], [40], [43], [44], [47], [48], [53], [56], [59], [63], [64], [77]–[79], [84], [92], [93], [96]–[99], [101], [103] | 29 |
| C6  | Monitoring                              | to be able to monitor and track key performance indicators, metrics, and other data to evaluate progress, to identify trends and to make informed decisions.                            | • |   |     | [32], [33], [35], [36], [40], [43], [44], [46]–[48], [53], [54], [57], [58], [61], [63], [64], [84]–[86], [89], [93], [96]–[99], [103], [105]             | 28 |
| C7  | Change Management                       | to be able to manage and implement change within an organisation, including identifying the need for change, planning and implementing change, and monitoring its impact.               | • | • | •   | [4], [5], [15], [28], [33], [36], [40], [42], [44], [47], [48], [53], [61], [77]–[80], [84]–[86], [89], [93], [96]–[98], [101], [103]                     | 27 |
| C8  | Software Integration                    | to be able to integrate different systems and software platforms to enable seamless communication and data exchange across the organisation.                                            | • |   |     | [4], [5], [15], [30], [33], [36], [40]–[44], [47], [53], [58], [63], [64], [77]–[80], [84], [85], [96]–[98], [105]                                        | 26 |
| C9  | Remote Working Readiness                | to be able to work in a remote or virtual environment, including the use of appropriate communication technology and tools.                                                             |   | • | •   | [4], [5], [15], [36], [44], [47], [53], [56], [58], [59], [61], [63], [77], [78], [80], [85], [86], [89], [93], [94], [96]–[99], [103], [105]             | 26 |
| C10 | Analytics, Data Analysis and Management | to be able to collect, analyse, interpret, and manage data to inform decision-making and improve organisational performance.                                                            | • | • | •   | [4], [5], [15], [32], [35], [40]–[43], [47], [48], [53], [54], [64], [77]–[80], [84]–[86], [96]–[98], [103]                                               | 25 |
| C11 | Technical Writing and Documentation     | to be able to write technical documents and manuals which convey technical information clearly and accurately to the stakeholders.                                                      | • | • | •   | [4], [5], [15], [33], [36], [40], [42]–[44], [47], [48], [53], [58], [59], [61], [77]–[80], [86], [93], [96]–[98], [103]                                  | 25 |
| C12 | Collaboration                           | to be able to work with others towards a common goal, to share knowledge and skills, and to build positive relationships.                                                               | • | • | •   | [4], [5], [36], [40], [42], [44], [47], [48], [53], [56], [79], [85]–[87], [89], [91]–[94], [96]–[98], [103], [105]                                       | 24 |

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|     |                                      |                                                                                                                                                                         |   |   |   |                                                                                                                                   |    |
|-----|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------|----|
| C13 | Technical Proficiency                | to be able to use and apply technical tools and software to accomplish tasks and goals.                                                                                 | • | • | • | [4], [15], [28], [32], [34], [35], [40]–[43], [47], [53], [57], [58], [64], [77]–[79], [84]–[86], [96]–[98]                       | 24 |
| C14 | Resource Management                  | to be able to manage resources, including financial, human and physical resources, to achieve organisational objectives.                                                | • | • | • | [5], [15], [30], [33], [40], [42]–[44], [47], [48], [53], [54], [64], [78], [79], [84]–[86], [93], [96], [97], [99], [103], [104] | 24 |
| C15 | Agile Thinking and Mindset           | to be able to embrace an agile approach to work, which involves being adaptable, flexible and responsive to change, and to focus on continuous improvement.             | • |   |   | [32], [33], [35], [36], [40], [43], [44], [46], [47], [53], [58], [61], [64], [84]–[86], [89], [93], [96]–[100], [105]            | 24 |
| C16 | Critical Thinking                    | to be able to evaluate information and ideas objectively, identify assumptions, assess arguments and make sound judgements.                                             | • | • | • | [4], [5], [15], [32], [33], [35], [40]–[43], [47], [53], [64], [77]–[80], [84]–[86], [91], [96]–[98]                              | 23 |
| C17 | Risk Management                      | to be able to identify potential risks and take action to mitigate or manage them in order to minimise the negative impact on the organisation.                         | • | • | • | [5], [32], [33], [35], [40]–[43], [47], [48], [53], [58], [64], [77], [78], [84]–[86], [96]–[98], [103], [105]                    | 23 |
| C18 | Project Management                   | to be able to plan, execute and monitor projects from start to finish, ensuring that they are completed within budget, on time and to the satisfaction of stakeholders. | • | • | • | [5], [32], [33], [35], [40]–[43], [47], [48], [53], [64], [77], [78], [84]–[86], [96]–[99], [103], [104]                          | 23 |
| C19 | Communication                        | to be able to express ideas, thoughts and information clearly to others both verbally and in writing.                                                                   | • | • | • | [4], [5], [15], [26], [40]–[43], [47], [53], [57], [62], [64], [78], [79], [84], [85], [96]–[99], [102]                           | 22 |
| C20 | Problem-solving                      | to be able to identify, analyse and solve problems in a logical and systematic way, using critical and creative thinking skills.                                        | • | • | • | [5], [31]–[33], [35], [40]–[43], [47], [48], [53], [64], [79], [84]–[86], [96]–[98], [103], [105]                                 | 22 |
| C21 | Adaptability and Flexibility         | to be able to adapt to changing circumstances and be flexible in response to new challenges and opportunities.                                                          | • | • | • | [15], [32], [33], [35], [40]–[43], [47], [53], [64], [77]–[79], [84]–[86], [96]–[99], [105]                                       | 22 |
| C22 | Knowledge sharing and shared mindset | to be able to share knowledge and ideas openly and proactively, to collaborate with others, and to foster a shared mindset, in order to achieve common goals.           | • | • | • | [4], [32], [33], [35], [40]–[43], [47], [53], [57], [64], [79], [80], [84]–[86], [96]–[98], [101], [103]                          | 22 |
| C23 | Security / Cybersecurity             | to be able to identify, assess and mitigate the risks and threats to information security and digital systems.                                                          | • | • | • | [4], [5], [15], [27], [33], [40]–[43], [47], [48], [53], [54], [64], [77]–[80], [84], [96], [97]                                  | 21 |
| C24 | Leadership                           | to be able to inspire, motivate, and guide others towards a common goal, and to make decisions that have a positive impact on the organisation.                         | • | • | • | [5], [32], [33], [35], [40]–[43], [47], [48], [53], [64], [84]–[86], [96]–[99], [103], [104]                                      | 21 |
| C25 | Process Improvement                  | to be able to identify opportunities for improvement in organisational processes and implement changes to increase efficiency and effectiveness.                        | • | • | • | [4], [5], [15], [27], [33], [36], [40], [44], [47], [53], [56], [77]–[80], [84], [86], [93], [96], [97], [99]                     | 21 |

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|     |                                               |                                                                                                                                                                                                                                                                                            |   |   |   |                                                                                                          |    |
|-----|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|----------------------------------------------------------------------------------------------------------|----|
| C26 | Systems Configuration, Support and Management | to be able to configure, support and manage technical systems and software in order to ensure their functioning.                                                                                                                                                                           | • | • | • | [4], [5], [15], [33], [36], [40], [42], [44], [47], [53], [77]–[80], [93], [96]–[100]                    | 20 |
| C27 | Information Management                        | to be able to manage information, including the organisation, storage and retrieval of data and information, in an accessible, secure and usable way.                                                                                                                                      |   | • |   | [5], [33], [36], [40], [42], [44], [47], [53], [58], [59], [63], [79], [84]–[86], [93], [96]–[98], [105] | 20 |
| C28 | Quality Control/Assurance                     | to be able to ensure that products, services and processes meet the highest quality standards and that customer satisfaction is maintained.                                                                                                                                                | • |   |   | [30], [33], [36], [40], [43], [46]–[48], [53], [63], [84]–[86], [92], [93], [96]–[98], [101], [103]      | 20 |
| C29 | Digital Acumen/Literacy                       | to be able to understand and use digital technologies and tools safely to accomplish tasks and objectives.                                                                                                                                                                                 | • | • | • | [4], [5], [15], [28], [41], [42], [44], [57], [58], [77]–[80], [85], [86], [93], [98]–[100]              | 19 |
| C30 | Resilience                                    | to be able to adapt and recover quickly from setbacks, adversity and stress, and maintain a positive outlook.                                                                                                                                                                              |   | • | • | [4], [5], [15], [28], [33], [44], [56], [57], [77]–[80], [92]–[94], [98], [99], [101], [102]             | 19 |
| C31 | Accountability and Responsibility             | to be able to take ownership of their work and actions, and to be responsible and accountable for results and outcomes.                                                                                                                                                                    | • | • | • | [30], [40], [42], [44], [47], [53], [62], [77], [78], [84], [85], [93]–[98], [102], [105]                | 19 |
| C32 | Testing                                       | to be able to design, carry out and analyse tests in order to evaluate the effectiveness, efficiency and quality of products, services and processes.                                                                                                                                      | • | • | • | [4], [5], [15], [27], [33], [40], [42], [47], [53], [61], [77]–[80], [84], [93], [96], [97]              | 18 |
| C33 | Crisis Management                             | to be able to manage and respond to crises and emergencies, including planning and preparedness, communication, and recovery efforts.                                                                                                                                                      |   | • | • | [4], [5], [15], [33], [44], [56], [57], [77]–[80], [87], [89], [93], [96], [98], [101], [102]            | 18 |
| C34 | Cost/Financial Management                     | to be able to manage financial resources, including budgeting, forecasting and cost control, in order to maximise profitability and minimise waste.                                                                                                                                        |   | • | • | [4], [5], [15], [33], [44], [56], [57], [77]–[80], [87], [89], [93], [96], [98], [101], [102]            | 18 |
| C35 | Training                                      | to be able to have the necessary skills and knowledge to use and manage new technologies and processes by receiving appropriate training, ensuring the training leads to being able to design and deliver training programmes that transfer knowledge and skills to colleagues or clients. | • | • | • | [4], [5], [15], [33], [39], [42], [44], [53], [61], [77]–[79], [96]–[98], [102], [105]                   | 17 |
| C36 | Organization and Time Management              | to be able to manage time and organise work to maximise productivity and achieve goals.                                                                                                                                                                                                    | • | • | • | [4], [5], [15], [41]–[43], [53], [57], [64], [77]–[79], [84], [85], [97], [98], [101]                    | 17 |
| C37 | Efficiency and Productivity                   | to be able to accomplish tasks and objectives in a timely and effective manner, with a focus on optimising resources and minimising waste.                                                                                                                                                 | • | • | • | [5], [15], [40]–[43], [47], [53], [64], [77], [79], [80], [84], [85], [96], [97]                         | 16 |

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|     |                                        |                                                                                                                                                                            |   |   |   |                                                                                         |    |
|-----|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------------------------------------------|----|
| C38 | Coordination                           | to be able to coordinate activities, resources and stakeholders in order to ensure that work is completed and objectives are achieved.                                     |   | • | • | [30], [33], [36], [44], [53], [56], [58], [61]–[63], [85], [86], [93], [94], [98], [99] | 16 |
| C39 | Stakeholder Engagement                 | to be able to communicate with and engage stakeholders, including customers, employees and partners, in order to build positive relationships and achieve shared goals.    | • | • | • | [4], [5], [15], [32], [33], [44], [57], [77]–[80], [93], [94], [98], [99]               | 15 |
| C40 | Knowledge of Standards and Compliance  | to be able to understand and comply with industry standards, regulations and best practices, in order to ensure the safety, quality and legality of products and services. | • | • | • | [5], [15], [33], [40], [44], [47], [53], [77], [78], [80], [93], [94], [96]–[98]        | 15 |
| C41 | Quick Response                         | to be able to respond quickly and decisively to urgent situations, emergencies or changing circumstances.                                                                  |   | • | • | [5], [15], [36], [44], [56], [57], [77]–[79], [87], [89], [93], [98], [99]              | 14 |
| C42 | Availability                           | to be able to be accessible and responsive to stakeholders, including customers, employees and partners, and to be available for work when needed.                         |   | • | • | [26], [33], [36], [44], [51], [56], [57], [62], [87], [93], [98], [99], [101], [102]    | 14 |
| C43 | Creativity and Innovation              | to be able to generate and apply new ideas and approaches in order to solve problems, improve processes, and create value.                                                 | • | • | • | [4], [5], [15], [33], [41], [57], [77]–[80], [86], [98], [99]                           | 13 |
| C44 | Ethical and Cultural Awareness         | to be able to understand different cultures and ethical perspectives, and to act in accordance with ethical principles and values.                                         | • | • | • | [5], [15], [30], [33], [44], [47], [53], [77]–[79], [96]–[98]                           | 13 |
| C45 | Data Governance                        | to be able to manage and govern data, including data quality, security, privacy and compliance, in order to ensure that data is accurate, reliable and accessible.         | • |   | • | [4], [40], [47], [53], [77], [78], [80], [93], [95]–[98]                                | 12 |
| C46 | User-friendly Design                   | to be able to design products, services or systems that are easy to use, intuitive and user-friendly, and that meet users' needs and preferences.                          | • |   |   | [28], [41], [42], [44], [53], [64], [86], [93], [96]–[98], [100]                        | 12 |
| C47 | Negotiation/ Vendor Management         | to be able to negotiate with vendors or suppliers to achieve favourable conditions, prices and results.                                                                    | • | • |   | [33], [43], [53], [56], [57], [93], [94], [98], [99], [101], [102]                      | 11 |
| C48 | Attention to Detail                    | to be able to pay close attention to detail and ensure that the work is accurate, thorough and meets the required standards.                                               |   | • |   | [30], [33], [42], [43], [57], [84], [93], [98], [99]                                    | 9  |
| C49 | Prioritize Tasks, Processes or Systems | to be able to prioritise tasks, processes or systems based on their importance and urgency, and to allocate resources accordingly.                                         |   | • |   | [28], [33], [44], [86], [94], [98], [99]                                                | 7  |
| C50 | Mental Toughness                       | to be able to persevere the mind through challenges, setbacks and adversity, while maintaining focus, determination and resilience.                                        | • | • |   | [26], [62], [63], [98], [99], [102], [106]                                              | 7  |
| C51 | Diversity, Equity, and Inclusion       | to be able to understand, value and promote diversity, equity and inclusion in the workplace, creating an environment that is welcoming, respectful and inclusive to all.  | • |   |   | [26], [29], [39], [46], [87], [100]                                                     | 6  |

**Legend:** A = Automation; B = Business Continuity & A/B = Automation to support/ensure Business Continuity

## Workforce Capabilities using Automation to support/ensure Business Continuity

### RQ 1: What are the workforce capabilities needed with automation?

The literature review of 76 articles from the MLR has led to the identification of 40 distinct capabilities. These capabilities, which are outlined in **Table 5.1**, answer **RQ1** proposed in the framework of this study. The derived list is based on the literature review, interpreted from the articles, incorporating each capability's ID, name, a brief general description, and whether it was deemed necessary for automation (depicted in Column A). The table also includes the articles in which each capability was discovered and their total count.

While **Table 5.1** provides a comprehensive overview, certain conclusions can be inferred. For instance, out of the top 25 capabilities (C1 to C25), only C5 and C9 do not relate to automation. Contrariwise, in the set of lower-ranked capabilities (C26 to C51), 17 are associated with automation. The capability most frequently interpreted was 'Customer Focus/Feedback', which had 48 instances, whereas 'Diversity, Equity, and Inclusion' was the least frequently interpreted with just 6 instances. Notably, the first capability identified as solely requiring automation (aside from those needed for BC) is 'Monitoring', which ranks 6th and was interpreted 28 times.

### RQ 2: What are the workforce capabilities needed with business continuity?

The literature review of 76 articles from the MLR has led to the identification of 44 distinct capabilities. These capabilities, which are outlined in **Table 5.1**, answer **RQ2** proposed in the framework of this study. The derived list is based on the literature review, interpreted from the articles, incorporating each capability's ID, name, a brief general description, and whether it was deemed necessary for BC (depicted in Column B). The table also includes the articles in which each capability was discovered and their total count.

While **Table 5.1** provides a comprehensive overview, certain conclusions can be inferred. For instance, out of the top 25 capabilities (C1 to C25), only C6, C8 and C15 do not relate to BC. Contrariwise, in the set of lower-ranked capabilities (C26 to C51), 22 are associated with BC. The capability most frequently interpreted was 'Customer Focus/Feedback', which had 48 instances, whereas 'Mental Toughness' was the least frequently interpreted with just 7 instances. Notably, the first capability identified as solely requiring automation (aside from those needed for automation) is 'Remote Work Readiness', which ranks 9th and was interpreted 26 times.

### RQ 3: What are the workforce capabilities using automation to support/ensure business continuity?

To find which of the identified workforce capabilities are important to support/ensure BC using automation a Delphi study was suggested and performed. The aim of the Delphi study was to obtain the consensus response of the experts group, preferably in the fewest number of rounds possible, since, as it has already mentioned in **Section 4.2**, as the rounds increase the drop rate of the participants may also

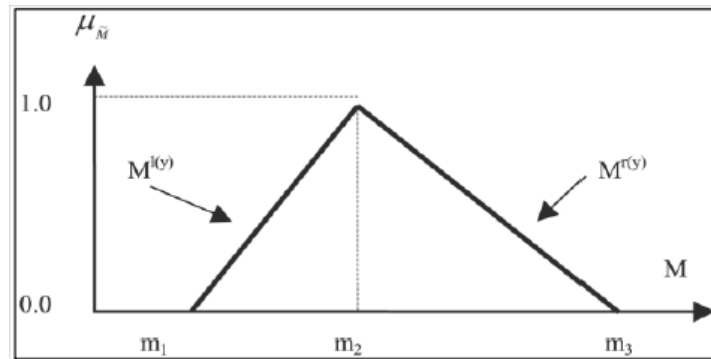
## Workforce Capabilities using Automation to support/ensure Business Continuity

increase, making the Delphi results less substantial [70]. There for, a questionnaire was created in which the experts rated 40 of the 51 workforce capabilities selected from **Table 5.1** (Column A/B) using a Likert scale with values between 1 and 5 (**Appendix F**).

Though out **Chapter 4**, more specifically in **Section 4.2**, the Fuzzy Delphi method was selected to be used, has it allowed to arrive at consensus per item and not per round which facilitates to arrive quicker to a consensus answer. The **Figure 4.5** illustrates the set of specific steps that was followed to calculate the consensus, starting with the definition of the selection of the Fuzzy scale, presented in **Table 5.2**, which will be used to translate the Likert values of the questionnaires to values between 0 and 1.

**Table 5. 2** - Relationship between Fuzzy Scale and Likert Scale (adapted from [107])

| Agreement Level      | Linkert Scale | Fuzzy Scale |     |     |
|----------------------|---------------|-------------|-----|-----|
| Very Important       | 5             | 0,6         | 0,8 | 1   |
| Important            | 4             | 0,4         | 0,6 | 0,8 |
| Neutral              | 3             | 0,2         | 0,4 | 0,6 |
| Low Importance       | 2             | 0           | 0,2 | 0,4 |
| Not At All Important | 1             | 0           | 0   | 0,2 |



**Figure 5. 1** - Triangular Fuzzy Number. (Adapted from [81], [107])

This step was to calculate the average values of  $m_1$ ,  $m_2$  and  $m_3$  representing the Triangular Fuzzy Number (**Figure 5.1**) with  $m_1$  being the minimum value,  $m_2$  being the reasonable value and  $m_3$  being the maximum value. Triangular Fuzzy Number is used to produce Fuzzy scales which are translation of the linguistic variables into Fuzzy numbers. The number of consent levels for the fuzzy scale should be odd and the bigger the value of the fuzzy scale the greater the accuracy of the data obtained. **Table 5.3** shows the translation of the data values obtained in the questionnaire of this research, in which, each item evaluated will have three different  $m$  values ( $m_1$ ,  $m_2$  and  $m_3$ ) that will be used to calculate the value of the level of agreement of the experts through **Equation (5.1)**:

$$d = \sqrt{\left(\frac{1}{3} * (m_1 - C_1)^2 + (m_2 - C_2)^2 + (m_3 - C_3)^2\right)} \quad (5.1)$$

## Workforce Capabilities using Automation to support/ensure Business Continuity

Using the **Equation (5.1)**, the threshold value (d) is obtained by getting the average fuzzy values (m1, m2 and m3) of each item and the fuzzy values (c1, c2 and c3) translated from the Likert Scale to the Fuzzy Scale. To obtain the experts consensus for each item, the threshold value should not exceed 0.2 ( $d \leq 0.2$ ). In **Table 5.3**, that shows the values obtained, all average values of d are presented respecting the threshold, as such, they were all used to calculate the global value of d, that ended up being equal to 0.127.

After the first condition being met (threshold value,  $d < 0.2$ ), the next step is to calculate the percentage per item through **Equation (5.2)**, in which the number of times the values of d are  $\leq 0.2$  is divided by the total number of participants in the round obtaining the percentage shown in **Table 5.3**.

$$\text{Item percentage} = \frac{\text{number of times the values of d are } \leq 0.2}{\text{Total number of participants}} \quad (5.2)$$

For each item to be accepted, the calculated percentage must be 75% or higher ( $\geq 75\%$ ), otherwise, that item is eliminated from the set. According to **Table 5.3**, of the 40 calculated item percentages, only items 13,14, 17 and 35 do not meet the required condition, and, thus, these items were rejected from the set.

$$\text{Overall percentage} = \frac{\text{sum of items percentage}}{\text{Total number of items} - \text{number of items discarded}} \quad (5.3)$$

To calculate the percentage of overall acceptance, **Equation (5.3)** was used in which all the percentages of the items that met the condition of  $\geq 75\%$  were summed and divided by the total number of items, excluding the items that were rejected due to not meeting the condition, in which, of the 36 accepted items, 88% global acceptance was obtained. This means that 88% of the experts agreed that the set of items (capabilities) represents a successful construct, meaning that the second condition for the Fuzzy Delphi method was achieved, since the percentage value of the construct must be  $> 75\%$  (Percentage of Consensus Expert Group,  $\% > 75.0 \%$ ). Therefore, since the data acquisition satisfies both conditions a second round of fuzzy Delphi is not necessary.

The Defuzzification process determined the score of each accepted item from which we will obtain the position, for this it's used the previously obtained values of m1, m2 and m3 in **Equation (5.4)** to calculate the fuzzy evaluation:

$$\text{Fuzzy evaluation} = \left(\frac{1}{3}\right) * (m1_{average} + m2_{average} + m3_{average}) \quad (5.4)$$

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**Table 5.3** shows the calculated values of the fuzzy evaluation, the higher the value the better positioned will be the item, which indicates that this item had a high level of consensus among participants. However, several items may have obtained the same fuzzy evaluation as for example items 20 and 30, in which case to determine the scoring order was used the percentage per item already calculated meaning the item that obtained a higher percentage would be in a higher position in **Table 5.4**. Yet, there may still be items that obtained the same percentage, in which case the number of interpretations during the literature review was used as a tiebreaker.

Moreover, an  $\alpha$ -cut value of 0.5 was applied, where  $\alpha$ -cut  $\geq 0.5$  indicates the approval of the item. This signifies the consensus among the experts to receive the item which means that any item with a fuzzy evaluation value of less than 0.5 would be discarded. However, as **Table 5.3** show none of the items were rejected which indicates that the third condition of the Fuzzy Delphi method was implemented (Fuzzy Evaluation  $\geq$  Value  $\alpha$  – cut = 0.5). Taking into account the experts' opinion and through the analysis of the Delphi study results it was possible to determine the order of importance of the workforce capabilities using automation to support/ensure BC, shown in **Table 5.4**.

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**Table 5. 3** - Data Analysis and Capabilities consensus calculation

| Item | Round 1 |       |       |            |                          |                                   |                  |       |                      |
|------|---------|-------|-------|------------|--------------------------|-----------------------------------|------------------|-------|----------------------|
|      | Average |       |       | Value of d | Item Number $d \leq 0.2$ | Percent of Each Item $d \leq 0.2$ | Fuzzy Evaluation | Score | Consensus of Experts |
|      | m1      | m2    | m3    |            |                          |                                   |                  |       |                      |
| 1    | 0,464   | 0,664 | 0,864 | 0,116      | 25                       | 89%                               | 0,664            | 18    | Accept               |
| 2    | 0,471   | 0,664 | 0,871 | 0,128      | 24                       | 86%                               | 0,669            | 15    | Accept               |
| 3    | 0,500   | 0,700 | 0,900 | 0,114      | 26                       | 93%                               | 0,700            | 2     | Accept               |
| 4    | 0,493   | 0,693 | 0,893 | 0,130      | 25                       | 89%                               | 0,693            | 4     | Accept               |
| 5    | 0,457   | 0,657 | 0,857 | 0,102      | 26                       | 93%                               | 0,657            | 22    | Accept               |
| 6    | 0,500   | 0,700 | 0,900 | 0,114      | 26                       | 93%                               | 0,700            | 2     | Accept               |
| 7    | 0,450   | 0,650 | 0,850 | 0,118      | 24                       | 86%                               | 0,650            | 25    | Accept               |
| 8    | 0,493   | 0,693 | 0,893 | 0,122      | 26                       | 93%                               | 0,693            | 4     | Accept               |
| 9    | 0,493   | 0,693 | 0,893 | 0,122      | 25                       | 89%                               | 0,693            | 4     | Accept               |
| 10   | 0,400   | 0,600 | 0,800 | 0,114      | 26                       | 93%                               | 0,600            | 35    | Accept               |
| 11   | 0,407   | 0,600 | 0,800 | 0,100      | 24                       | 86%                               | 0,602            | 34    | Accept               |
| 12   | 0,464   | 0,664 | 0,864 | 0,155      | 22                       | 79%                               | 0,664            | 18    | Accept               |
| 13   | 0,421   | 0,621 | 0,821 | 0,166      | 20                       | 71%                               | X                | X     | Reject               |
| 14   | 0,400   | 0,593 | 0,793 | 0,150      | 17                       | 61%                               | X                | X     | Reject               |
| 15   | 0,464   | 0,664 | 0,864 | 0,126      | 25                       | 89%                               | 0,664            | 18    | Accept               |
| 16   | 0,471   | 0,664 | 0,864 | 0,162      | 23                       | 82%                               | 0,667            | 16    | Accept               |
| 17   | 0,364   | 0,564 | 0,764 | 0,146      | 19                       | 68%                               | X                | X     | Reject               |
| 18   | 0,457   | 0,657 | 0,857 | 0,122      | 24                       | 86%                               | 0,657            | 22    | Accept               |
| 19   | 0,443   | 0,643 | 0,843 | 0,135      | 23                       | 82%                               | 0,643            | 27    | Accept               |
| 20   | 0,479   | 0,679 | 0,879 | 0,113      | 26                       | 93%                               | 0,679            | 10    | Accept               |
| 21   | 0,436   | 0,629 | 0,829 | 0,133      | 23                       | 82%                               | 0,631            | 29    | Accept               |
| 22   | 0,450   | 0,650 | 0,850 | 0,139      | 23                       | 82%                               | 0,650            | 25    | Accept               |
| 23   | 0,471   | 0,664 | 0,864 | 0,143      | 24                       | 86%                               | 0,667            | 16    | Accept               |
| 24   | 0,471   | 0,671 | 0,871 | 0,119      | 26                       | 93%                               | 0,671            | 13    | Accept               |
| 25   | 0,464   | 0,664 | 0,864 | 0,107      | 27                       | 96%                               | 0,664            | 18    | Accept               |
| 26   | 0,471   | 0,671 | 0,871 | 0,129      | 25                       | 89%                               | 0,671            | 13    | Accept               |
| 27   | 0,493   | 0,693 | 0,893 | 0,122      | 26                       | 93%                               | 0,693            | 4     | Accept               |
| 28   | 0,493   | 0,693 | 0,893 | 0,122      | 25                       | 89%                               | 0,693            | 4     | Accept               |
| 29   | 0,443   | 0,643 | 0,843 | 0,135      | 23                       | 82%                               | 0,643            | 27    | Accept               |
| 30   | 0,479   | 0,679 | 0,879 | 0,139      | 24                       | 86%                               | 0,679            | 10    | Accept               |
| 31   | 0,493   | 0,686 | 0,886 | 0,128      | 26                       | 93%                               | 0,688            | 9     | Accept               |
| 32   | 0,457   | 0,657 | 0,857 | 0,122      | 25                       | 89%                               | 0,657            | 22    | Accept               |
| 33   | 0,421   | 0,614 | 0,814 | 0,118      | 24                       | 86%                               | 0,617            | 31    | Accept               |
| 34   | 0,421   | 0,614 | 0,814 | 0,131      | 23                       | 82%                               | 0,617            | 31    | Accept               |
| 35   | 0,393   | 0,593 | 0,793 | 0,124      | 19                       | 68%                               | X                | X     | Reject               |
| 36   | 0,479   | 0,679 | 0,879 | 0,139      | 23                       | 82%                               | 0,679            | 10    | Accept               |
| 37   | 0,421   | 0,614 | 0,814 | 0,118      | 23                       | 82%                               | 0,617            | 31    | Accept               |
| 38   | 0,400   | 0,600 | 0,800 | 0,086      | 27                       | 96%                               | 0,600            | 35    | Accept               |
| 39   | 0,421   | 0,621 | 0,821 | 0,128      | 21                       | 75%                               | 0,621            | 30    | Accept               |
| 40   | 0,507   | 0,707 | 0,907 | 0,119      | 25                       | 89%                               | 0,707            | 1     | Accept               |

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**Table 5. 4** - List of capabilities rated based on experts opinion.

| Item / Capability Numbers |     | Capability                                    | Fuzzy Evaluation | Score | Score using Tiebreakers |
|---------------------------|-----|-----------------------------------------------|------------------|-------|-------------------------|
| 40                        | C32 | Testing                                       | 0,707            | 1     | 1                       |
| 3                         | C7  | Change Management                             | 0,700            | 2     | 2                       |
| 6                         | C37 | Efficiency and Productivity                   | 0,700            | 2     | 3                       |
| 8                         | C4  | Preparation and Planning                      | 0,693            | 4     | 4                       |
| 27                        | C19 | Communication                                 | 0,693            | 4     | 5                       |
| 28                        | C3  | Continuous Learning                           | 0,693            | 4     | 6                       |
| 9                         | C25 | Process Improvement                           | 0,693            | 4     | 7                       |
| 4                         | C34 | Cost/Financial Management                     | 0,693            | 4     | 8                       |
| 31                        | C20 | Problem-solving                               | 0,688            | 9     | 9                       |
| 20                        | C36 | Organization and Time Management              | 0,679            | 10    | 10                      |
| 30                        | C16 | Critical Thinking                             | 0,679            | 10    | 11                      |
| 36                        | C23 | Security / Cybersecurity                      | 0,679            | 10    | 12                      |
| 24                        | C35 | Training                                      | 0,671            | 13    | 13                      |
| 26                        | C12 | Collaboration                                 | 0,671            | 13    | 14                      |
| 2                         | C2  | Business Acumen / Literacy                    | 0,669            | 15    | 15                      |
| 23                        | C39 | Stakeholder Engagement                        | 0,667            | 16    | 16                      |
| 16                        | C1  | Customer Focus / Feedback                     | 0,667            | 16    | 17                      |
| 25                        | C21 | Adaptability and Flexibility                  | 0,664            | 18    | 18                      |
| 1                         | C31 | Accountability and Responsibility             | 0,664            | 18    | 19                      |
| 15                        | C33 | Crisis Management                             | 0,664            | 18    | 20                      |
| 12                        | C17 | Risk Management                               | 0,664            | 18    | 21                      |
| 5                         | C5  | Decision-making                               | 0,657            | 22    | 22                      |
| 32                        | C30 | Resilience                                    | 0,657            | 22    | 23                      |
| 18                        | C40 | Knowledge of Standards and Compliance         | 0,657            | 22    | 24                      |
| 7                         | C24 | Leadership                                    | 0,650            | 25    | 25                      |
| 22                        | C9  | Remote Working Readiness                      | 0,650            | 25    | 26                      |
| 19                        | C22 | Knowledge Sharing and Shared Mindset          | 0,643            | 27    | 27                      |
| 29                        | C43 | Creativity and Innovation                     | 0,643            | 27    | 28                      |
| 21                        | C41 | Quick Response                                | 0,631            | 29    | 29                      |
| 39                        | C11 | Technical Writing and Documentation           | 0,621            | 30    | 30                      |
| 33                        | C10 | Analytics, Data Analysis and Management       | 0,617            | 31    | 31                      |
| 37                        | C26 | Systems Configuration, Support and Management | 0,617            | 31    | 32                      |
| 34                        | C45 | Data Governance                               | 0,617            | 31    | 33                      |
| 11                        | C14 | Resource Management                           | 0,602            | 34    | 34                      |
| 38                        | C13 | Technical Proficiency                         | 0,600            | 35    | 35                      |
| 10                        | C18 | Project Management                            | 0,600            | 35    | 36                      |

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

### **CHAPTER 6. CONCLUSION**

This research has made important contributions towards the field of automation, especially regarding BC, and towards academic studies, as it presents a list of workforce capabilities, that use automation, deemed necessary to support/ensure BC. There for, this research used two main resources: a MLR, conducted in order to synthesize existing knowledge by identifying an updated list of 51 capabilities, of which 40 related to automation and 44 related to BC (RQ1 and RQ2), and a Delphi study, conducted in order to create a set of the capabilities, interpreted in the literature, that were rated by RPA experts determining which capabilities of the workforce are the most important to support/ensure business continuity, regarding automation (RQ3).

Workforce capabilities have been changing over time, highlighting in this study Customer Focus/Feedback, being the most interpreted capability in the literature and Testing being the most highly rated by experts. The results of this research show alinement with the proposed initial questions, contributing towards researchers and professionals of this area to better understand the context and relationship between automation and business continuity.

As automation is increasingly being adopted by organizations and analyzed by researchers, BC has increasingly been a topic of concern. This research assumes a critical role in the consensus of identifying key capabilities and their definitions, so that the topic can continue to be more substantially applied and studied.

The lack of available scientific literature on the research topic led to a MLR, instead of a SLR, using GL instead of scientific literature, which may have affected the results. Also, automation, and more specifically RPA, is a recent technology, making it difficult to identify and acquire participants with high experience or knowledge level on the subject, especially related to BC.

Future research may extend the findings presented here by developing a completely new list of capabilities, perhaps when automation acquires a higher level of intellect through AI and ML, making it even more independent of human intervention. Another future research may be regarding people's views and opinions on their use and collaboration with machines in the work environment, and what could be done to minimize some of the negative feelings/impacts of it.

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## Appendix A

Source Code used to obtain the GL articles.

```
1 #!/usr/bin/env python
2  # -- coding: utf-8 --
3  # This code fetches google search results in a
4  # Requirements: 'pip install requests bs4 pandas'
5
6  from requests import get
7  from bs4 import BeautifulSoup
8  import pandas
9  import time
10
11 def csv_dump(results, name):
12     print(results, name)
13     df = None
14     df = pandas.DataFrame(results)
15     df.index += 1
16     df.to_csv(name + '.csv')
17
18 def parse_results(raw_html):
19     soup = BeautifulSoup(raw_html, 'html.parser')
20     result_block = soup.find_all('div', attrs={'class':'g'})
21     for result in result_block:
22         link = result.find('a', href=True)
23         title = result.find('h3')
24         if link and title:
25             yield { 'URL': link['href'], 'Title': link.text.strip() }
26
27 def google_search(query,max_results=500,num_results=100,lang="en"):
28     usr_agent ={'User-Agent': 'Mozilla/5.0 (X11; Linux x86_64; rv:10.0) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/61.0.3163.100 Safari/537.36'}
29     escaped_query = query.replace(' ', '+')
30     results = []
31     for start in range(0,max_results,num_results):
32         google_url = 'https://www.google.com/search?q={}&num={}&start={}&hl={}'.format(escaped_query, num_results+1, start, lang)
33         print(google_url)
34         time.sleep(3)
35         response = get(google_url, headers=usr_agent)
36         response.raise_for_status()
37         results += parse_results(response.text)
38     return results
39
40 def get_results(query, name):
41     print(query, name)
42     results = google_search(query)
43     print(results)
44     csv_dump(results, name)
45
46 if __name__ == '__main__':
47     get_results('business continuity AND (robotic process automation OR RPA OR intelligent process automation OR IPA OR automation OR robotic automation OR intelligent automation) AND (people OR workforce OR capabilities OR skills OR functionalities OR features)',
48     'capabilities')
```

**Figure A. 1** - Python code for fetching Google search results (adapted from [76])

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

## Workforce Capabilities using Automation to support/ensure Business Continuity

### Appendix B

List of all Articles studied, identified by the ID, dataset and year of publication.

| ID   | Title                                                                                                              | DS | Year | Topic                                                                 |
|------|--------------------------------------------------------------------------------------------------------------------|----|------|-----------------------------------------------------------------------|
| [84] | 10 Advantages of Process Automation - Impact Networking                                                            | 4  | 2022 | The advantages of Process Automation                                  |
| [41] | 5 Digital Workplace Trends You Need To Know                                                                        | 4  | 2022 | The new Digital Workplaces trends                                     |
| [42] | A Guide to Robotic Process Automation in a Post-Covid World                                                        | 4  | 2022 | RPA Analysis needed to Implementation                                 |
| [64] | Alphaiota works with Automation Anywhere to improve patient care                                                   | 4  | 2022 | Intelligent Automation implementation in healthcare                   |
| [43] | Are accounting firms ready for the new normal? How robotics process automation can help                            | 4  | 2020 | RPA in Accounting Firms                                               |
| [85] | Automation Offers a Treat, Not Trick for Employers in Crippling Labor Market                                       | 4  | 2022 | Benefits and Consequences of Automation                               |
| [32] | B is for Business Case   Business Analyst   Business Outcomes   Business Continuity Planning   Bots   Buy-in   BPM | 4  | 2020 | Business with Automation                                              |
| [35] | Business Process Automation – Benefits, applications, examples and steps to automate                               | 4  | 2022 | Benefits and steps to Implement Business Process Automation           |
| [86] | Business Process Automation in the New Normal                                                                      | 4  | 2022 | The urgency of Business Process Automation                            |
| [34] | Business Process Automation vs Robotic Process Automation: How Are They Different?                                 | 4  | 2022 | Differences between BPA and RPA                                       |
| [33] | Considering robotic process automation to enhance your business resilience? Here are some key considerations       | 4  | 2022 | Considerations to take before Implementing Automation                 |
| [30] | COVID-19 accelerates enterprise use of automation in digital transformation                                        | 4  | 2020 | The impacts of Covid 19 on the use of Automation                      |
| [44] | COVID-19 Outbreak: How Robotic Process Automation (RPA) could ensure Business Continuity                           | 4  | 2020 | Ensure Business Continuity with Robotic Process Automation            |
| [87] | Ensure Business Continuity With RPA                                                                                | 4  | 2020 | Ensure Business Continuity with Robotic Process Automation            |
| [89] | Ensuring Business Continuity Management Capabilities                                                               | 4  | 2020 | Ensure Business Continuity Management with Robotic Process Automation |
| [88] | Entering the next frontier of enterprise automation                                                                | 4  | 2022 | The Evolution of Automation use in Asia                               |
| [90] | Gartner report: 70% of organizations will implement structured automation by 2025                                  | 4  | 2022 | The Evolution of Automation                                           |
| [5]  | Global Pandemic: Business Model Impact on Enterprises reTHINK, reIMAGINE, reINVENT Businesses                      | 5  | 2020 | The Covid 19 impact in Business                                       |

## Workforce Capabilities using Automation to support/ensure Business Continuity

|      |                                                                                                      |   |      |                                                                                                                                        |
|------|------------------------------------------------------------------------------------------------------|---|------|----------------------------------------------------------------------------------------------------------------------------------------|
| [91] | GlobalLogic's Rajesh Rai on how HR 4.0 is transforming organisations in today's digital era          | 4 | 2022 | The importance of Human Resources Automation in Companies                                                                              |
| [52] | How Eastern Europe Excels in RPA Technology                                                          | 4 | 2021 | The Evolution of Automation use in Eastern Europe                                                                                      |
| [92] | How Robotic Process Automation (RPA) can help recover the health (and business) sector?              | 4 | 2022 | The importance of Automation in Healthcare and Business Sectors                                                                        |
| [93] | How Robotic Process Automation helps ensure business continuity in the age of COVID-19               | 4 | 2020 | Ensure Business Continuity with Robotic Process Automation                                                                             |
| [36] | How Robotic Process Automation is Transforming the Workplace                                         | 4 | 2019 | The Transformation of the Workplace due to Robotic Process Automation                                                                  |
| [37] | How to explain Robotic Process Automation (RPA) in plain English                                     | 4 | 2021 | Robotic Process Automation Benefits, Use Cases and Implementation Steps                                                                |
| [59] | How To Make Intelligent Process Automation (IPA) A Reality                                           | 4 | 2020 | Benefits and Challenges of Intelligent Process Automation                                                                              |
| [94] | How you can use RPA (Robotic Process Automation) to Enhance your COVID19 Business Continuity Plan    | 4 | 2020 | Ensure Business Continuity Management with Intelligent Automation and Robotic Process Automation                                       |
| [24] | IDC Spending Guide Sees Worldwide Digital Transformation Investments Reaching \$3.4 Trillion in 2026 | 4 | 2022 | The Growth of Digital Transformation around the World                                                                                  |
| [95] | Improving finance and accounting software with AI                                                    | 4 | 2022 | The Importance of Artificial Intelligence and Robotic Process Automation in Business                                                   |
| [38] | Increasing Operational Efficiency Made Simple with Robotic Process Automation                        | 4 | 2022 | The Importance of Automation in Increasing Operational Efficiency                                                                      |
| [25] | Infosys Engineering Cloud Is a Unique Core-Engineering Platform” Says Gopikrishnan Konnanath         | 4 | 2022 | The Growth of Digital Transformation                                                                                                   |
| [77] | Infrastructure as Code for Business Continuity in Institutions of Higher Learning                    | 5 | 2021 | Cloud implementation to support Business Continuity                                                                                    |
| [78] | Integrated Alarm Systems                                                                             | 6 | 2012 | Implementation of automated hardware and software                                                                                      |
| [45] | Intelligent Process Automation – Overview and How It Helps Businesses                                | 4 | 2022 | Benefits of Intelligent Process Automation, Differences and Similarities between it and Robotic Process Automation                     |
| [60] | Intelligent Process Automation (IPA)                                                                 | 4 | 2022 | Benefits of Intelligent Process Automation                                                                                             |
| [46] | Intelligent Process Automation vs Robotic Process Automation                                         | 4 | 2021 | Benefits of Intelligent Process Automation, Differences and Similarities between it and Robotic Process Automation and Hyperautomation |
| [29] | Intelligent Process Automation vs RPA: Understanding the Difference                                  | 4 | 2021 | Benefits and Challenges of Intelligent Process Automation, Differences between it and Robotic Process Automation                       |
| [39] | IPA vs RPA – What's the Difference?                                                                  | 4 | 2021 | Differences between Intelligent Process Automation and Robotic Process Automation                                                      |

## Workforce Capabilities using Automation to support/ensure Business Continuity

|       |                                                                                                                                                                                                                             |   |      |                                                                                      |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--------------------------------------------------------------------------------------|
| [56]  | Make RPA the anchor of your business contingency plan                                                                                                                                                                       | 4 | 2020 | Benefits of Robotic Process Automation in Business Continuity                        |
| [61]  | Making Business Automation Intelligent: A framework for combining DPA, RPA, and AI                                                                                                                                          | 4 | 2022 | Intelligent Process Automation Benefits and Use Cases                                |
| [15]  | Modeling and reconfiguration of critical business processes for the purpose of a Business Continuity Management respecting security, risk and compliance requirements at Credit Suisse using algebraic graph transformation | 8 | 2009 | Business Continuity Management respecting security, risk and compliance requirements |
| [79]  | Normalization of Industrial Machinery with Embedded Devices and SOA                                                                                                                                                         | 8 | 2006 | A use case of implementation and deployment of an automation system                  |
| [47]  | Protect Your Robot Workforce: Extending Endpoint Protection to Robotic Process Automation (RPA) in a First-of-its-Kind Integration                                                                                          | 4 | 2021 | The Robotic Process Automation Threats                                               |
| [96]  | Roadmap to RPA Implementation: Thinking Long Term                                                                                                                                                                           | 4 | 2022 | Implementation of Robotic Process Automation                                         |
| [53]  | Robotic process automation (RPA): What it is, how it works and its benefits                                                                                                                                                 | 4 | 2022 | Benefits of Robotic Process Automation                                               |
| [40]  | Robotic Process Automation (RPA) and Low-Code: When Should You Use What?                                                                                                                                                    | 4 | 2022 | Benefits and Limitations of Robotic Process Automation                               |
| [97]  | Robotic Process Automation (RPA) Post Implementation: How To Scale Effectively?                                                                                                                                             | 4 | 2020 | Limitations of Robotic Process Automation                                            |
| [27]  | Robotic Process Automation A Road Map for Wealth Management                                                                                                                                                                 | 4 | 2019 | Robotic Process Automation Benefits, Use Cases and Implementation Steps              |
| [54]  | Robotic Process Automation: recruiting bots to accelerate clinical trials                                                                                                                                                   | 4 | 2022 | Advantages and Limitations of using Robotic Process Automation in Healthcare         |
| [48]  | Robotic process automation: transforming business functions, powering business resilience                                                                                                                                   | 4 | 2021 | Benefits and Use Cases of Robotic Process Automation                                 |
| [103] | Robotic Process Automation-as-a-Service (RPAaaS): benefits, use cases and solutions                                                                                                                                         | 4 | 2021 | Benefits and Use Cases of Robotic Process Automation-as-a-Service                    |
| [104] | Robotics software success in trust's Outpatients department                                                                                                                                                                 | 4 | 2021 | A use case of Implementing Automation                                                |
| [99]  | RPA – the short and long-term solution to business continuity?                                                                                                                                                              | 4 | 2020 | The Evolution of Automation due to Covid 19                                          |
| [57]  | RPA as an opportunity during the COVID-19 crisis                                                                                                                                                                            | 4 | 2021 | Benefits and Implementation of Robotic Process Automation                            |
| [100] | RPA Benefits: 20 Ways Bots Improve Businesses For The Better                                                                                                                                                                | 4 | 2022 | Benefits and Use Cases of Robotic Process Automation                                 |
| [98]  | Securing business continuity with RPA Maintenance                                                                                                                                                                           | 4 | 2020 | Maintaining RPA to ensure business continuity                                        |
| [105] | Software AG and Automation Anywhere collaborate to advance automation processes                                                                                                                                             | 4 | 2021 | The Evolution of Automation                                                          |
| [10]  | "The Adoption of Robotic Process Automation Technology to                                                                                                                                                                   | 4 | 2021 | The Adoption of Robotic Process Automation to                                        |

## Workforce Capabilities using Automation to support/ensure Business Continuity

|       | Ensure Business Processes during the COVID-19 Pandemic"                                                              |   |      | Ensure Business Processes                                                       |
|-------|----------------------------------------------------------------------------------------------------------------------|---|------|---------------------------------------------------------------------------------|
| [31]  | The Dark Side of Robotic Process Automation                                                                          | 4 | 2020 | Challenges and Threats of Robotic Process Automation                            |
| [58]  | The Importance of Intelligent Automation For Enterprises in 2022                                                     | 4 | 2022 | The Importance of Intelligent Automation                                        |
| [108] | The key to American economic recovery? Automation.                                                                   | 4 | 2021 | The Importance of Investment in Automation by United States of America          |
| [106] | To take the Automation road, you must know your destination                                                          | 4 | 2020 | Implementation of Automation                                                    |
| [109] | Top 5 Trends in Intelligent Automation 2022                                                                          | 4 | 2022 | The Benefits of Intelligent Automation                                          |
| [55]  | Top Robotic Process Automation Companies                                                                             | 4 | 2022 | Robotic Process Automation Market                                               |
| [4]   | Toward transforming business continuity services                                                                     | 2 | 2009 | Virtualization benefits in Business Continuity                                  |
| [28]  | Ultimate guide to RPA (robotic process automation)                                                                   | 4 | 2021 | The Evolution of Automation and its Benefits, Challenges and Differences        |
| [80]  | Understanding the Characteristics of IT Capability in Delivering a Customer-Focused Strategy: The case of Saudi Bank | 6 | 2016 | IT Capabilities to deliver a customer-focus strategy in business                |
| [101] | User Submission: RPA in a Pandemic: Driving Automation in the Post Pandemic Era!                                     | 4 | 2022 | The Evolution of Automation due to Covid 19                                     |
| [110] | What are the advantages and challenges in industrial automation?                                                     | 4 | 2022 | Advantages and Challenges of Automation                                         |
| [63]  | What Intelligent Process Automation Can Contribute to the Hybrid Workplace                                           | 4 | 2022 | The Benefits of Intelligent Process Automation in People                        |
| [111] | What is Document AI? How Machine Learning Powers Some of the Document AI Platforms?                                  | 4 | 2022 | The Evolution of Automation                                                     |
| [49]  | What Is Robotic Process Automation (RPA)? Meaning, Working, Software, and Uses                                       | 4 | 2022 | Benefits and Use Cases of Robotic Process Automation                            |
| [50]  | What Is Robotic Process Automation and How Can It Save You Time?                                                     | 4 | 2022 | Benefits of Robotic Process Automation                                          |
| [51]  | WHAT IS RPA AND HOW CAN BUSINESSES USE IT FOR THEIR BENEFIT?                                                         | 4 | 2019 | The Benefits of Robotic Process Automation in Business                          |
| [73]  | Why Emotion Makes a Massive Difference in Digital Transformation                                                     | 4 | 2022 | The Impact of People in Digital Transformation                                  |
| [62]  | Why intelligent process automation (IPA) and not just RPA?                                                           | 4 | 2022 | The evolution from Robotic Process Automation to Intelligent Process Automation |
| [102] | Why RPA is a game changer in the post-Covid era                                                                      | 4 | 2020 | The Evolution of Automation due to Covid 19                                     |

## Appendix C

Literatures grouped by the eight concepts identified regarding BC and automation. These concepts are the key factors found in the literature about automation and BC regarding the workforce capabilities.

| Articles | A | BC | BCM | BP | BPA | DR | DT | H | IA/IPA | RPA |
|----------|---|----|-----|----|-----|----|----|---|--------|-----|
| [84]     | • |    |     | •  | •   |    |    |   |        | •   |
| [41]     | • | •  |     |    |     |    |    |   |        | •   |
| [42]     | • | •  |     | •  |     |    |    |   |        | •   |
| [64]     | • | •  |     |    |     |    | •  |   | •      |     |
| [43]     | • | •  |     |    |     |    |    |   |        | •   |
| [85]     | • | •  |     |    |     |    |    |   |        |     |
| [32]     | • | •  |     | •  |     |    | •  |   | •      | •   |
| [35]     | • |    |     | •  | •   |    |    |   |        | •   |
| [86]     | • | •  |     | •  | •   |    | •  |   |        | •   |
| [34]     | • | •  |     | •  | •   |    |    | • |        | •   |
| [33]     | • | •  |     | •  | •   |    |    |   | •      | •   |
| [30]     | • | •  |     | •  |     |    | •  | • |        | •   |
| [44]     | • | •  |     |    |     |    |    |   |        | •   |
| [87]     | • | •  |     |    |     |    |    |   |        | •   |
| [89]     | • | •  | •   | •  |     |    |    |   | •      | •   |
| [88]     | • | •  |     |    |     |    | •  |   | •      | •   |
| [90]     | • | •  |     |    |     |    |    |   |        |     |
| [5]      | • | •  |     | •  |     |    |    |   |        |     |
| [91]     | • | •  |     |    |     | •  |    |   |        |     |
| [52]     | • | •  |     |    |     |    |    |   |        | •   |
| [92]     | • | •  |     |    |     | •  | •  |   |        | •   |
| [93]     | • | •  |     |    |     |    | •  |   |        | •   |
| [36]     | • | •  |     | •  | •   |    |    |   |        | •   |
| [37]     | • |    |     | •  | •   |    | •  |   | •      | •   |
| [59]     | • | •  |     |    |     |    |    |   | •      | •   |
| [94]     | • | •  |     | •  |     | •  |    |   | •      | •   |
| [24]     | • |    |     |    |     |    | •  |   |        |     |
| [95]     | • | •  |     |    |     |    |    |   | •      | •   |
| [38]     | • | •  |     | •  | •   |    | •  |   | •      | •   |
| [25]     | • | •  |     |    |     |    | •  |   |        |     |
| [77]     | • | •  |     |    |     | •  |    |   |        |     |
| [78]     | • | •  |     |    |     |    |    |   |        |     |
| [45]     | • | •  |     | •  |     |    |    |   | •      | •   |
| [60]     | • | •  |     | •  |     |    | •  |   | •      | •   |
| [46]     | • | •  |     | •  |     |    |    | • | •      | •   |
| [29]     | • | •  |     | •  |     |    |    |   | •      | •   |
| [39]     | • | •  |     | •  | •   |    |    |   | •      | •   |
| [56]     | • | •  |     | •  |     |    |    |   |        | •   |
| [61]     | • | •  |     | •  | •   |    | •  |   | •      | •   |
| [15]     | • | •  | •   | •  |     | •  |    |   |        |     |
| [79]     | • | •  |     | •  |     |    |    |   |        |     |
| [47]     | • | •  |     | •  |     |    | •  |   |        | •   |
| [96]     | • | •  |     | •  | •   |    | •  | • |        | •   |
| [53]     | • |    |     |    |     |    |    | • |        | •   |
| [40]     | • | •  |     | •  | •   |    |    |   | •      | •   |

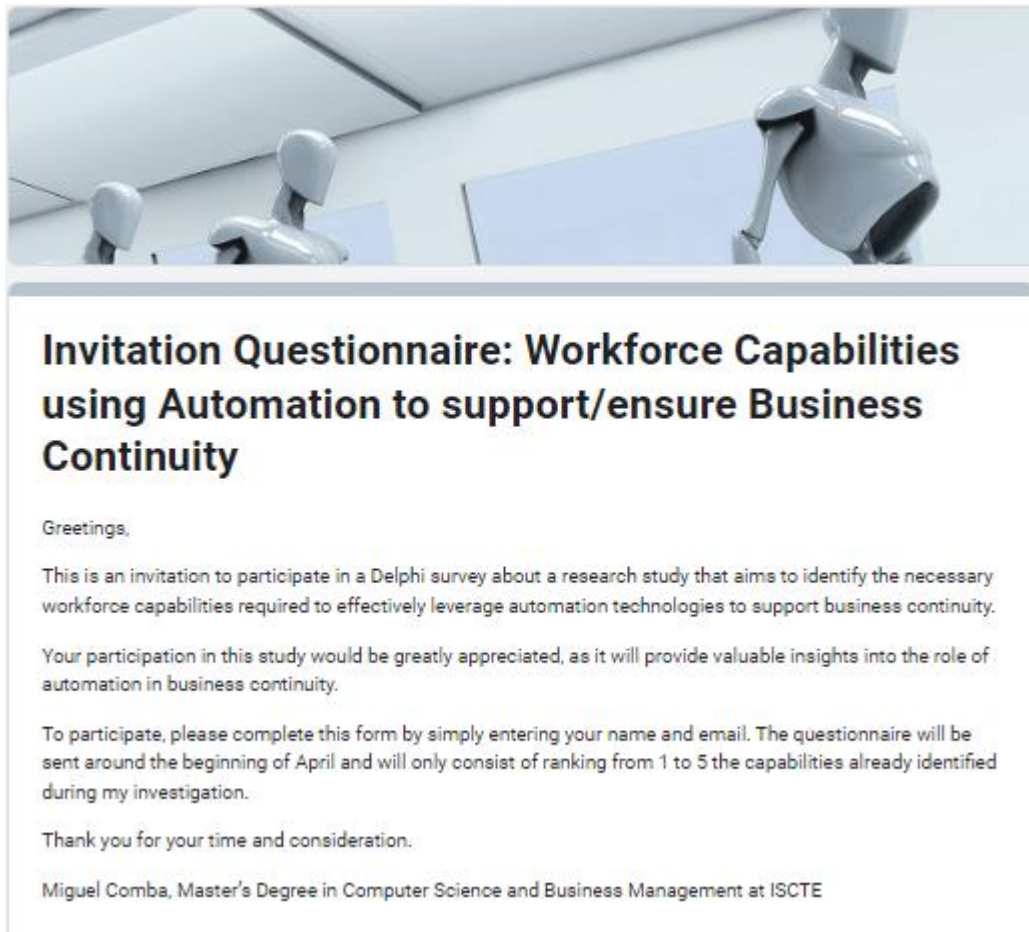
## Workforce Capabilities using Automation to support/ensure Business Continuity

|       |   |   |   |   |   |   |   |   |   |   |
|-------|---|---|---|---|---|---|---|---|---|---|
| [97]  | • | • |   | • |   |   | • |   |   | • |
| [27]  | • | • |   | • | • | • |   |   | • | • |
| [54]  | • | • |   |   |   |   |   |   |   | • |
| [48]  | • | • |   | • |   |   | • | • | • | • |
| [103] | • |   |   |   |   |   |   |   |   | • |
| [104] | • | • |   |   |   |   |   |   |   | • |
| [99]  | • | • |   | • |   |   | • |   | • | • |
| [57]  | • | • |   | • |   |   | • |   | • | • |
| [100] | • | • |   |   |   |   |   |   |   | • |
| [98]  | • | • |   | • |   |   |   |   | • | • |
| [105] | • | • |   |   |   |   |   |   | • | • |
| [10]  | • | • | • | • | • | • | • |   |   | • |
| [31]  | • | • |   | • |   |   |   |   | • | • |
| [58]  | • | • |   | • |   |   | • |   | • | • |
| [108] | • | • |   |   |   |   | • |   |   | • |
| [106] | • | • |   |   |   |   | • |   | • | • |
| [109] | • | • |   | • |   |   | • |   | • | • |
| [55]  | • | • |   | • | • |   | • |   | • | • |
| [4]   | • | • | • | • |   | • |   |   |   |   |
| [28]  | • | • |   | • | • |   | • | • | • | • |
| [80]  | • | • |   | • |   |   |   |   |   |   |
| [101] | • | • |   |   |   |   |   |   |   | • |
| [110] | • | • |   |   |   |   |   |   | • |   |
| [63]  | • | • |   | • |   |   |   |   | • | • |
| [111] | • | • |   |   |   |   |   |   |   |   |
| [49]  | • | • |   | • |   |   |   | • | • | • |
| [50]  | • | • |   |   |   |   | • |   |   | • |
| [51]  | • | • |   | • |   |   | • |   | • | • |
| [26]  | • | • |   |   |   |   | • |   |   |   |
| [62]  | • | • |   |   |   |   |   |   | • | • |
| [102] | • | • |   |   |   |   | • |   |   | • |

**Legend:** A = Automation; BC = Business Continuity; BCM = Business Continuity Management; BP = Business Process; BPA = Business Process Automation; DR = Disaster Recover; DT = Digital Transformation; H = Hyper-automation; IA/IPA = Intelligent Automation or Intelligent Process Automation & RPA = Robotic Process Automation.

## Appendix D

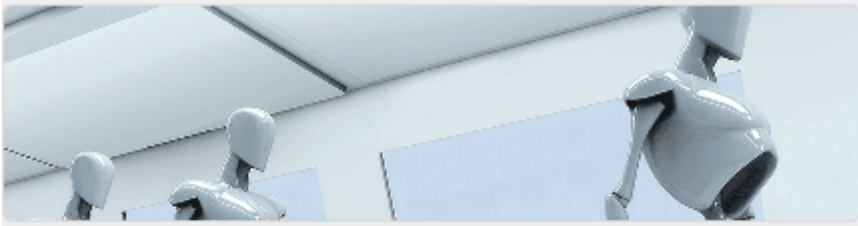
Invitation sent to the participants.



## **Workforce Capabilities using Automation to support/ensure Business Continuity**

## Appendix E

Questionnaire accessible via: <https://forms.gle/3yAWR2pLYsjybcx6>.



### Workforce Capabilities using Automation to support/ensure Business Continuity

Greetings,

A research study is beeing conducted for the master's dissertation in Computer Science and Business Management at ISCTE, on the workforce capabilities using automation to support/ensure business continuity.

The purpose of this questionnaire is to gather information and insights on which of these workforce capabilities are most important in the context of automation and business continuity. All answers will be kept strictly confidential and will only be used for research purposes.

This questionnaire should take around 15 min to complete (if you read all the descriptions). Please answer all questions with your honest and thoughtfull opinion until the April 30th, to help ensure the accuracy and validity of this research study.

Your participation is greatly appreciated.

Sincerely,  
Miguel Comba, Master's Degree in Computer Science and Business Management at ISCTE

---

#### Accountability and Responsibility \*

to be able to take ownership of their work and actions, and to be responsible and accountable for results and outcomes.

|            | 1                     | 2                     | 3                     | 4                     | 5                     |             |
|------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------|
| Irrelevant | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Significant |

---

#### Business Acumen / Literacy \*

to be able to understand and analyse financial statements, market trends and business strategies, in order to identify which areas automation can be most effective and which processes should remain under human control, ensuring that automation technology is being used in a way that aligns with the overall business strategy and objectives.

|            | 1                     | 2                     | 3                     | 4                     | 5                     |             |
|------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------|
| Irrelevant | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Significant |

## **Workforce Capabilities using Automation to support/ensure Business Continuity**

## Workforce Capabilities using Automation to support/ensure Business Continuity

### Appendix F

Participants' answers to the questionnaire.

| Items / Experts | 1    | 2   | 3   | 4    | 5   | 6    | 7    | 8   | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16  | 17   | 18   | 19   | 20   | 21   | 22  | 23   | 24   | 25   | 26   | 27   | 28  | 29   | 30   | 31   | 32   | 33   | 34   | 35   | 36   | 37   | 38   | 39   | 40   |   |
|-----------------|------|-----|-----|------|-----|------|------|-----|------|------|------|------|------|------|------|-----|------|------|------|------|------|-----|------|------|------|------|------|-----|------|------|------|------|------|------|------|------|------|------|------|------|---|
|                 | C 31 | C 2 | C 7 | C 34 | C 5 | C 37 | C 24 | C 4 | C 25 | C 18 | C 14 | C 17 | C 42 | C 38 | C 33 | C 1 | C 44 | C 40 | C 22 | C 36 | C 41 | C 9 | C 39 | C 35 | C 21 | C 12 | C 19 | C 3 | C 43 | C 16 | C 20 | C 30 | C 10 | C 45 | C 29 | C 23 | C 26 | C 13 | C 11 | C 32 |   |
| 1               | 5    | 5   | 4   | 5    | 4   | 4    | 4    | 5   | 4    | 3    | 3    | 5    | 5    | 4    | 5    | 4   | 3    | 4    | 3    | 3    | 5    | 5   | 4    | 4    | 4    | 4    | 4    | 4   | 3    | 4    | 4    | 5    | 4    | 4    | 4    | 5    | 4    | 4    | 3    | 5    |   |
| 2               | 5    | 5   | 4   | 4    | 5   | 4    | 5    | 5   | 5    | 5    | 4    | 5    | 3    | 5    | 5    | 5   | 4    | 5    | 5    | 5    | 4    | 4   | 5    | 4    | 5    | 5    | 5    | 4   | 4    | 5    | 5    | 4    | 4    | 4    | 5    | 4    | 4    | 4    | 4    | 5    |   |
| 3               | 4    | 4   | 5   | 3    | 5   | 4    | 3    | 5   | 5    | 4    | 4    | 4    | 3    | 2    | 4    | 4   | 2    | 3    | 5    | 5    | 3    | 4   | 4    | 5    | 4    | 5    | 5    | 4   | 5    | 5    | 4    | 4    | 5    | 2    | 4    | 3    | 4    | 3    | 4    | 5    |   |
| 4               | 3    | 4   | 5   | 5    | 4   | 5    | 3    | 5   | 5    | 2    | 2    | 3    | 5    | 3    | 4    | 3   | 2    | 4    | 3    | 4    | 4    | 4   | 3    | 3    | 4    | 4    | 5    | 5   | 3    | 3    | 4    | 5    | 5    | 5    | 5    | 5    | 4    | 4    | 4    | 4    |   |
| 5               | 4    | 4   | 5   | 5    | 4   | 4    | 5    | 4   | 5    | 4    | 5    | 5    | 5    | 4    | 4    | 5   | 5    | 4    | 4    | 4    | 4    | 3   | 4    | 4    | 4    | 4    | 4    | 4   | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    |   |
| 6               | 4    | 5   | 5   | 4    | 4   | 5    | 4    | 5   | 5    | 5    | 4    | 4    | 5    | 3    | 4    | 5   | 3    | 4    | 4    | 4    | 3    | 5   | 3    | 4    | 4    | 3    | 4    | 4   | 5    | 5    | 4    | 4    | 2    | 4    | 3    | 4    | 4    | 4    | 5    | 5    |   |
| 7               | 3    | 5   | 5   | 5    | 4   | 5    | 4    | 4   | 5    | 5    | 5    | 5    | 3    | 3    | 3    | 4   | 4    | 3    | 4    | 5    | 5    | 5   | 3    | 4    | 4    | 5    | 5    | 5   | 4    | 5    | 5    | 3    | 5    | 4    | 3    | 3    | 3    | 5    | 3    | 5    |   |
| 8               | 5    | 5   | 4   | 4    | 4   | 5    | 4    | 5   | 5    | 4    | 4    | 5    | 5    | 4    | 5    | 5   | 4    | 4    | 4    | 5    | 4    | 5   | 4    | 4    | 4    | 5    | 4    | 4   | 4    | 5    | 4    | 4    | 5    | 4    | 5    | 4    | 3    | 5    | 4    | 5    |   |
| 9               | 4    | 5   | 5   | 4    | 4   | 5    | 4    | 4   | 5    | 4    | 5    | 4    | 5    | 4    | 4    | 4   | 4    | 3    | 5    | 4    | 5    | 5   | 4    | 4    | 4    | 4    | 4    | 5   | 5    | 5    | 5    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 4    | 5    |   |
| 10              | 5    | 5   | 5   | 5    | 5   | 5    | 4    | 5   | 5    | 4    | 4    | 5    | 4    | 5    | 4    | 5   | 5    | 5    | 5    | 4    | 4    | 4   | 5    | 5    | 5    | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 4    | 4    | 5    | 5    | 4    | 4    | 3    | 4 |
| 11              | 4    | 4   | 5   | 4    | 4   | 3    | 4    | 4   | 5    | 4    | 4    | 4    | 3    | 3    | 4    | 5   | 3    | 3    | 3    | 4    | 3    | 3   | 5    | 4    | 4    | 5    | 5    | 5   | 4    | 4    | 4    | 4    | 4    | 4    | 3    | 4    | 4    | 3    | 3    | 4    |   |
| 12              | 4    | 5   | 5   | 5    | 5   | 5    | 4    | 5   | 5    | 5    | 5    | 5    | 3    | 4    | 4    | 5   | 5    | 5    | 3    | 4    | 4    | 5   | 5    | 5    | 4    | 4    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 4    | 5    | 5    |   |
| 13              | 5    | 4   | 4   | 5    | 4   | 5    | 5    | 5   | 5    | 4    | 4    | 5    | 3    | 5    | 5    | 5   | 4    | 5    | 5    | 4    | 5    | 5   | 5    | 5    | 4    | 5    | 5    | 5   | 5    | 5    | 5    | 4    | 5    | 5    | 5    | 5    | 4    | 5    | 5    | 5    |   |
| 14              | 5    | 4   | 4   | 5    | 4   | 5    | 5    | 4   | 3    | 3    | 3    | 3    | 5    | 4    | 5    | 5   | 5    | 5    | 4    | 4    | 4    | 4   | 5    | 4    | 5    | 5    | 5    | 5   | 3    | 3    | 3    | 4    | 3    | 4    | 3    | 5    | 4    | 3    | 3    | 3    |   |
| 15              | 5    | 3   | 4   | 4    | 5   | 3    | 4    | 5   | 4    | 4    | 4    | 5    | 4    | 5    | 5    | 5   | 4    | 4    | 5    | 4    | 5    | 5   | 5    | 5    | 4    | 4    | 4    | 3   | 5    | 5    | 5    | 5    | 4    | 5    | 4    | 5    | 5    | 4    | 5    | 5    |   |
| 16              | 3    | 4   | 3   | 2    | 3   | 4    | 3    | 2   | 3    | 2    | 1    | 2    | 3    | 1    | 2    | 1   | 2    | 3    | 2    | 3    | 1    | 2   | 1    | 2    | 2    | 2    | 2    | 3   | 2    | 2    | 1    | 2    | 1    | 1    | 2    | 3    | 1    | 2    | 3    | 3    |   |
| 17              | 4    | 4   | 5   | 3    | 3   | 4    | 4    | 4   | 4    | 3    | 4    | 5    | 4    | 4    | 4    | 4   | 3    | 4    | 4    | 4    | 5    | 4   | 4    | 5    | 4    | 4    | 4    | 4   | 4    | 4    | 5    | 4    | 4    | 3    | 4    | 5    | 4    | 4    | 4    | 5    |   |
| 18              | 4    | 3   | 4   | 5    | 5   | 5    | 3    | 3   | 4    | 4    | 4    | 4    | 4    | 3    | 3    | 3   | 3    | 4    | 4    | 4    | 4    | 3   | 4    | 4    | 4    | 4    | 3    | 4   | 4    | 4    | 4    | 4    | 4    | 3    | 4    | 4    | 4    | 4    | 4    | 4    |   |
| 19              | 4    | 4   | 5   | 5    | 4   | 4    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 4    | 4    | 4    | 4    | 4    | 4    | 5    | 5    |   |
| 20              | 5    | 3   | 4   | 5    | 5   | 5    | 4    | 4   | 4    | 4    | 4    | 5    | 4    | 3    | 4    | 3   | 3    | 4    | 4    | 4    | 4    | 5   | 5    | 5    | 5    | 4    | 4    | 3   | 5    | 5    | 5    | 3    | 5    | 5    | 4    | 3    | 3    | 4    | 4    | 5    |   |
| 21              | 5    | 5   | 5   | 5    | 5   | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5   | 5    | 5    | 4    | 5    | 5    | 4   | 5    | 5    | 5    | 5    | 4    | 5   | 4    | 4    | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5    |   |
| 22              | 5    | 5   | 5   | 4    | 4   | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5    | 5    | 5   | 4    | 5    | 5    | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5   | 5    | 5    | 5    | 5    | 4    | 5    | 4    | 5    | 5    | 4    | 5    | 5    |   |
| 23              | 4    | 4   | 4   | 5    | 5   | 4    | 5    | 5   | 4    | 4    | 4    | 3    | 4    | 3    | 4    | 4   | 4    | 5    | 5    | 5    | 3    | 5   | 5    | 5    | 4    | 5    | 5    | 4   | 3    | 4    | 4    | 4    | 3    | 4    | 5    | 5    | 5    | 3    | 4    |      |   |
| 24              | 5    | 5   | 5   | 4    | 4   | 4    | 4    | 4   | 3    | 4    | 4    | 3    | 2    | 3    | 4    | 5   | 4    | 4    | 5    | 4    | 4    | 4   | 5    | 5    | 5    | 3    | 5    | 5   | 5    | 5    | 5    | 5    | 4    | 4    | 5    | 5    | 5    | 5    | 5    | 5    |   |
| 25              | 5    | 5   | 5   | 5    | 5   | 5    | 5    | 5   | 5    | 5    | 4    | 5    | 4    | 4    | 5    | 5   | 5    | 5    | 4    | 5    | 4    | 4   | 4    | 4    | 4    | 5    | 4    | 5   | 4    | 5    | 5    | 4    | 4    | 5    | 5    | 5    | 5    | 4    | 5    | 5    |   |
| 26              | 4    | 5   | 4   | 5    | 4   | 4    | 4    | 4   | 5    | 4    | 4    | 4    | 5    | 5    | 5    | 5   | 4    | 5    | 5    | 5    | 5    | 4   | 5    | 4    | 4    | 5    | 5    | 5   | 4    | 4    | 5    | 5    | 4    | 3    | 3    | 3    | 4    | 4    | 4    | 3    |   |
| 27              | 4    | 5   | 3   | 5    | 4   | 5    | 5    | 4   | 4    | 3    | 4    | 5    | 5    | 5    | 5    | 5   | 3    | 5    | 4    | 5    | 5    | 3   | 5    | 4    | 5    | 5    | 5    | 3   | 5    | 5    | 4    | 5    | 3    | 5    | 3    | 5    | 3    | 3    | 4    | 4    |   |
| 28              | 4    | 3   | 5   | 5    | 4   | 5    | 5    | 5   | 4    | 4    | 4    | 4    | 5    | 5    | 5    | 4   | 4    | 4    | 5    | 5    | 5    | 5   | 4    | 5    | 5    | 4    | 5    | 5   | 5    | 5    | 5    | 5    | 5    | 5    | 4    | 5    | 5    | 4    | 5    | 5    |   |