Lucy Anne Temple

**Digital Co-Production and Technology Adoption: The Case of CuidAR the Argentine digital application for COVID-19**

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Supervisor: Dr. Veiko Lember

Presented by: Lucy Anne Temple
Keskuse, 22-34
12911 Tallinn, Estonia
+372 5363 0768
l_temp02@uni-muenster.de

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# Abbreviations

| | |
|---|---|
| AMBA | Metropolitan Area of Buenos Aires |
| ARSAT | Argentine Satellite Solution Company |
| BI | Behavioral Intention |
| CABA | City of Buenos Aires |
| CESSI | Argentine Software Industry Chamber |
| COEPs | Provincial emergency committees |
| CONICET | National Scientific and Technical Research Council |
| COVID-19 | Corona Virus Disease |
| CUHC | Mobility Permit / Certificado único habilitante para ciruclar |
| EE | Effort Expectancy |
| FC | Facilitating Conditions |
| GBA | Gran Buenos Aires (AMBA – CABA) |
| IADB | Inter American Development Bank |
| IS | Information System |
| IT | Information Technology |
| MARS | Motivation, Ability, Role Perception and Situational Factors |
| NPG | New Public Governance |
| NPM | New Public Management |
| PAHO | Pan American Health Organization |
| PE | Performance Expectancy |
| PEOU | Perceived Ease of Use |
| PU | Perceived Usefulness |
| SI | Social Influence |
| SN | Subjective Norm |
| TAM | Technology Acceptance Model |
| TRA | Theory of Reasoned Action |
| UNDP | United Nationds Development Programme |
| UTAUT | Unified Theory of Acceptance and Use of Technology |
| WHO | World Health Organization |

# 1    Introduction

Public administration and management paradigms have evolved in recent decades; the view and role of governments, as well as that of citizens, have changed. Today, alongside the New Public Governance model, citizens are involved in service planning and design, and service provision cannot be fathomed without citizen involvement (Bracci, Fugini, & Sicilia, 2016; Bovaird, 2007). Co-production is one way of citizen participation and will be the focus of this study; its definition and boundaries can sometimes be blurry but throughout this research, a clear definition will be selected to structure the research.

Furthermore, the introduction of Information Technology (IT) has changed the way citizen participation is conducted with the introduction of new digital technologies and online spaces for citizen and government interaction. Currently, there is little empirical evidence of how digital technologies impact citizen co-production with government (Lember, 2018). Moreover, the impact of new technologies on this process is not straightforward and different technologies impact participatory public governance in different ways. Users of these technologies play an important role in shaping decisions and outcomes (Bovaird, 2007).

Digital solutions have reached all aspects of modern life. The global pandemic that struck the world in 2020 brought several effects along with it. The majority of countries around the world called for an increase in personal hygiene, social distancing, and self-isolation, alongside travel bans and rigorous testing regimes. Many countries imposed strict lockdowns of cities, and in some cases of whole countries. The economic impact of slowing down countries to a complete halt is devastating, yet the entire impact of this has not been unraveled as many countries are still struggling to control the spread of the coronavirus disease (COVID-19). An array of digital solutions have been rolled out to mitigate the effects and slow down the fast expansion of the virus. None of these intend to be a standalone solution but aid the containment of the virus by providing governments with extra tools. Most of these digital solutions are mobile phone based, and have different functionalities such as "contact tracing, quarantine enforcement (digital fences) and movement permissions (Digital leashes), and social distancing/movement monitoring" (Kitchin, 2020). There have been many discussions over the technical feasibility of these solutions and the ethical issues related to citizen privacy, together with doubts about their effectiveness (Kichin, 2020). Equally important, the adoption numbers of these technologies remains reasonably low, hindering the possibility of being successful in their implementation (Drozdiak, Lee & De Vynck, 2020).

By mid-2020, the center of the pandemic shifted to the American continent, and by the beginning of August 2020, Latin America was still showing daily increases of cases, with

no peak in sight or any signs of slowing down. Five Latin American countries were ranked within the twenty states with the highest COVID-19 numbers: Brazil, Peru, Chile, Colombia, and Argentina (Worldometer, 2020). All these countries approached the situation in different ways with varied results. The current research focuses on the case of Argentina. In spite of having a rocky start and a belief that the virus would not reach Argentine soil, the government ended up responding quickly when the first cases began to appear. Aligning with the World Health Organization (WHO) recommendations and prioritizing health over the economy, they rapidly closed the country's borders, and a country-wide lockdown was implemented by mid-March (WHO, 2020). The biggest city in the country, Buenos Aires, and its surroundings were still in lockdown at the beginning of August, becoming one of the longest lockdowns in the world. For the most part, the curve was flattened, or at least shifted in time, as cases began skyrocketing by the end of July, and the daily report from the Ministry of Health continued to reflect  increases in numbers, reaching over 7000 new cases per day (Worldometer, 2020).

On April 27th 2020, the Argentine government launched a digital solution to help tackle the spread of the virus. The application, called CuidAR, was promoted and led by the national government and created by members of the Argentine scientific community with leading private enterprises in software development. CuidAR does not do contact tracing, and in no way geo-locates citizens, but allows the population to carry out a health self-assessment every 48hs and access their mobility permits if they have valid reasons to leave their homes. By using this application citizens are co-producing with the government, allowing for more accurate and relevant statistics to be generated, leading to the possibility of evidence-based decision-making. Moreover, this digital solution provides citizens with a means of communication with provincial health providers, and also allows the government to contact the citizen directly if support is needed (Ministerio de Salud, 2020). At the beginning of July, the adoption numbers of CuidAR were quite high in comparison to the numbers other countries presented, with over six and a half million users representing over 16% of the population (Drozdiak et al., 2020).

Citizen motivation to co-produce through digital technologies is still a new field of research that is lacking empirical testing. The goal of the current research is to understand the factors affecting motivation to co-produce while adopting government promoted technology. In order to have a comprehensive analysis of this, factors affecting technology adoption will be combined with the factors leading to citizen motivation to co-produce, creating a theoretical framework that was tested on the case study of Argentina during the 2020 COVID-19 pandemic. The guiding research question for the study was:

- *What are the factors affecting citizen motivation to co-produce and adopt the digital application CuidAR proposed by the Argentine government to aid the emergency measures of COVID-19 in the country?*

After this introductory chapter containing an overview of the relevant topics, research questions and goals, the literature review pertinent to the case study will be presented. Here different conceptual theories surrounding citizen participation, citizen co-production with government, digital co-production, factors affecting citizen motivation to co-produce and the factors affecting technology adoption will be described. Moreover, the importance of trust as a key enabler will be detailed. Chapter three will seek to summarize the findings in chapter two, by developing a conceptual framework that will be used to analyze the impact of different variables on motivation to co-produce and behavioral intention to adopt a technology. Next, chapter four presents the methodology and research design for this study, including why a case study approach was selected, the data collection methods, and the data analysis procedures. Chapter five contains the case study description, providing a brief overview of the impact and measures implemented in Argentina to face the COVID-19 pandemic, a description of the CuidAR application, what its functions are, and how it was created. The next chapter contains the analysis of the results; here a description of the answers provided by the respondents will be portrayed and the results of the correlations will be presented, the findings discussed, and the main hypotheses will be contested. The results will be discussed related to the research question and theoretical implications presented in the literature. Finally, the concluding chapter will summarize the main research findings regarding citizen co-production through digital applications in the context of COVID-19 in Argentina, propose future work, and mention some limitations to the study.

# 2        Literature Review

There are various different ways of citizen participation, and with the introduction of digital technologies these have changed and extended their reach. In this research the focus will be on citizen participation through co-production, particularly co-production using digital technologies. In the following sections the concept and background of co-production will be presented, the chosen definition to carry out this study selected and the impact of digital technologies on co-production described. Further along, the factors affecting citizens' motivation to co-produce will be analyzed. As the use of digital technologies is involved in this case study, the factors affecting technology adoption will also be presented. An overarching concept that was encountered in all these topics was the impact of trust: trust in government and trust in technology. Therefore, the impact of trust on these topics will be explored as well.

## 2.1        A Brief Overview of Citizen Participation

Engaging citizens in the production of public services is a recurring topic in academic literature. There are different ways to include citizens in this process. Government and citizen interaction is a constant, as citizens somehow consume, use or receive services from the government. This relationship between them has evolved through time, and different levels of interaction exist. As stated in the OECD handbook of "Citizens as Partners", the government is continuously seeking ways to strengthen the relationship with citizens. The different levels of interaction between these two parties, are explored differently by the relevant authors, but a basic three type of interaction will be presented here:

- Information- when the government shares information or citizens access this information. This is a one-directional relationship.

- Consultation- the government asks for citizen feedback on policy making issues. This is a two-directional relationship.

- Participation- citizens participate in decision-making or policy creation. This represents a more complex two-directional relationship.

(OECD, 2001)

As the relationship becomes more complex, citizens' influence increases. One would wonder why citizen involvement is beneficial or sought. As follows are some of the reasons why governments seek to increasingly involve citizens and why they feel pressure to do so:

- Better Public Policy - citizen participation ensures effective implementation and provides the government with a better base for policymaking.

- Increased Trust in Government, Transparency and Accountability - participation enhances government legitimacy, it shows openness and appears to be more trustworthy. Citizens have more tools to make governments accountable for their actions.

- Stronger Democracy - encourages more active citizenship and helps fight the decrease in public support as citizens gain insight into what government is doing. Also, by giving citizens the opportunity to provide their feedback, it indirectly increases the probability of compliance.

(OECD, 2001)

This research will focus on a particular form of citizen participation: co-production. In the following section this term will be explored.

## 2.2 Co-Production

### 2.2.1 Background to Co-Production

Public administration and public management paradigms have shifted with the passing of the decades. Until the end of 1970's the predominant paradigm was what we now call "old public administration" where citizens have a passive role of clients and public organizations have an active role in the relationship providing services to the public (Bracci, Fugini, & Sicilia, 2016). Further along, New Public Management (NPM) became the leading administration model, stating that governments should be administered in a similar way to private organizations; a market focus, high levels of privatization and contracting (Bracci et al., 2016; Meijer, 2012). As stated by Hood (as cited in Bracci et al., 2016) the NPM model portrays the population not as clients, but as consumers of public services. Co-production first becomes a key aspect in public administration with the more recent New Public Governance (NPG) model, that understands that public service delivery is a complex task comprising relationships with many actors, networks, and inter-organizational relationships (Bracci et al., 2016). In the NPG model, as stated by Osborne, citizens are not acting as clients or consumers but are invited to participate as co-producers, their contribution is fundamental to service delivery, and design (as cited in Bracci et al., 2016). It is with NPG that public administrations start viewing citizens as useful resources: new innovative ideas are implemented in collaboration with citizens (Alford, 2009; Bovaird, 2007). A reduced

budget, increasing complexity of services, a need for heterogeneous services provision, all together create the need for collaboration with citizens (Bracci et al., 2016).

Co-production is not a new term, One of the first authors to talk about it was Elinor Ostrom (1996) who defined co-production as "the process through which inputs used to provide a good or service are contributed by individuals who are not in the same organization". Many others continued on a similar definition, others narrowed it down to a restricted definition, Bovaird (2007) uses co-production as "the provision of services through regular, long-term relationships between professionalized service providers (in any sector) and service users or other members of the community, where all parties make substantial resource contributions". Furthermore, Alford (2009) states that two elements must be present to identify co-production:

1. Creation of public value and possibly private value

2. "Co-production should contribute to both outputs and outcomes"

(Alford 2009 as stated in Bracci et al., 2016)

An interesting statement by Bovaird (2007) is that co-production means that both citizens and government must take risks, the user has to trust the professional and the professional must trust the users, rather than dictate what they should do. The co-production approach believes that citizens and service users should become a part of the planning and delivery of services, locating the citizens in the decision-making process (Bovaird, 2007). As stated by Bovaird (2007), the concept of co-production is not only important in service delivery but throughout the whole value chain.

Due to the fact that many different authors define co-production in a variety of ways, it is important to define three of the main aspects that need to be present in order to consider citizen participation as co-production, these are:

1. Must be voluntary, not coercive participation

2. An active rather than passive involvement of citizens

3. Focused on public value creation in terms of outputs

(Bovaird, 2007; Alford, 2009; Pestoff, 2012 & Brandsen & Honingh, 2015 in Bracci et al., 2016)

Bracci et al., (2016) add a few more aspects to co-production, but these are not necessary in order to consider a relationship between citizens and government to be co-production,

some of these are: that the process should be transformative and innovative, should foster sustainability and should encompass the whole policy process (Bracci et al., 2016).

According to the literature, there are three main types of co-production related to the degree of citizen involvement, these are the citizen as a co-implementer, the citizen as a co-designer, and the citizen as an initiator (Voorberg, Bekkers, & Tummers, 2015). The first type is the most studied in the literature, where the citizen is required to perform some implementation tasks, an example of this would be in recycling, citizens must separate their garbage in order for this to work (Voorberg et al., 2015). The second classification is when the citizens somehow participate in the decision-making process of how things must be done, usually invited by the government to participate in this process (Voorberg et al., 2015). Finally, the third type is when citizens are the ones that initiate the process, and the government then joins in on this process (Voorberg et al., 2015). There exists a discussion as to whether these above mentioned processes represent co-production or co-creation. Due to the ambiguity of these terms, the following section will try to clarify the similarities and differences between them.

### 2.2.2    Co-Production vs. Co-Creation

Brandsen & Honingh (2016) try to extensively explain the differences and similarities between co-production and co-creation. This is an important aspect in this literature overview, as many times public authorities and authors use these terms interchangeably, yet this is not really possible. The first main difference between these terms is their origin: co-production originates in the public sector whilst co-creation first appeared in the private sector and is only recently being used in the public sector (Brandsen & Honingh, 2016). The authors state three ways of understanding the relationship between these two terms: either they represent almost the same, or they both represent citizen input but of different type, or co-creation is a more encompassing definition, while co-production is more specific (Brandsen & Honingh, 2016). They believe defining these concepts is important to be able to avoid comparisons of dissimilar things, making clear distinctions will help avert misunderstandings.

Firstly, we will explore the similarity between these terms, and common aspects that they share:

- They represent direct citizen input in the production phase.

- They refer to the collaboration between citizens and public agencies

- They need active input from citizens - this means that it is not consumerism only

(Brandsen & Honingh, 2016)

The difference between these terms is the key to why this research document will only focus on co-production. Co-creation involves the cases when citizens are involved in the planning of a service, sometimes they initiate it and participate in the strategic level of creation. On the other hand, co-production is usually related to the participation of citizens in the implementation phase (Brandsen & Honingh, 2016). The definition of co-production that will be followed throughout this research is that portrayed by Brandsen and Honingh (2016), who define co-production as "a relationship between the employees of an organization and (groups of) individual citizens. It requires direct and active inputs front these citizens to the work of the organization. The professional is a paid employee of the organization, whereas the citizens receive compensation below market value or no compensation at all".

### 2.2.3    Digital Co-Production

With the advent of digital technologies, digitally enhanced co-production becomes a suitable option where budget deficits exist: the introduction of the internet, and technological tools allow for new ways of citizen co-production (Fugini & Teimourikia, 2016; Noveck, 2015; Linders, 2012). There exists a discussion in the literature of whether digital technologies promote active citizen participation, or simply represent a passive way for citizens to participate (Brandsen and Honingh, 2015). Some authors suggest that with the provision of services through digital solutions, citizens are somehow co-producing and not necessarily choosing to do so (Brandsen and Honingh, 2015; Bovaird et al. 2015). The aforementioned distinction between co-production and co-creation, as well as the use of digital technologies according to Bovaird and Löffler (2010) suggest that co-production and digital technology focus on co-delivery, and not co-creation, this means not strategic co-planning or co-designing.

In the literature evolving around digital technologies and co-production a discussion has emerged as to  whether these new tools somehow empower citizens (Noveck, 2015; Lember, 2018; Linders, 2012), or on the other hand, limit the ways in which citizens can co-produce, making them passive participants. This discussion lacks thorough empirical support. Although this discussion exceeds the scope of this research study, the concept is still somewhat relevant and must be mentioned as one of the possible effects of digital technologies on co-production. Moreover, digital technologies may lead to greater participation and contribute to higher trust in government and increased engagement of citizens (Meijer, 2012; Linders, 2012).

Nobody can go against the fact that digital technologies have changed modern life. Digital technologies are present in small daily activities such as self-checkout points in grocery stores, or our mobile phones: today most smartphones we use daily to communicate can

somewhat replace a GPS, a personal computer, and a diary/schedule among other things. Furthermore, technology is also changing the co-production of citizens with the government. As Lember (2018) mentions, technology is somehow changing traditional co-production, enabling new forms of co-production or replacing the typically humancentric process of co-production. Some argue that new forms of digital solutions will somehow replace co-production processes and allow the citizen to become self-sufficient (Lember, Brandsen, & Tõnurist, 2019)

The reduced budgets in government lead to new digital practices that reduce the costs of traditional co-production (Lember, 2018; Linders, 2012; Meijer, 2012). The cost of connecting with citizens can be reduced thanks to new technologies, and allow for interaction 24 hours a day, this is why Meijer (2012) states that new media can strengthen co-production and enable new ways of communication between government and citizens. The use of digital technologies to co-produce can somewhat reduce the distances between involved parties, reaching areas that before were harder to include in the co-production process by diminishing geographic, temporal and organizational barriers (Lember et al., 2019)

There are also some negative aspects associated with the use of digital technologies for co-producing: limitation on the way in which co-production can take place and the fact that digital technologies for co-production can worsen the digital divide in society, leaving those with no access further excluded, only the educated and skilled have access to new technologies (Lember, 2018; Linders, 2012). Also, some governments aim to include digital technologies just to show how modern they are instead of reaping the benefit of technology (Lember, 2018).

## 2.3    Citizen Motivation to Co-Produce

After understanding the importance of citizen engagement, and the particularities of citizen-government co-production, it is relevant for this study to comprehend what motivates citizens to co-produce with the public sector. Several authors mention that this topic has rarely been studied (Eijk, C. & Steen, T., 2014 & 2015; Petukiene, Tijunaitiene & Damkuviene, 2012). Firstly, even before speaking about motivation, it is important for citizens to perceive co-producing as an option, having the opportunity to participate (Eijk, C. & Steen, T., 2014). Furthermore, as the literature on co-production highlights, citizen participation should be voluntary, not forced (Petukiene et al., 2012), therefore this research will only be focusing on voluntary based motivation to co-produce.

The authors Eijk & Steen (2014) summarize the following key aspects regarding citizens' motivation to co-produce: capacity, self-centred or egoistic motivations, and community-

oriented motivations. Capacity relates to how the individual understands his/her competences to participate (Eijk, C. & Steen, T., 2014). Different authors refer to citizen capacity in different ways, one example is the perceived control over one's life, the fact that they believe that their actions will have a positive impact, and that they are capable of doing it, will motivate them to participate (Fledderus & Honingh, 2015). Furthermore, the authors explore this point as internal efficacy, regarding citizens' personal interpretation of their competence to participate effectively (Eijk, C. & Steen, T., 2015). The authors also believe that citizens consider the external efficacy of their involvement, regarding their feelings as to how their participation will affect the decision-making or service provision (Eijk, C. & Steen, T., 2015). The self-centered and community-oriented motivations can be jointly explained under the term salience: "The quality of being particularly noticeable or important; prominence" (Oxford Dictionaries, 2020). Personal salience, or egoistic motivations, focuses on how the citizen perceives the service as affecting himself/herself whilst social salience, or community-oriented motivation, is related to how the issue is important for the community or society at large (Eijk, C. & Steen, T., 2015). This means that citizens' motivation is not merely altruistic but can also be motivated by personal reasons. Nevertheless, the egoistic motivation is not necessarily a negative motivation, in the act of co-producing, there is a common benefit even if the original reasons for doing so were not altruistic (Pestoff, 2012)

According to Pestoff (2012) there are two main aspects that must be considered when trying to understand citizen involvement in co-production: these are the motivation of individuals to participate and the ease with which this can be done. The latter relates to the things that make citizens become involved more easily such as the amount of information available to them regarding the service and its provision, or the distance to the service provider (this of course applies when the co-production process requires physical presence of citizens). It also involves the transaction cost the citizen perceives from the participation; the time and effort required by them (Pestoff, 2012). The former, relates again to what Eijke & Steen (2015) mentioned as salience: citizens will be motivated to participate in co-production activities if they value the service provided as important to them, and/or their relatives. The more a person feels the service impacts, or is important for them, the more likely they are to become motivated and involved in co-production (Pestoff, 2012).

Another author who focuses on what motivates citizens to co-produce is John Alford (2009). He first acknowledges that several streams of academia assume the reasons why citizens co-produce instead of explaining their motivations. Some of these assumptions are that people only make choices according to the benefits and costs they represent, that it is not in their self-interest to take part in a group or collective action, and finally, that

people are only motivated by self-interest (Alford, 2009). He builds upon what work-motivation specialists understand as intrinsic rewards, where there is no need for any sort of extrinsic benefit to the cost of co-producing, but the citizens might find enjoyment or stimulation and a sense of fulfillment when co-producing. Furthermore, he puts forth the notion of Sociality, as "the enjoyment we derive from associating with others, from receiving their approval" (Alford, 2009). He insists that people may participate even if it might be disadvantageous financially, only because they enjoy the approval and company of others. Finally, he responds to the last assumption, by mentioning that citizens do not necessarily only act in self-interest but according to their moral values, he presents this as normative motivation (Alford, 2009). Alford is not alone in highlighting the importance of sociality as a motivator and the impact of normative considerations, Joost Fledderus & Marlies Honingh (2015) agree with these arguments.

Verschure, Brandsen & Pestoff (2012) discuss the concept of co-production through three main aspects; what motivates co-production, how co-production can be organized, and what the effects of co-production are (Verschure, Brandsen & Pestoff, 2012). They again highlight the two key items of citizen participation in co-production mentioned by Pestoff (2012) and Alford (2009): the ease with  which citizens can participate and their motivation to do so: the importance of not only making their participation easier but also developing techniques to motivate citizens (Verschure et al., 2012). The more barriers to their participation, the greater their motivation must be: how salient the service/product is for them (Pestoff, 2012; Eijke & Steen, 2014) Also, they agree with Alford (2009) that economic rewards or material interest is not the only motivation for citizen participation. Furthermore, after a series of empirical studies, Alford (2014) emphasizes that in order to be able to understand the motivation behind citizens co-producing it is important to take the multiplicity of factors into account, he continues to state the importance of considering the relationship amongst them, and not to try to understand them individually.

The MARS model, an acronym that stands for motivation, ability, role perceptions, and situational factors, states that extrinsic and intrinsic motivation are the most important antecedents to co-production behavior (Fu & Lin, 2013). On the one hand, extrinsic motivation relates to the motivation being associated with something external, either gaining a reward or avoiding being reprimanded. On the other hand, intrinsic motivation involves doing something because it creates a sense of reward for the person (McShane & Von Glinow, 2009). The MARS model is an individual behavior model that portrays behavior as a result of factors and influences, internal and external that combined together affect or determine individual behavior and results. The various factors represented in the acronym have an effect on performance, if one is changed or diminished, the performance will decrease (McShane & Von Glinow, 2009, p. 34). Other authors have also focused on

extrinsic motivations to co-produce, such as material and non-material rewards to citizen participation, from a formal material reward to an expression of appreciation from a relevant elder, it is crucial for citizens to see their participation as useful and valued (Petukiene et al., 2012). In their article, the authors focus on how the public organization can find different ways to motivate citizens to participate, focusing on stimuli from the Public Sector organizations to somehow prompt citizen participation (Petukiene et al., 2012).

Socioeconomic factors have their effect on almost every aspect of people's lives. This is of course also important when considering citizens' motivation and behavior to co-produce. Aspects such as gender, location of residence and characteristics of neighborhoods affect the likelihood of a citizen co-producing (Eijk, C. & Steen, T., 2015). Resources such as available time and conditions can also affect the citizens' ability to co-produce. An example would be a family that has a sick member that needs to be taken care of, their lack of availability will be a barrier to co-producing (Fledderus & Honingh, 2015). Lack of available time to participate also directly impacts their motivation to co-produce (Holgersson & Karlsson, 2014). Moreover, the social and economic reality must be taken into account when trying to understand citizen motivation such as the local culture (Petukiene et al., 2012). Furthermore, when talking about digital participation, their ability to co-produce, also relates to the access to digital technologies, related many times to their socioeconomic conditions (Holgersson & Karlsson, 2014).
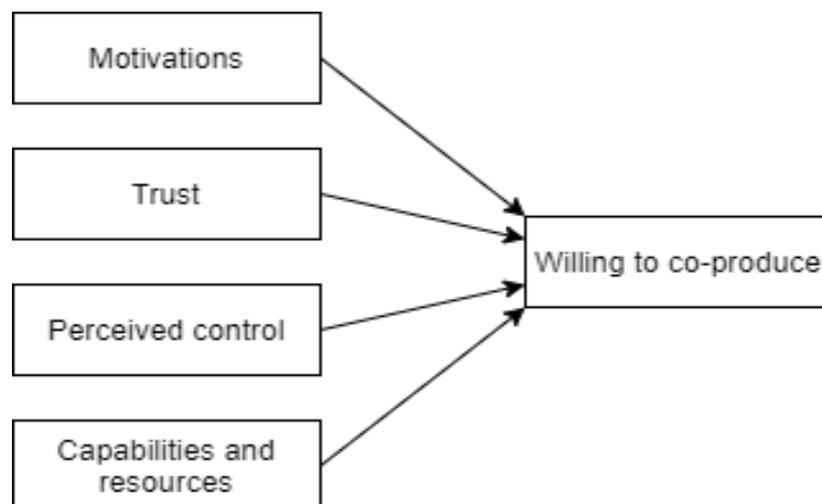


**Figure 1 Factors affecting the willingnes to co-produce (Fledderus & Honingh, 2015)**

Many authors agree with extrinsic and intrinsic motivations to co-produce as key factors for citizen involvement (Fledderus & Honingh, 2015; Vanleene, Voets, & Verschuere, 2017; Tõnurist & Surva, 2017). Fledderus & Honingh (2015) also try to understand the reasons for citizen co-production focusing on the different variables presented throughout

this section: motivation, trust, perceived control, and capabilities and resources. A study on the national probation service in Estonia highlights the importance of trust alongside extrinsic and intrinsic motivation to co-produce a service (Surva, Tõnurist & Lember, 2016) It is important to note that all the aspects revolving around trust will be further developed in section 2.5, as it represents a key aspect that will enable, or generate the motivation in citizens to co-produce. Figure 1 shows a graphic representation of the willingness to co-produce according to Fledderus & Honingh (2015).

Volunteerism can also help discern what triggers co-production, (Eijk & Steen, 2014; Tõnurist & Surva, 2017; Alford, 2009) as it is widely accepted that co-production includes voluntary action (Alford, 2009). Nevertheless, Volunteerism and co-production differ on one main point: usually citizens are also users and beneficiaries of those public services or products they participate in co-producing (Eijk & Steen, 2014). Many times, co-production has been merely understood as volunteerism: this misconception does not provide a complete view of the topic as it would mean co-production is mostly dependent on altruism (Alford, 2009). The authors Tõnurist & Surva (2017), explore in detail the relationship between volunteerism and co-production and how the use of citizens in co-production schemes somehow clashes with the idea of volunteerism, nonetheless, their focus is on co-production and volunteering examples such as firefighters. Also, the authors mention that citizen participation needs three main pillars in order to occur: ability to co-produce, motivation to do so, and access to co-production activities (Tõnurist & Surva, 2017).

In this section the literature on what motivates citizens to co-produce was presented. When this topic first emerged, the belief was that only economic factors would motivate citizens to co-produce, but experience has shown that this is not entirely the case, and there are several factors that affect citizen motivation. The case at hand involves the co-production of citizens through a digital platform. For this reason, different technology adoption models will be presented in the following section. Thus, both the motivation to co-produce and the factors leading to adopting a technology will be analyzed in this study.

## 2.4 Technology Acceptance and Adoption Models

Many governments are moving towards information systems and different approaches to e-government platforms. These platforms and systems are not always adopted by the citizens as expected. Information system (IS) success is related to the usage of the system. In the following section various theories used to gain insight into how individuals behave, what influences their adoption of certain technologies, and their attitude towards technology and e-government adoption will be presented. The focus will be on models

that focus on individuals' adoption of said technologies, and not the success factors or quality of the IS itself.

As stated in the previous sections of this literature review, understanding the motivation of individuals to co-produce is key to understanding their behaviour. This also applies to individuals using or rejecting a certain IS: the expectancy-value theory is one of the first approaches to try and explain this. The basis of this theory explored by Ajzen and Fishbein (1980) is Behavioral Intention (BI), trying to understand the elements that can influence individuals' behavior can help implementers and researchers to better predict the likelihood of an individual engaging in the use of a technology. The expectancy-value theory states that individuals behave according to the value they attribute to the outcomes expected, the higher the value, the more willing they will be to act, or increase their effort (Borders, Earleywine & Huey, 2004). In summary, individuals behave according to the expected outcomes and the values they give these outcomes.
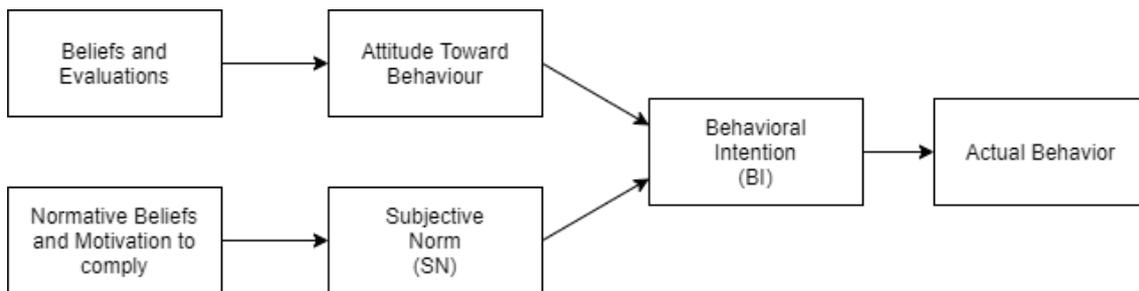


**Figure 2 Representation of the Theory of Reasoned Action (Ajzen & Fishbein, 1980)**

The theory of reasoned action (TRA) tries to explain the aspects that determine the intended behavior of individuals (Ajzen & Fishbein, 1980). The model shown in figure 2 derived from social psychology says that an individual's BI is firstly determined by his attitude and the subjective norm (SN) (Davis, Bagozzi & Warshaw, 1989). Attitude refers to the individual's feelings about performing the behavior (Ajzen & Fishbein, 1980), meanwhile, the SN is the perception the individual has of how other people think he should act, of what people that are important to him believe he should do (Davis et al., 1989). Furthermore, a person's attitude is thus determined by his beliefs regarding the consequences of behaving in such a way, multiplied at the same time by how he or she evaluates those consequences (Davis et al., 1989). Also, the SN is further determined by his motivation to comply and his normative beliefs related to his actions (Fishbein & Ajzen, 1975). Normative beliefs are the "perceived expectations of specific individuals and groups" (Bradley, 2012). The TRA is a model that has been applied empirically, and

several authors have tried to understand the model's limitations, but it is important to note that TRA helps understand the psychological variables affecting user acceptance of IS systems (Davis et al., 1989).

The TRA was the stepping stone theory used by Davis to develop the Technology Acceptance Model (TAM), a theory designed to understand the user acceptance of IS, one of the main purposes of TAM was to aid the understanding of the impacts of external variables on internal aspects such as beliefs, attitudes and intentions (Davis et al, 1989). Furthermore, TAM, as is stated in its name, is used specifically for technology, and does not include the SN mentioned in TRA but similarly to TRA, actual technology usage in TAM is determined by BI (Bradley, 2012). As shown in figure 3, the TAM model has two key variables that are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). On the one hand, PU relates to the fact that individuals will use an IS if they believe it will help them, make things easier for them: extrinsic characteristics (Davis et al., 1989). On the other hand, PEOU means that even if an application seems useful, it will only be used if it is perceived to be easy to use: that is, if the benefits of using it overcome the effort related to using the IS, also related to intrinsic characteristics (Bradley, 2012). Both PU and PEOU influence attitudes towards using the system, that leads to the individuals' BI. Furthermore, PEOU also influences PU, and PU also directly influences the BI of the user. Finally, BI leads to the actual usage of the IS (Bradley, 2012). The TAM model has some limitations, it is based only on self-reported usage, and can only be used to understand voluntary usage of an IS, if it is obligatory, this model cannot be applied, also TAM has been used empirically mostly on cases with students and students are a different demographic to workers in organizations or citizens (Bradley, 2012).
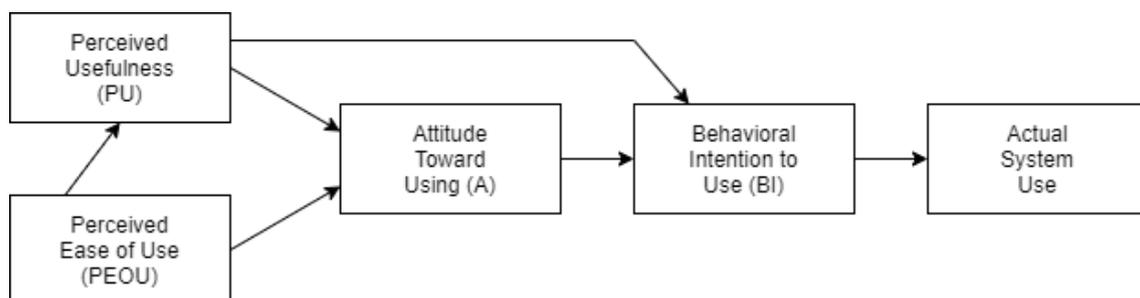


**Figure 3 Technology Acceptance Model (TAM) (Davis et al., 1989)**

The TAM model has been used frequently in IS research and has been applied to very different technologies such as database programs, word processors, software and decision support systems (Bradley, 2012). Nevertheless, Venkatesh and Davis (2000) expanded on the TAM model, to create the TAM2, this new model adds seven new variables, to help in the understanding of social influence and cognitive processes on user intentions (Venkatesh & Davis, 2000). The TAM2 is more complex, due to the increased number of variables present in the model and the relationships between them. In an effort to continue to improve the applicability and relevance of these models, the Unified Theory of Acceptance and Use of Technology (UTAUT) shown in figure 4 was created (Venkatesh, Morris, Davis & Davis, 2003). Both of these new models, TAM2 and UTAUT can, to a certain extent, help explain things in more detail, but at the same time, they have an increased number of variables and added complexity: researchers have to decide whether this complexity is valuable for the case at hand (Bradley, 2012). The UTAUT model helps explain 70% of behaviour intention and usage, but some authors believe that UTAUT does not differ much from TAM and other previous models (Cauter, Snoeck & Crompvoets, 2014).
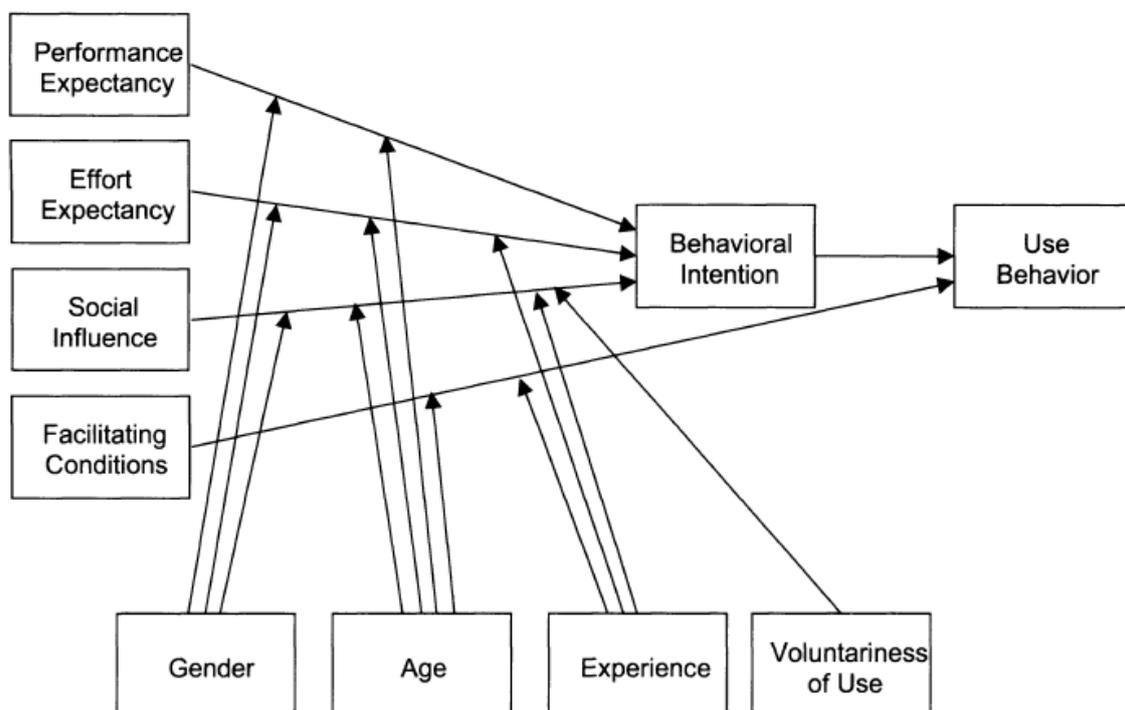


**Figure 4 The UTAUT Model (Venkatesh et al., 2003)**

The UTAUT model considers human factors such as personal aspects, age, gender, experience and voluntariness (Venkatesh et al., 2003). Furthermore, it agglomerates aspects from the previously mentioned models, and some others, to determine four main factors of user acceptance of IS and use behaviour (Venkatesh et al., 2003): Performance

expectancy (PE) is as PU in TAM, whilst effort expectancy (EE) is very similar to PEOU. Also, social influence (SI) can be related to SN, "the degree to which an individual perceives that important others believe he should use the new system" (Cauter et al., 2014, p. 74). The fourth and final aspect is facilitating conditions (FC), that relates to the belief of the individual that the existing infrastructure supports the use of the system (Venkatesh et al., 2003). As shown in figure 4 the first three variables affect BI whilst the last one directly influences use behaviour. The human factors moderate the four main variables in different ways: Gender moderates SI, EE, and PE. Age moderates all four main factors. Experience moderates FC, SI, and EE. Lastly, Voluntariness of use affects SI (Venkatesh et al., 2003).

As aforementioned, each of these models presented throughout this section present some benefits and shortcomings. This is why, to be able to conduct this study, an adaptation of these models will be used, focusing on the aspects most relevant to the case study.

## 2.5    Trust

The literature on citizen participation, on co-production, on citizen motivation and on technology adoption all mention trust as a key variable.

Trust can be present as different types and be understood in different ways. Throughout the literature these definitions vary. Some examples are particularized trust and generalized trust (Fledderus & Honingh, 2015; Pistilli & Pennarola, 2016). Particularized trust refers to the trust citizens have in a person, representative, or institution whilst generalized trust focuses on trust in people in general (Fledderus & Honingh, 2015). Institutional trust is related to the trust in institutions, for example governmental institutions, schools and universities (Pistilli & Pennarola, 2016). Finally, technology mediated trust, a term still discussed in academic literature, is the trust associated not with the technology itself, but with the creators, designers and operators of the technology, this means the people behind the technology (Pistilli & Pennarola, 2016). The literature on citizen participation, on co-production, on citizen motivation and on technology adoption all mention trust as a key variable. In the following sections the importance of trust in co-production with the government will be analysed, and secondly, the relationship between trust and technology adoption.

### 2.5.1    Trust and Co-Production & Digital Co-Production

When co-production involves working with other citizens, having trust in the other participants may be an important precondition to co-production (Fledderus & Honingh, 2015). These authors also studied the trust citizens co-participating had in local

government and in politics and government in general. Besides, they sought     to understand the relationship between trust and motivation through empirical research and found that the use of extrinsic motivators does not seem to attract citizens with lower levels of trust.

Citizen participation is affected by trust in Government and in the Administration (Bovaird & Löffler, 2012; Ma & Wu, 2019), trust in government and the feeling of responsiveness from government will affect the desire of citizens to engage in the co-production processes (Eijk & Steen, 2015). This statement is supported by several authors in the relevant literature pertinent to citizen motivation to participate in co-production. Furthermore, citizens must trust the government to deliver the services, and also to provide them with the opportunity to meaningfully engage (Eijk & Steen, 2014). Similarly, Gordon, Osgood & Boden (2016) & Fledderus & Honingh (2015) mention that a lack of trust can represent a barrier to citizen participation, they also say that the confidence citizens have in government institutions will also directly affect their participation. They continue by recommending public officials to aid in building trust amongst participants. Similarly, Brandsen, Steen & Verschuere (2018), state that co-production of services will not automatically create trust in citizens, but when designing these services special attention should be directed at  ways to build trust in citizens, by focusing on what motivates them and their capabilities.

Trust is a three-way factor in co-production: citizens trust in government affects their possibility and willingness to participate, and governments must trust citizens in order to value their participation in co-production processes. Also, there is a general belief that co-production indirectly increases trust in government (Fledderus, 2015). The authors Fledderus, Brandsen & Honingh (2014) try to understand the theoretical relationship between co-production and trust and propose a design to conduct empirical research on this topic because the theory does not confirm in any way that co-production necessarily leads to more trust. Moreover, the empirical research conducted in The Netherlands by Fledderus & Honingh (2015) shows that trust in local government seems to be an important precondition for citizen participation, so governments will benefit from participation if they gain citizens' trust beforehand.  Also, the belief that the co-production of public services leads to increased trust is still a topic that needs further exploration in the empirical field (Fledderus, 2015). Nevertheless, Vanleene & Verschuere (2018) state that an indirect effect of community co-production is a renewed trust in government; as disadvantaged minorities usually have high distrust, co-production helps reduce this and increase trust and transparency. Also, some authors argue that governments that underperform in their services, create a motivation in citizens to co-produce services in

order to improve them (Parrado, Ryzin, Bovaird, & Löffler, 2013). Nevertheless, this does not mean that co-production increases when distrust increases (Parrado et al., 2013).

As mentioned previously, co-production may lead to change in citizens' view of government. The authors Kang & Van Ryzin (2019) try to investigate how co-production creates increased trust in government. Their empirical results do not show clear results but highlight the need for further research in this field, as there seems to be a shift in citizens' opinion of government. Moreover, the use of digital solutions somehow relates to the desire of governments to increase the level of citizen trust and achieve higher levels of satisfaction with government in society.

The use of digital technologies is increasing, and e-government solutions are emerging in many countries around the world. Citizens may avoid the use of ICTs due to many factors: these can be cultural, fear of invasion of privacy, and lack of trust in government (Porumbescu, 2016). Drawing on an extensive range of sources, the authors Clifton, Díaz Fuentes & Llamosas García (2020) analyse the drivers and barriers to ICT-enabled co-production of services, one of their findings in their systematic review is related to citizen trust, where a lack of trust usually reduces citizen participation in digital co-production (Clifton et al., 2020). Furthermore, in the cases where the trust in government was higher, digital co-production became prevalent, again, there seems to be a two-way correlation, the higher the citizen participation the greater the trust in government (Clifton et al., 2020). In their analysis of the relevant literature on the topic, a way of increasing trust in government is involving experts in the creation of digital governmental services (Clifton et al., 2020). Similarly, Porumbescu (2016) examines the use of e-government sites and social media accounts related to citizen perception and trustworthiness of government. An interesting finding in this text was that citizens were more responsive to e-government platforms that transmitted less detailed information, an excess of information and details derived in higher levels of dissatisfaction and criticism. Accordingly, the effects of government transparency on trust depend greatly on the way in which information is presented by the digital platforms (Porumbescu, 2016).

Relevant to this current study, trust perceptions may influence citizens' concern regarding the privacy of their online health information (Kenny & Connolly, 2016). Regarding technology for health, an increased trust in the technology provider showed less privacy concerns from the users (Kenny & Connolly, 2016).

### 2.5.2    Trust & Technology Adoption and Acceptance

The authors Pistilli & Pennarola (2016) discuss the reasons why technology mediated trust should be present in the UTAUT model, how it affects each of the variables, and

move forward in presenting an enriched model. Below are the different variables present in the UTAUT model, and their relationship with technology mediated trust:

- PE- if the user trusts the person behind the technology, he/she is more likely to attribute more value, generating a positive effect on behavioral intention.

- EE- if the user trusts the developer or issuer of the technology he will understand as true the information regarding ease of use, again positively affecting behavioral intention.

- SI- this variable contemplates the influence relevant peers have on users adopting the technology, this recognition of relevance is closely related to trust too: therefore, technology mediated trust strengthens the social influence, impacting positively on behavioral intention.

- FC- technology mediated trust is able to increase the credibility reinforcing the relationship between user behavior.

(Pistilli & Pennarola, 2016)

Notably, the authors stress the difficulty in measuring trust and trustworthiness of institutions and technology developers. This of course is a fact that is generally mentioned throughout the literature on the impact of trust (Pistilli & Pennarola, 2016).

These authors were not alone in believing trust should be included in technology acceptance models: Belanche, Casaló & Flavián (2012) state that trust and personal values should be integrated into the TAM model to evaluate the adoption of e-government services. To do so they test a set of new hypotheses related to trust in the TAM model, these are:

- PEOU can motivate users by increasing their trust, also an easy to use platform improves transparency.

- Trust affects PU, attitude towards use, and intention to use a given e-government service positively.

(Belanche et al., 2012)

Akkaya, Wolf & Krcmar (2013) try to understand the factors influencing e-government adoption in the German household. They argue that the perceived risk of using e-government tools and trust are essential for adoption. They continue to divide trust into, trust in government and trust in technology, or trust in the internet (Akkaya et al., 2013).

They propose a model combining some variables present in the literature, where trust is a key aspect for e-government adoption.

The present theoretical background presented through this chapter contain several key issues that will be addressed and contemplated in the following chapter where the conceptual framework guiding the research will be presented.

# 3 Conceptual Framework

The current chapter will determine the way in which the concepts and theories presented in chapter 2 can help guide the current research, the key variables, and hypotheses relevant to this case study. Figure 5 represents a graphic interpretation of the conceptual framework that will be used to analyse the case study of the digital application for COVID-19 in Argentina: the CuidAR application. This framework consists of six main variables that affect the behavioral intention and the motivation of citizens to adopt the digital solution implemented by the government to tackle the pandemic in the country. Furthermore, this means it is not only the behavioral intention to adopt the technology but it is also related to their motivation to co-produce by using the application.
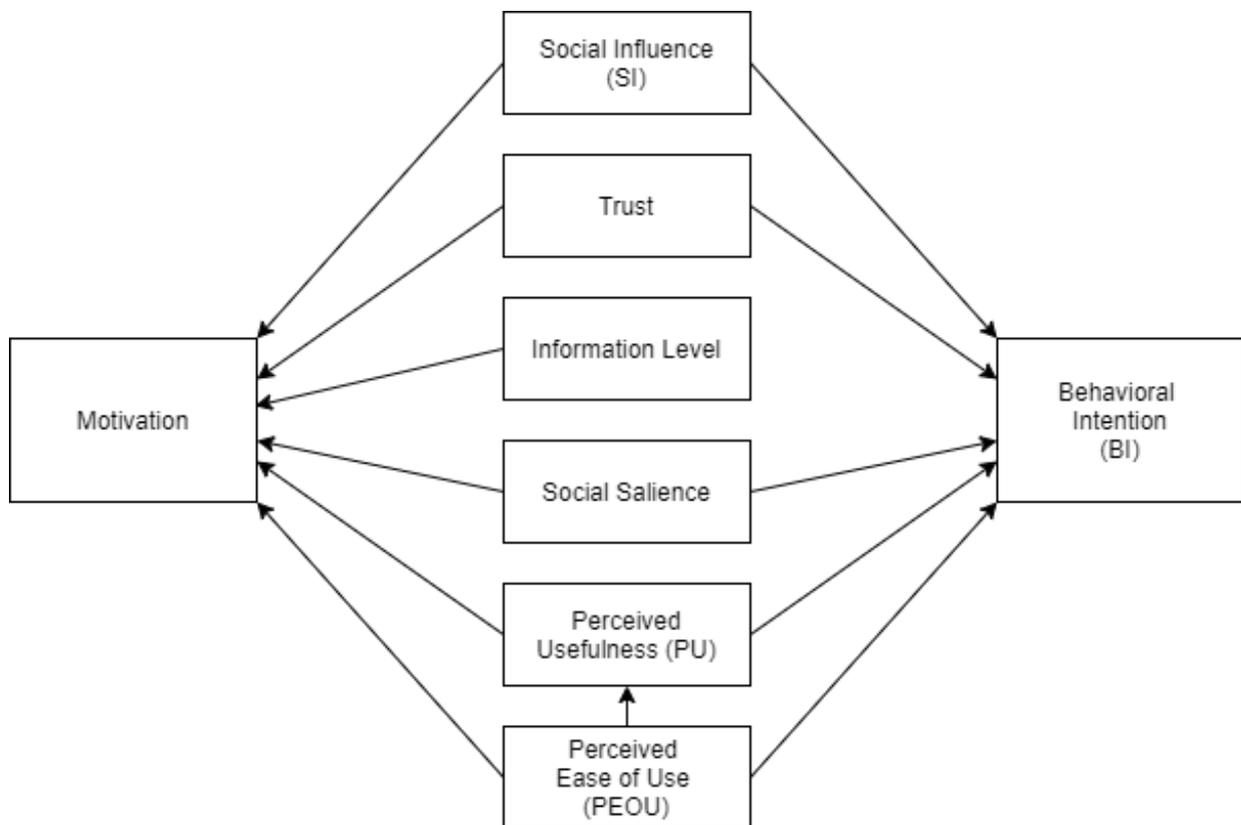


**Figure 5 Proposed Conceptual Framework Derived From Literature**

This conceptual framework is by no means conceived as a comprehensive and exhaustive explanation of the factors affecting citizen digital co-production and technology adoption, but is intended as a conceptual guide to help organize the analysis of the case study of the digital application introduced by the Argentine government to support the range of measures implemented to control the spread of COVID-19. Nevertheless, the conceptual

framework could be applied to other cases, as the main variables are derived from the literature on the topics.

## 3.1     Independent Variables

In the next subsections the independent variables of this conceptual framework will be presented. Independent variables are those that influence the dependent variables. This means that changes in the independent variable will somehow have an impact on the dependent variable, in this case behavioral intention and motivation. The independent variables for this thesis are the factors affecting citizen motivation to co-produce and to adopt new technologies and have been determined by the prior literature, these are: 1) Social Influence, 2) Trust, that has further been divided into trust in government, technology-mediated trust, and trust in correct use of data 3) Information Level, 4) Social Salience, 5) Perceived Usefulness, 6) Perceived Ease of Use.

### 3.1.1     Social Influence

For this framework, SI is understood as in the UTAUT model: "the degree to which an individual perceives that important others believe he should use the new system" (Cauter et al., 2014, p. 74). This includes what society believes about the application and what the government believes one should do. This is closely related to extrinsic motivation to co-produce, not necessarily a material reward but an expression of appreciation from a relevant elder, as it is crucial for citizens to see their participation as useful and valued (Petukiene et al., 2012). And also, to sociality, as mentioned by Alford (2009) as the enjoyment of receiving the approval of others.

Therefore, the following hypotheses are presented for social influence:

**H1a:** *There is a relationship between Social influence and behavioral intention.*

**H1b:** *There is a relationship between Social influence and motivation*

### 3.1.2     Trust

As detailed throughout chapter 2, trust is a key variable affecting citizens' behavior. In this framework trust will focus on trust in government, trust in technology or technology-mediated trust, and trust in data protection measures.

The view on trust in  technology adoption is closer to that mentioned by Akkaya, Wolf & Krcmar (2013), that trust is essential for technology adoption, and further divides it into trust in government and trust in technology or "the internet" in this case it will be the

software or application. The views presented on trust and technology adoptions such as Belanche et al., (2012) and Pistilli & Pennarola (2016) focus on how trust affects the different variables represented in this conceptual framework. Trying to understand the correlation between trust and all the variables, would be a very complicated task and probably would not have the desired outcome for the scope of this research.

Moreover, as mentioned in section 2.5.1 there is a very close relationship between trust and co-production as trust in government will affect the desire of citizens to engage in the co-production processes (Eijk & Steen, 2015), lack of trust can represent a barrier to citizen participation (Gordon et al., 2016; Fledderus & Honingh, 2015). As mentioned by Porumbescu (2016) and Clifton et al. (2020) the lack of citizen trust reduces citizen participation in digital co-production. Finally, when co-producing includes providing health information, citizens that have increased trust in technology, and the technology provider (the government), manifested fewer privacy concerns (Kelly & Connolly, 2016).

Therefore, the following hypotheses are presented related to trust:

**H2a:** *There is a relationship between Trust in government and behavioral intention*

**H2b:** *There is a relationship between Technology mediated trust and behavioral intention*

**H2c:** *There is a relationship between Trust in the correct usage of data and behavioral intention*

**H2d**: *There is a relationship between Trust in the correct usage of data and motivation.*

**H2e:** *There is a relationship between Technology mediated trust and motivation.*

**H2f:** *There is a relationship between Trust in government and motivation*

### 3.1.3    Information Level

As Pestoff (2012) mentioned, one of the factors one has to understand regarding citizen involvement in co-production practices is the ease with which this can be done. In order to be able to participate, the citizens have to have certain information available about the service. The information level in this framework relates to the knowledge of the citizens regarding the service. Nevertheless, Porumbescu (2016) mentioned the importance of how the information is presented, higher levels or excess information can sometimes lead to more dissatisfaction.

Below is the hypothesis presented related to the information level:

**H3**: *There is a relationship between the information level and motivation*

### 3.1.4   Social Salience

Social Salience represents how the issues at hand, the co-production of services, or the use of technology affect or are important to the community. To see if citizens believe that their use of the digital e-government solution will be beneficial for society. This is closely related to external efficacy as a motivation to co-produce, citizens must believe that their participation will affect the decision-making process (Eijk & Steen, 2015). For this variable, the belief of the benefits provided to society will be used, and if they believe that using the application will be useful for the government to better understand the COVID-19 situation in Argentina. Moreover, social salience is associated to normative beliefs or individuals as mention in the TRA model.

Therefore, the following hypotheses are presented for social salience:

**H4a:** *There is a relationship between Social salience and behavioral intention*

**H4b**: *There is a relationship between social salience and motivation*

### 3.1.5   Perceived Usefulness

Perceived usefulness is as mentioned in the TAM model, where citizens will use the IS if they believe it will help them, make things easier for them. In the UTAUT model, it would be PE. Additionally, when talking about motivation to co-produce, PU is also key: citizens will be more willing to co-produce if they believe the service and outcomes of their participation will be useful for themselves; the more salient the service the more they will be willing to participate (Pestoff, 2012).

Therefore, the following hypotheses are presented for Perceived Usefulness:

**H5a:** *There is a relationship between Perceived Usefulness and behavioral intention*

**H5b**: *There is a relationship between Perceived Usefulness and motivation.*

### 3.1.6   Perceived Ease of Use

In this framework, PEOU will be understood as the one presented in the TAM model: if an application is useful, it will only be used if it is perceived as easy to use, the benefits of using it must overcome the effort related to using it (Bradley, 2012). Consequently, PEOU will also affect the PU. However, it also relates closely to citizens believing that co-producing is possible and easily done. According to Pestoff (2012), citizen

involvement is determined not only by their motivation to co-produce but the ease with which co-production can be done. In some measure it involves a cost-benefit transaction perceived by citizens regarding the time and effort needed to co-produce (Pestoff, 2012).

Therefore, the following hypotheses are presented for PEOU:

**H6a:** *There is a relationship between Perceived ease of use and perceived usefulness*

**H6b:** *There is a relationship between Perceived ease of use and behavioral intention.*

***H6c***: *There is a relationship between Perceived ease of use and motivation.*

## 3.2    Dependent Variables

The dependent variables in this study are the Behavioral Intention of the citizens to use the technology and their motivation to co-produce with government. The results presented in chapter 6 and the analysis in chapter 7 will portray the effects the previously mentioned independent variables had on BI and motivation. The next subsections will describe what is understood as BI and motivation in this research. Moreover, the belief of some relationship between PEOU and PU will also be tested, but these variables have been explained previously.

### 3.2.1    Behavioral Intention

Behavioral intention is understood in this thesis as the intention to use this application by downloading the application or not. As explained, BI relates to how the different variables expressed previously affect the intention of the user. Therefore, BI is composed of the aspects explained in the TRA model, the TAM model, and the UTAUT model.

### 3.2.2    Motivation

Motivation is understood as the citizens motivation to participate with government to co-produce by using the application CuidAR. In this case, the co-production process is somehow a by-process of using the application, but their motivation was analysed separately.

## 3.3    Summary

The current chapter described the different variables involved in the conceptual framework that will be used throughout this research. Table 1 shows the different hypotheses that will be tested.

| Summary of Hypotheses |
|---|
| **Social Influence**<br>**H1a:** There is a relationship between Social influence and behavioral intention.<br>**H1b:** There is a relationship between Social influence and motivation |
| **Trust**<br>**H2a**: There is a relationship between Trust in government and behavioral intention<br>**H2b:** There is a relationship between Technology mediated trust and behavioral intention<br>**H2c:**  There is a relationship between Trust in the correct usage of data and behavioral intention<br>**H2d:** There is a relationship between Trust in the correct usage of data and motivation.<br>**H2e:** There is a relationship between Technology mediated trust and motivation.<br>**H2f**: There is a relationship between Trust in government and motivation |
| **Information Level**<br>**H3:** There is a relationship between the information level and motivation |
| **Social Salience**<br>**H4a:** There is a relationship between Social salience and behavioral intention<br>**H4b:** There is a relationship between social salience and motivation |
| **Perceived Usefulness**<br>**H5a:** There is a relationship between Perceived Usefulness and behavioral intention<br>**H5b:** There is a relationship between Perceived Usefulness and motivation. |
| **Perceived Ease of Use**<br>**H6a:** There is a relationship between Perceived ease of use and perceived usefulness<br>**H6b:** There is a relationship between Perceived ease of use and behavioral intention.<br>**H6c:** There is a relationship between Perceived ease of use and motivation. |

**Table 1 Summary of Presented Hypotheses**

The hypothesis will be tested through a series of correlations, and the results will be presented in Chapter 6 of the research.

# 4 Methodology and Research Design

This is a case study to examine the adoption of the CuidAR application in Argentina and the factors affecting its acceptance in society: such as trust in government and data security, perceived usefulness, perceived ease of use, and motivation to co-produce with the government. A deductive approach was used for this study, where pre-existing theory was utilized as a basis for the formulation of hypothesis (Silverman, 2017). This positivistic approach goes from the general to the particular: from the general theory to the specific knowledge gained in the research process, that is then tested against the conceptual framework (Kothari, 2004). Usually deductive approaches are associated with quantitative research, where an empirical study can be developed through a questionnaire and the gathered data can help sustain the hypothesis or not. This also allows for the research to be repeated if needed. Nevertheless, in this case, a mixed-method approach was used combining quantitative and qualitative methodology in order to analyse a cross-sectional time horizon, a study of a phenomenon at a specific point of time: the COVID-19 pandemic in Argentina (Saunders & Tosey, 2013). Figure 6 shows the research design for this thesis, and the methodological path taken in order to answer the research questions.
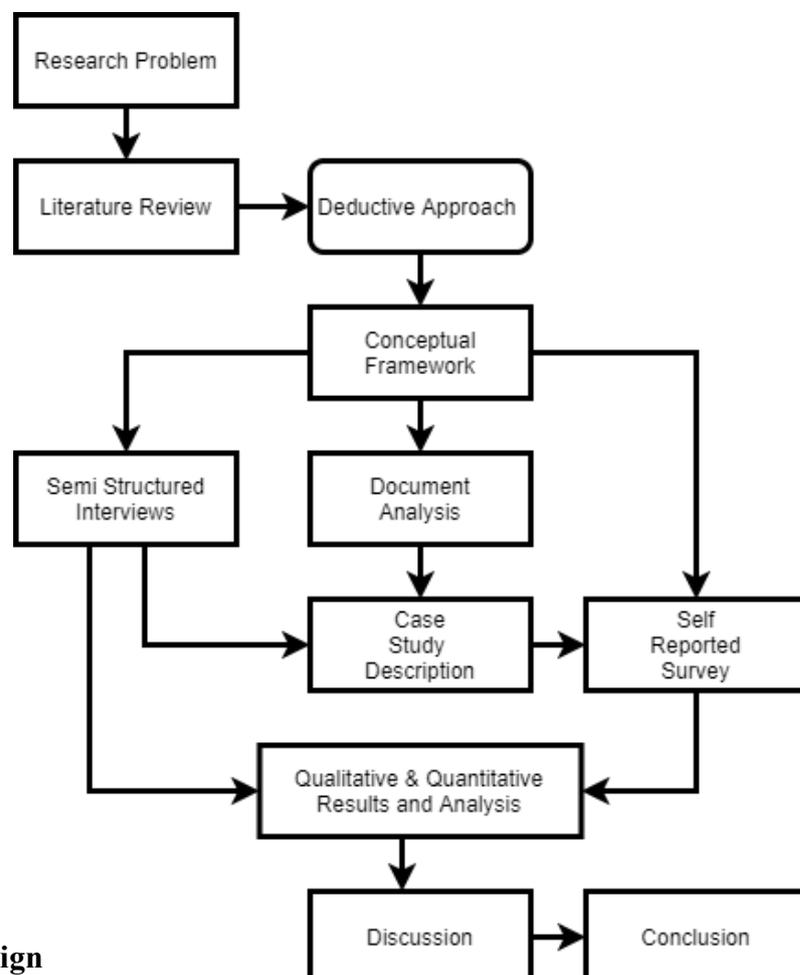


**Figure 6 Research Design**

The following sections will explain the methods chosen for this research paper, introducing data collection processes and data analysis approaches used to answer the research question and the limitations to the methodology selected.

## 4.1 Single Case Study

This research follows a clear methodological path as shown in figure 6: one of the key aspects of a case study as mentioned by Robert Yin (2014). Moreover, a single case study is ideal for this research as it focuses on a contemporary event, and the researcher has no control over the behavioral events (Yin, 2014). A case study also relies on a great variety of evidence, in this case, document analysis, semi-structured interviews and a self-reported survey were used to collect evidence. According to Yin's (2014) twofold definition of the features and scope of a case study, case study research is an overarching mode of research: 1) it investigates a usually complex scenario where the boundaries between the case and its context are not clearly defined, and 2) it is a contemporary phenomenon and needs theoretical propositions that guide the design, collection and analysis of data. By conducting a single case study with a mixed method of data collection approach, a holistic analysis of the phenomenon can be achieved. A case study also represents the opportunity to shed some empirical light on the concepts developed in this study's theoretical background (Yin, 2014). The case was selected because it was appropriate at this time to analyse these factors and because of accessibility of data through connections in the country, the absence of any language barrier as well as prior contacts.

## 4.2 Data Collection Methods

In order to be able to answer the research questions regarding the case study, a mixed method of data collection was used: document analysis, semi-structured interviews, and a self-reported survey. Firstly, a document analysis was carried out, where various documents relevant to the case study were analysed to find pertinent information regarding the creation of the digital application in Argentina. Secondly, two semi-structured online interviews were key to identify main aspects of the creation of the application, details on the process and actors involved. Thirdly, a digital self-reported survey was distributed online for Argentine citizens and residents to answer. Document Analysis is combined with the interviews and the survey to create a triangulation, where the researcher can draw upon multiple sources of evidence, helping to avoid biases that could exist with one single data collection method (Bowen, 2009). By using a mixed-method approach of quantitative and qualitative methods, the biases and limitations of

each technique can be reduced (Lee & Smith, 2012). In the following sections these methods will be explored in detail in order to show how, together, they provided the relevant data for the research.

### 4.2.1 Secondary Sources – Document Analysis

The case study involves a very current, ongoing, situation: the impact of COVID-19. The focus is on Argentina, and more so on the digital solution proposed by the government as a technological aid to tackle the spread and effects of the virus. With the aim of being able to comprehend the timeline of actions carried out by the government, a series of official decrees and provisions were analysed. Furthermore, the different government online portals were scrutinized to gather all the information regarding the CuidAR application, the operating system, versions, terms and conditions, how it works and why it is offered to the citizens, what is done with the data collected, and the benefits of using the application. Documents developed during the crisis from relevant organizations such as the United Nations Development Programme (UNDP) and the Inter-American Development Bank (IADB) were used to help describe the situation in the country, especially in the informal settlements, where overcrowding and poor infrastructure create a dangerous combination for the vulnerable population. At the same time, many national and international news portals helped provide contemporary information on the case at hand.

Mixed-method studies usually include document analysis, even though it is sometimes used as a stand-alone method (Bowen, 2009). The documents can help by providing contextual information and can show information gaps that must be further explored with other data collection methods, and can, in some cases, also provide supplementary data which supplements information provided by other sources (Bowen, 2009).

### 4.2.2 Semi-Structured In-Depth Interviews

In qualitative studies, the most common way to collect data is by means of interviews. Semi-structured in-depth interviews are those with a pre-set of open-ended questions that interviewees must answer. This method allows for a conversation to take place, while at the same time tackling all the desired topics, allowing for the relevant information to be gathered (Jamshed, 2014). The questionnaire that was used to conduct the interviews can be found in Appendix A of this document.

For the current study, e-mails were sent out to all the organizations participating in the development of the CuidAR application. This included the Public Innovation department of the national government, the National Scientific and Technical Research Council

(CONICET), and the private companies, all of them part of the Argentine Software Industry Chamber (CESSI). The national government, who commissioned the development of the application, was not able to grant an interview, but delegated this task to the Fundación Sadosky (Interview A, 2020), a public organization that led the team of developers and worked as the nexus between the government and the private companies donating their time and human resources to develop the application. The second interview was with one of the partners of Hexacta (Interview B, 2020), one of the largest companies involved in the creation of the application. Both interviewees shared contacts, creating a snowball effect in trying to collect more primary data, sadly, these were not successful.

### 4.2.3    Self-Reported Survey

The conceptual framework developed in chapter 3 was the basis for designing a digital survey for citizens and residents in Argentina during the COVID-19 pandemic in 2020. In this section, the reasons for using this method of data collection will be presented alongside the benefits it offers.

One of the main reasons for conducting a survey lies in the fact that an online survey allows for a large amount of data to be collected in a short timeframe, and in this case, it is completely free. The survey is based on self-reporting from the population: to put it another way, participants are asked about their feelings, attitudes, and beliefs on a certain topic. This special-purpose survey is ideal for gaining insights of participants in observational studies and may be the only way to make sure that all the data needed is available, and can be somehow related (Fowler, 2014). Additionally, the anonymity of the conducted survey, where no register of personal details from respondents was collected, allows participants to feel free to answer and to be honest about their responses, making the results more dependable (Fowler, 2014). As stated by Fowler (2014), surveys must follow a certain procedure in order to achieve the best results to accurately describe the sought objectives, these are: sampling, designing questions and data collection.

**Sample and Targeted Population**

It is almost impossible and highly impractical to study the whole population in any given research; consequently a sample of participants is used to represent the population.  The targeted population of this research were Argentine citizens or residents living in the country during the COVID-19 crisis. The sample is a much smaller group than that of the population studied, but to a certain extent inferences of the population can be made from the results of a survey (Kadam & Bhalerao, 2010). The suggested sample size[1] with a confidence level of 99% and a margin of error of 5% is 666 respondents. The total number

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[1] Sample size calculated with online sample size tool available in surveymonkey.uk

of respondents to the survey, which was conducted entirely online, was 845, slightly above the recommended sample size. This can somehow aid in reducing biases of data collection methods. This digital solution offers an easy to use tool, both for the researcher and the respondent, and allows for a simple way of gathering information. The survey was distributed on a variety of social media platforms such as: Facebook, Twitter, Instagram and WhatsApp. Furthermore, the survey was shared with the relevant members involved in the creation of the application. Several online groups in different geographical areas of Argentina accepted the publication of the survey, thus somewhat expanding its outreach.

**Questions and Survey Design**

The conceptual framework was used as a guiding structure to develop the questions for the survey. Due to the fact that several theories and models were used to develop said framework, the questions and statements in these studies were used as guides to create the questionnaire: Davis et al., 1989 and Venkatesh et al., 2003 & Jones, McCarthy, Halawi, & Mujtaba, 2010. This case is a novelty, and very particular to the case study: none of these questions were completely applicable but used as a reference to design new questions.

Many surveys provide respondents with statements, where they have to agree or disagree with what is being said, others provide questions, a more direct way of conducting a survey. A short survey was sent out to twenty Argentine citizens, asking if they preferred to answer surveys with statements where they had to agree or disagree, or direct questions. The results from this pre-survey was that eighteen respondents preferred direct questions over statements, as they believed this option to be clearer and more straightforward. They also mentioned that they would often agree with parts of statements, and disagree with others, which would make it difficult for them to answer. Therefore, the survey was created focusing on questions instead of statements. This short survey is available in Annex C and the complete survey sent out to the Argentine population can also be found in Annex D.

As mentioned by Presser et al. (2004), pretesting of surveys dates back to the 1930s and based on experience a small trial usually reveals numerous problems: this is why once the questions were defined, a pre-test of these was executed. A total of twelve Argentine citizens, of different ages and gender tried out the survey. They were asked to analyse if the questions were hard to read, presented comprehension difficulties, or if they found trouble trying to answer the questions, the pilot also sought to focus on practical aspects of the survey such as if the task was achievable and clear (Fowler, 1995). The feedback received was in regard to:

- Time taken to complete the survey: this helped define the time to complete the survey in the survey instructions. If the survey was too long, it would affect participation.

- Unavailable options for answering some questions: some questions needed adjustments to allow better representation and validity of the targeted population.

- Improved wording: some questions were not clear for people not familiarized with the topic; therefore, some improvements were made to include a more inclusive language.

- Opt-out option: in some questions an opt-out option was missing that was then added.

- Technical issues: as the survey was conducted online, the pre-test was conducted both on a computer and a mobile phone, this way respondents could give their feedback regarding technical suitability and visibility of the survey.

## 4.3    Data Analysis

Most of the questions in the survey were designed on a 5-point Likert scale, and in some points a 3-point Likert scale was used. The use of odd options of choice is to allow the respondents an opt-out, neutral or exit option. By doing this, respondents are not forced to make a choice, somehow improving the validity of the results (Joshi, Kale, Chandel, & Pal, 2015). An example of this is when asked about the image portrayed by media the options to answer were: "very positive", "positive", "neutral", "negative", "very negative". The frequencies and percentages of the selected answers will be used as descriptive information in the results section.

To be able to see the relationship between variables Spearman's rank correlations will be run through the program SPSS belonging to the technology company IBM. Due to the fact that most of the data collected is ordinal, this means that the values represent categories, as in the likert scale used throughout the survey, a Pearson's correlation will not be run to test the hypotheses (de Winter, Gosling, Potter, 2016). The Spearman correlation coefficient measures the strength of the relationship between the variables that ranks between -1 to +1 as follows is the rank that will be used to define how strong or weak a correlation between variables is:

- + or - .00 to .19: Very weak

- + or - .20 to .39: Weak

- + or - .40 to .59: Moderate

- + or - .60 to .79: Strong

- + or - .80 to 1.0: Very Strong

To test the statistical significance of the correlations the "p-value" or probability value will be used. If the p value is higher than 0.05, it will be assumed that there is no relationship between the variables, therefore the null hypothesis will be accepted (Kain & MacLaren, 2007). With values below 0.05 the null hypothesis will be rejected assuming there is a relationship between variables, then the correlation coefficient will determine how strong or weak that relationship is.

## 4.4     Limitations to Methodology

Every research paper contains some limitations, this case study is no exception. The shortcomings to the research methodology and design will be discussed below, along with some of the steps taken to reduce the effect of these constraints.

Firstly, this study represented a case study, an analysis of the motivation to co-produce with the government during the COVID-19 crisis in Argentina. The particularities of the effect of the coronavirus on different countries, the socio-economic environment and political context make the findings hard to extrapolate. Nevertheless, the methodological design can be re-used for further studies in other cases, and as Yin (2014) stated, "case studies are generalizable to theoretical propositions". If this were to happen, it would be interesting to add some macro environment variables in the study to be able to compare the findings in different countries.

Second, the self-reported survey has several limitations: it collects information on people's beliefs, feelings and perceptions, which in many cases can be biased. Furthermore, in Argentina there is a high political polarization (Kornstanje, 2016), as there is a bipartisan rivalry that splits the country in two. This political determination can somehow affect people's answers, because they may believe that the survey is somehow intended to criticise the current government. Also, this method of collecting data, or defining the sample is somewhat biased for several reasons: only citizens and residents with access to the internet and/or access to a computer or smartphone could answer the survey and the outreach and network of the researcher is relatively  limited, as not all the provinces in Argentina are represented in the survey results. Nevertheless, as the study focuses on a digital mobile application, it is very logical to only focus on citizens that have access to the internet and digital tools. In order to reduce the bias in the survey to

some extent, the number of respondents was increased, going over 50% of the required sample size, allowing for less margin of error and higher representativeness.

Thirdly, two in-depth semi-structured interviews were conducted to gather information on the creation, development and design of the application. These interviews provided useful information on how the team was divided, how the responsibilities were assigned and some insights on how the relevant stakeholders viewed the government interaction and promotion of the application. Having more interviews would have been interesting to be able to have a variety of viewpoints. Due to the current situation in the country, most companies that already donated their time in developing CuidAR, were not available for a conversation.

Fourth, the current case study is ongoing, this has some benefits: citizens are asked for their opinion, and perception of the application, and this is still fresh in their minds. Meanwhile, the flexibilization of quarantine could imply that people will find more use in the application soon. A limitation regarding this temporal constraint is that there is little documentation surrounding the case, the numbers on downloads, versions and improvements to the application are still raw and in many cases newspaper articles have been used to complement the information on the COVID-19 scenario.

# 5 Case Study Description

In this chapter the case study that is analysed in this research will be described. Firstly, a small introduction of the effect and current situation of the COVID-19 pandemic (July 2020[2]) on Argentine territory will be presented. In second place, the digital solution created by the government alongside several private organizations will be identified: why it was created, how it works and what were the privacy and security measures included in the system. The information gathered and analyzed for this section include official government documents such as decrees and administrative decisions, government online portals, newspaper articles, and two primary sources from the interviews conducted.

## 5.1 COVID-19 in Argentina

By the beginning of February COVID-19 was already a notorious health issue around the world. Meanwhile, in Argentina, the Minister of Health was declaring that there was no need to fear the virus as it would not reach the country: there were no direct flights from China and the warm summer temperatures would not allow the virus to thrive in the Argentine territory (Tiempo Argentino, 2020). The Minister of Health continued to explain that children were not at risk of contracting the virus, as the number of cases among young children was low and classes would start in 2020 with no exceptions (Ámbito Financiero, 2020). Nevertheless, security protocols were implemented at the international airports, in an attempt to catch possible cases entering the country (Infobae, 2020).

The pandemic found Argentina in an already fragile state, with poverty rates of 35.5%, inflation of 50%, a new Government in office and trying to negotiate a sovereign debt (Alzúa & Gosis, 2020). On March 3rd the first reported case of COVID-19 appeared in the city of Buenos Aires, the Argentine capital. Patient zero was a traveller returning from Milan, Italy, one of the hotspots of the virus in Europe at that time (BBC, 2020). Only four days later, the first COVID-19 related death was confirmed in the country (BBC, 2020b). The Argentine Minister of Health stated that the early arrival of the virus in the country had taken him by surprise (Infobae, 2020b). By mid-March the government began to take action to find ways to stop the spread of the virus in the country, so a health emergency was declared (Decree 260/2020), land and air borders were closed: tourists travelling from at-risk countries were denied entrance to the country, music concerts, private events with over 200 people and school classes were cancelled (La Nación, 2020). On March 20th, the Argentine President, Alberto Fernández, declared a strict lockdown of all the Argentine territory until April 12th with the end goal of protecting public health

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[2] The current state of effects and daily cases of COVID-19 in the country continue to change.

and avoiding the spread of the virus, people were obliged to remain in their homes, only leaving for essential reasons: food and medication (Ministerio de Salud, 2020). Argentina is a federal country, smaller cities showing low numbers of active cases were slowly allowed to move towards a more open system of social distancing (Decreto 576/2020). On the other hand, the metropolitan area of the Province of Buenos Aires (AMBA) and the City of Buenos Aires (CABA), have continued to show a growing number of daily cases, forcing the government to extend the strict lockdown until August 16th.

On July 14th the total number of registered cases in the country reached 106,910[3] and the number of deaths attributed to COVID-19 was 1,968. The province of Buenos Aires was home to a total of 57,925 cases and 975 deaths, whilst CABA had 40,237 diagnosed cases and 745 deaths. This means that the province represents 54% of the infected cases, and the city another 37%: in summary, the whole area is the largest hotspot in the country with 91% of the diagnosed cases. On July 14th the number of daily cases in the province of Buenos Aires was 2262 and in the city 1039 (Coronavirus Argentina, 2020). The total population in the region is estimated to this day to be around 20 million people, representing almost 50% of the country's total population (INDEC, 2020).

Knowing the impact social lockdown would have on the economy, some special economic measures were implemented. An emergency fund was distributed amongst the most affected families of 10,000 Argentine pesos, an approximate equivalent of 120 Euros, focused primarily on unemployed citizens or those without any proper income (Ministerio de Economía, 2020). Due to high inflation rates, rental contracts include inflation clauses, with price increases every four to six months: rental prices have been frozen by law, and evictions banned in order to avoid affected families becoming homeless (Ministerio de Economía, 2020). Various tax measures were implemented during the health emergency, including some payment extensions and suspensions. Furthermore, some benefits were granted to autonomous workers, companies, and the self-employed such as loans with low to no interest rates, unemployment insurance extension, and emergency subsidies provided by the government (Ministerio de Economía, 2020; Decree 376/2020). The quarantine was mostly kept, but partially relaxed to allow new essential activities to operate, the fear of economic depression and the lack of financing available create a very unstable economy, the economic impact of the lockdown will increase unemployment, reduce incomes and increase uncertainty (Alzúa & Gosis, 2020).

During the lockdown, the Ministry of Health was able to increase intensive care facilities by 37%. Also, recovered patients were called to donate blood in order to create a COVID-

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[3] By August 4th cases had reached 213 535 and deaths 3979.

19 antibody serum. The Ministry has tried to continue supplying the necessary medical treatment to patients throughout the country, while at the same time supplying hospitals with the necessary equipment to treat COVID-19 cases (Ministerio de Salud, 2020).

The strict lockdown alongside the various sanitary measures such as the obligation to wear facemasks in public places has managed to keep the death rate low, around 35[4] deaths per million inhabitants, compared to other Latin American countries (Worldometer, 2020). Every day the Ministry of Health publishes an official gazette with the current cases, new deaths and availability of hospital beds (Reporte Diario Matutino, 2020).

By mid-July the AMBA area had already undergone 119 days of lockdown, one of the longest lockdown periods in the world due to COVID-19. Essential workers and a few primary sector providers were allowed to continue working, but the general population could only move about for medical appointments or to take care of the elderly and children (Certificado de Circulación, 2020). In order to be able to move around in the city, citizens must have a valid permit. This permit can be obtained through the government website, or through the government application for COVID-19 called CuidAR. Details of the application, how, when and why it was created, and all the security details, procedures and services available in this e-government platform will be described in the following sections of this chapter. The government has not been the only one to reach out to digital solutions for COVID-19. Many private companies, stores, and food and drink establishments have had to offer customers new alternatives in order to continue in business. People can now purchase more goods online than before and online sales have increased by 84% (Infobae Económico, 2020).

One of the riskiest areas for the spread of the virus was the informal settlements that are widely present in Buenos Aires. Since 1950, urban areas in Latin America have seen a pronounced increase in population with about 80% of its population living in cities (Adrienne Arsht Latin American Center, 2014). The states' capacity to provide proper infrastructure, services and housing has lagged. This has led to informal settlements that are excluded from the formal market, denominated slums (Pírez, 2013). The city of Buenos Aires has over 39 slums or informal settlements (Suárez, Mitchell, & Lépore, 2014). These informal and densely populated neighbourhoods with inappropriate infrastructure hinder the efforts to control COVID-19 amongst its population. The poor infrastructure, overcrowding, reduced family income due to the crisis and lack of good internet connectivity precluding the possibility of remote working are some of the challenges faced in these neighbourhoods (Vera, 2020). Furthermore, these

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[4] Data from July 14th

neighbourhoods contain a highly vulnerable population. The government of CABA did a thorough job in trying to contain the virus in the neighbourhood of Barrio 31, one of the oldest slums in the city (Vera, 2020). The government worked with the neighbours and political leaders to spread the message of the importance of hygiene, and the social distancing rules, also sanitation checkpoints were installed in many entrances to the neighbourhoods. People with symptoms related to COVID-19 were tested and isolated, and manual contact tracing was conducted.  The older, high risk population, where social distancing was possible, were offered a service of food delivery, and containment, whilst those who lived in worse conditions were offered a stay in a distancing centre (Vera, 2020). The government sought to slow the spread in this area, offering support and assistance when needed and providing food security and rights to the citizens. WI-FI spots were installed in the area, and mobile phones distributed to reduce the need for moving around and to encourage people to stay at home. Furthermore, these digital tools can help reduce the educational inequality which grew due to the pandemic, as some families had no access to digital tools to continue with education (Vera, 2020)

## 5.2     The Argentine Government Digital Application for COVID-19 – CuidAR

The WHO and the Pan American Health Organization (PAHO) support the use of information technology (IT) to help detect cases faster, guarantee the attention and follow up of cases and avoid the virus transmission, this practice has extended throughout several countries in the world (Jefatura de Gabinete de Ministros, 2020). As an integral part of the strategy for prevention and care of public health in light of the COVID-19 pandemic, the national government developed the system and application CuidAR (Decisión Administrativa 432/2020). The use of IT facilitates the detection and monitoring of cases, this is why the government promotes the use of the CuidAR application. This application, alongside other emergency health policies, have succeeded in flattening the curve, and for many of the provinces with less population to gradually resume social, economic and administrative activities. The effective and efficient use of the application has reinforced the response rate of the government, mitigating the virus transmission (Jefatura de Gabinete de Ministros, 2020). The use of the application is voluntary, with the exception of travellers returning from abroad, when it becomes compulsory according to the Migration Agency (Disposition 1771/2020).

The application is linked to a larger system that articulates information with the different health areas in charge of care during the crisis, not only from the national but also provincial governments. The application provides prevention and care to the population and provides concrete input for the sanitary intervention of the health ministries throughout the country. Furthermore, CuidAR is associated with the permit to move

about, or "Certificado único habilitante para circular" (CUHC), during the lockdown only people with this permit and having an essential job are allowed to use public transport and move further than essential services near their homes. Citizens with CUHC for assisting elderly or medical appointments are not allowed to use public transport, if they do, their transport ticked will be blocked after the second use.

For the development of the application a consortium was established with public sector organizations such as Fundación Sadosky, CONICET, the Argentine Satellite Solutions company (ARSAT); private sector companies such as Hexacta, Globant, G&L Group, C&S, Qservices, GestiónIT, Intive, Finnegans y Faraday, all belonging to the Argentine Software Industry Chamber (CESSI). Also, Amazon Web Services was part of the project (Jefatura de Gabinete de Ministros, 2020). A very important aspect of this consortium was that all the time and human resources from the private sector was completely donated, they worked in a collaborative format due to the limitations regarding public tendering and contracts. They donated their time, human resources and experience to the Argentina society, a total of over 110 people working full time during four non-stop weeks (Interview B, 2020; Finnegans, 2010).

### 5.2.1 How does the application work?

After downloading the application, a series of personal data must be introduced such as: full name, ID number, gender, and phone number. The second step is to conduct a health self-assessment to see if the self-test is compatible with COVID-19 symptoms. This form is a sworn statement, so should not be done lightly, if no signs of the disease are there it must also be repeated every 48hs. According to the results of this test, the application will give some recommendations if needed:

- Those who have no symptoms and no need or permission to move around, will be reminded not to leave their homes, to do so only for groceries, medication, essential paperwork or banking transactions and to follow the preventive measures.

- Those who have valid reasons to go out, can process their CUHC, the application will give them a QR code and token and remind them of the sanitary measures when leaving home.

- Those with permission or not to leave home that are diagnosed with COVID-19 symptoms from the application, will be instructed to self-isolate as a preventive measure and will be provided with emergency numbers or contacted according to the jurisdiction where they are living.

(Jefatura de Gabinete de Ministros, 2020)

All the information from the self-assessment is managed by the Provincial Emergency Committees (COEPs). The COEPs have a dashboard for each province, which will allow them to contact those citizens with COVID-19 symptoms, offer them assistance, provide health services, provide support and all the required information (Jefatura de Gabinete de Ministros, 2020). The COEPs are the only ones allowed to follow-up on these cases, to take care of and assist those at risk of COVID-19 and contain the expansion of the virus, thus avoiding overwhelming the health system (Jefatura de Gabinete de Ministros, 2020).
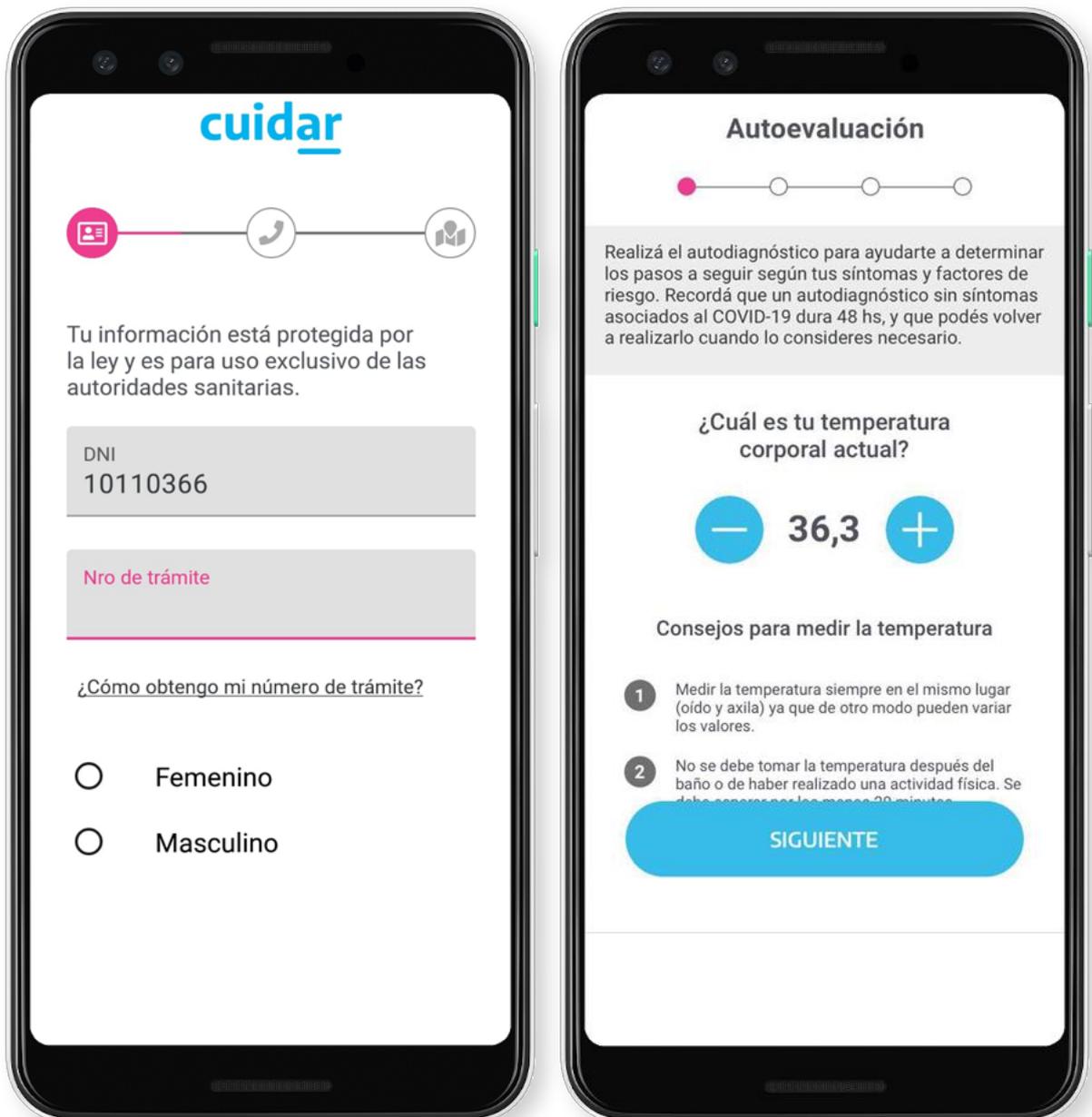


**Figure 7 Registration interface with national ID and Health self-assesment interface**

The images shown in Figure 7 are screenshots of two of the main interfaces of the CuidAR application. The one on the left is the initial phase, where citizens must enter their ID number and code to be able to register. On the right, a screenshot of the first page of the health self-assessment is shown, it also describes that a healthy result is only valid for 48hs and that the test must be redone after this time period.



**Figure 8 Results of health-assesment & CUHC interface**

The next two screenshots displayed in Figure 8, represent the results given to a healthy citizen after conducting the assessment. It reminds people to follow security measures, and only leave their homes for essential reasons. The last screenshot is a valid CUHC,

that allows the citizen to move around by their own means of transport, public transport is reserved only for essential workers. As seen in the picture, a QR code and a security token are included in this interface.

### 5.2.2    Data Collection and Privacy Measures

One of the biggest worldwide concerns regarding IT solutions to COVID-19, has been the privacy measures involved, and the lack of information on what happens to the data collected (Kitchin, 2020).  In this section the privacy and data collection details for the CuidAR application will be described. As mentioned in the application's terms and conditions, it complies with the national law on protection of personal data, and the database with all the collected data is duly registered (Ley N°25.326, 2001; Disposición 3/2020). The application has been designed to assist the government and citizens throughout the pandemic; once the crisis is overcome, and in compliance with the personal data regulations, the data will be eliminated, only anonymized aggregated data will be saved for statistical knowledge and evidence (Jefatura de Gabinete de Ministros, 2020). Also, the new version of the application allows for citizens to contact the government and demand the elimination of all their data and reverse engineering is allowed for the application code to be audited, increase transparency and allow for comments and feedback from the population (Términos y Condiciones, 2020). According to Interview A (2020), the government and the consortium are working towards publishing the code, The Interviewee also mentioned that this had always been the original plan, but due to the speed with which the application was created, they had to prioritize security and did not want to make the code vulnerable. Nevertheless, he stated that the security measures in the application are excellent and that its transparency and openness are compatible with security, but the urgency made them prioritize. He also believed that having mentioned this, many citizens would feel comfortable using the application, he believes that higher transparency would create an increased sense of security (Interview A, 2020).

The COEPs are the only ones allowed to observe the information regarding the self-assessment of those citizens in their district with symptoms indicative of COVID-19 to offer them the corresponding assistance. All the data collected by the national and provincial health authorities are for the sole purpose of delivering answers for prevention, containment and treatment of the virus (Decisión Administrativa 431/2020). Moreover, all the data regarding statistics, such as number of self-assessments and application users by area are aggregated in a completely anonymous way (Términos y Condiciones, 2020).

All the stored data complies with international security and privacy standards. All the measures both at the technical level, and the organizational level comply with various

ISO standards (ISO 27001, 27017, & ISO 27018) that are designed to avoid non-authorized access to data or the disclosure of content, and they have encryption systems in place (Jefatura de Gabinete de Ministros, 2020). Furthermore, the representative from Hexacta stated that from a technical point of view, many good practices and international benchmarks were used both on the mobile application and on the web application. Some of the aspects considered were:

- Having the data encrypted in the database.

- Communication between the dashboard and mobile application has encrypted messaging, and the citizens' information is hidden. Therefore, people using the dashboard cannot know who the data belongs to.

- Three cyber-hacking audits were conducted in order to detect vulnerabilities in the infrastructure of the software.

- People can opt for a wiping of data- Once they no longer need the application, they can ask for the data to be deleted.

- The application does not have a geo-localization feature, diminishing the sensitivity of the information gathered by the government. Most of the information included, is information he government already has: ID number, address, age, etc.

(Interview B, 2020)

This information is crucial, as Interview B does not belong to the government, and yet stands behind the technical security measures in the application.

### 5.2.3    Creation of the Application

As mentions Interviewee A, the application was born out of the government's need to have fast reliable and accurate information for the decision-making process during the COVID-19 crisis in Argentina (Interview A, 2020). Furthermore, interviewee A, stated that there are too many bureaucratic barriers regarding the state having access to citizens' data. He of course stated that relaxing these measures presents risks, but he believes that there should be exceptions during health emergencies such as COVID-19, he said that ideally these extraordinary measures should require Congressional approval (Interview A, 2020). An interesting fact he mentioned was that the need for accurate and trustworthy data during the pandemic is a constant, but data is not available and until it is finally able

to be collected, it might be too late, and decisions end up being taken on proxy variables (Interview A, 2020).

The representative from Fundación Sadosky, was the leader of the consortium creating the application. He was the government representative, and coordinated the efforts of all the private companies, while three members of CONICET acted as product owners, and helped coordinate the contacts between the different government agencies and the private companies (Interview A & B, 2020). The private companies belong to the CESSI. On a Friday, the companies were contacted and called upon to donate their knowledge, expertise and human resources to develop the application. By Saturday morning, they were already assembling teams, by Monday, they started working on the application (Interview B, 2020). One of the companies had the task of creating a backend dashboard to visualize the gathered data for the government. The largest company, Globant, had the main task of creating the mobile application software and the interfaces that citizens would interact with when downloading the application. Thirdly, Hexacta had the task of creating the Backoffice web application that connects the COEPs with the data provided through CuidAR. A fourth company focused on all the security aspects, while a fifth company focused on stress tests, to make sure the application and software infrastructure could withstand the volume of information. Finally, a sixth company focused on testing the applications, and a seventh company conducted three cyber-attack audits, to test and find vulnerabilities in the system (Interview B, 2020). This division of tasks was closely connected to the availability and expertise of each company, as Globant had an available workforce of 60 people, and Hexacta of 11 (Interview B, 2020). There was a very aggressive deadline for producing the application in two weeks, this meant that everybody was working 20-hour days, with no time off at weekends. In the end, due to changes in the requirements and scope of the application, the deadline was further extended to a total of four weeks (Interview A & B, 2020).

Both interviewees A and B, believe the government's communication strategy regarding the CuidAR application was very weak (Interview A, 2020; Interview B, 2020). The representative from Fundación Sadosky, went on to say  that in today's world where IS are part of any ambitious project, there needs to be a general  understanding of IT among government representatives, he believes that as all Argentine politicians  must understand the basics of economics, they must also understand IT (Interview A, 2020).  Moreover, interviewee B stated that many media outlets contacted them and other private companies to give their opinion regarding the application: they had willingly donated their time, but the unsatisfactory government communication strategy, together with  their lack of knowledge about  the application was starting to affect their image (Interview B, 2020). Both interviewees state that the geo-localization aspect of the application provoked  a

strong negative response from data privacy activists, local media and some members of the political opposition (Interview A & B, 2020): this is why, in the end that feature of the application was removed. Finally, after a considerable amount of criticism, and attacks from the media, there was a press conference to help clarify all the doubts that had arisen. Interviewee B believes that the government had a reactive response instead of being proactive and anticipating things, whilst Interviewee A, believes that the government thought these criticisms would gradually dissipate (Interview A & B, 2020).

# 6       Analysis and Results

This chapter presents the descriptive data collected from the self-reported survey and some relevant insights gathered from the interviews. The information is separated into 7 categories, firstly general information about the respondents and some overarching questions asked, and then the six main variables discussed in the conceptual framework: social influence, trust, information level, social salience, PU, and PEOU. Moreover, the Spearman's rank correlation of each of the variables will be included in this section. The final section will discuss and summarize the findings.

## 6.1       General Results

The online survey conducted received a total of 845 answers. From these respondents, 48 had never heard of the CuidAR application. For them, 5.6% of the sample, the survey ended very quickly, as they could not provide their opinion and feelings regarding the application. The demographics of the sample can be seen in the pie chart in figure 9. The youngest age range and the oldest (Younger than 18 and older than 75 respectively) are the age groups with lowest representation. This is mostly assumed to be by the lack of relevance the survey has for teenagers, as they have no need to leave the house during lockdown, and older people often find it difficult  to use digital tools such as mobile phones or computers to be able to access the survey.
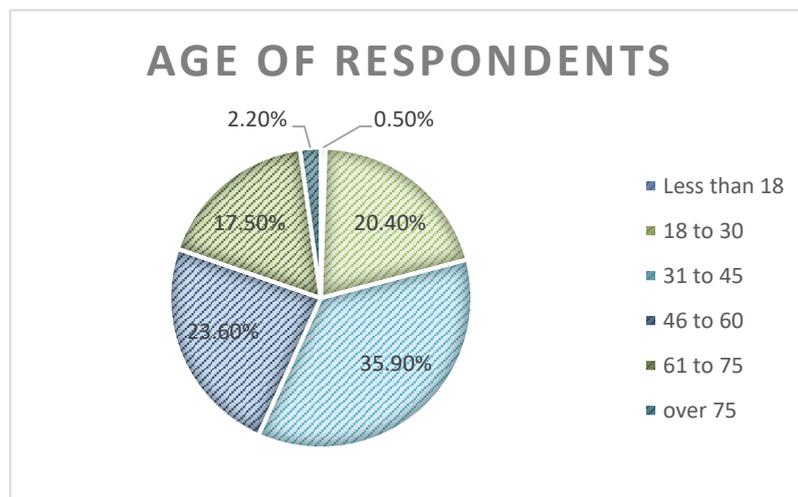


**Figure 9 Age of survey Respondents**

Gender was not asked for in the survey as this variable is not included in the conceptual framework. Moreover, in Argentina a Boolean option of Female/Male is usually not welcome by society, and a greater list of options must be given, which are not relevant to

the case at hand. Another factor that was not included in the demographics, was income or educational level. These again were excluded so as not to make the survey too long and complex as they will not be taken into account as factors affecting motivation to co-produce and technology adoption. This would have been interesting to analyse as socioeconomic factors may affect motivation to co-produce, but the complexity of the Argentine case make this exceed the scope of the study. The results portrayed in this chapter are contemplated on the basis of 797 survey answers, as the respondents that had not heard about the CuidAR application were no longer considered in the overall sample.

The geographic distribution of the respondents is represented in table 2 and is as follows: Almost 38% of the answers were from people living in the City of Buenos Aires (CABA), 27% from the Metropolitan Area of Buenos Aires, excluding CABA, also known as Greater Buenos Aires (GBA). Another 22% from the rest of the province of Buenos Aires. Clearly this area has the highest representation in the survey, but also represents the highest population density in Argentina, as 50% of the population lives in the region (INDEC, 2020). Following them in the number of answers per province are, the province of Mendoza and the province of Neuquén with 3%, the province of Santa Fé, Córdoba and Río Negro all have between 1% and 2% of the sample. These, after the province of Buenos Aires, are the provinces with a larger population, containing the largest cities in the country (INDEC, 2020). Sadly, some of the provinces are not represented in the sample and others have a very low representation of fewer than 5 respondents.

| Place of Residence | Frequency | Percentage (%) |
|---:|:---:|:---:|
| CABA | 306 | 37.8 |
| GBA | 226 | 27.7 |
| Buenos Aires Province | 170 | 22.5 |
| Province of Mendoza | 22 | 3.1 |
| Province of Neuquén | 20 | 2.6 |
| Province of Santa Fe | 14 | 1.8 |
| Province of Río Negro | 11 | 1.3 |
| Province of Córdoba | 8 | 1.2 |

**Table 2 Geographic distribution of Respondents Frequency Table**

Only 12 out of the 845 citizens do not have access or do not know if they have an Android and/or IOS operating system on their telephones. This was a relevant question as the CuidAR application needs those operating systems to function. This shows that digital access in Argentina seems to be quite high. Respondents were asked if they believed the attitude and response the government had used to tackle COVID-19 was correct or not. Almost 44% believed that it was correct, or mostly correct, 16% did not know and 40% believed the attitude was incorrect, either totally or partially.

According to Interviews A and B (2020), the number of users of the CuidAR application at the beginning of the month of July 2020 was over 6.5 million. The representation of users and non-users of the application in the survey was almost 50/50, with 391 respondents using the application and 406 not using the application. At the end of the survey, those not using the application, were asked if they would consider downloading it: 72.6% said it was very unlikely or unlikely, and 17.5% said maybe, with only 2.5% saying they would consider it.
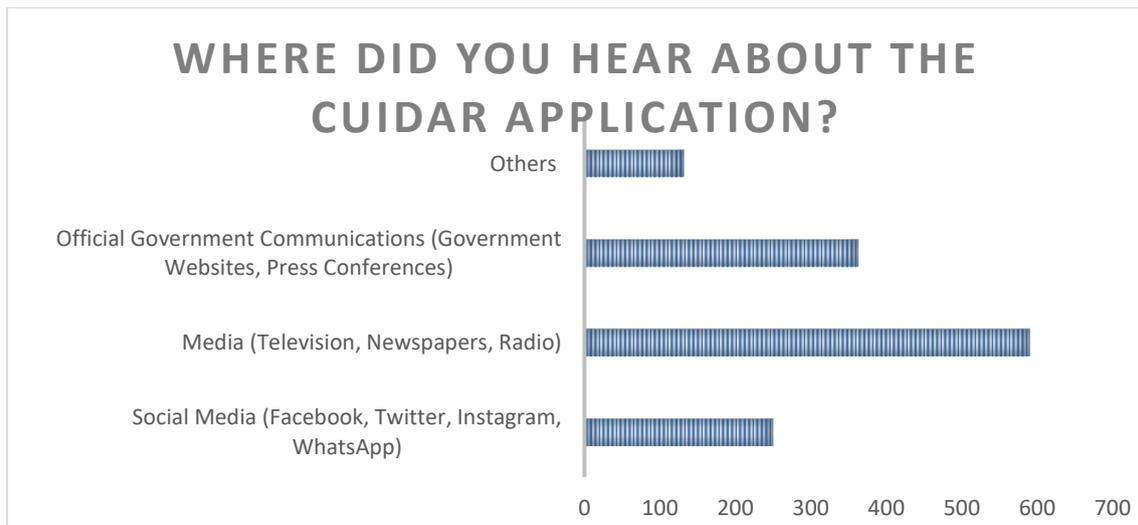


**Figure 10 Where did respondents hear about the CuidAR application**

The next question in the survey was where they had heard about the application, they could choose one or more options of the following: social media (Twitter, Facebook, WhatsApp, Instagram), media (television, radio, newspapers), official government communications (government website, press conference), and others. The bar chart in figure 10 shows the frequency with which each option was selected. The most popular was in the media, with 74% or 590 of the respondents selecting this option. In second place you find official government communications with 45.5% or 363 of the respondents and in third place, social media with 31% or 250 of the respondents, the option that was least selected was 'other' with only 16% or 132 of respondents selecting this option. This shows that the application has been present in the national media portals, and citizens have also received information about the application from government communications either online on the website or during press conferences.

Finally, they were asked to analyse the image portrayed by different news outlets such as TV, radio, newspapers, and social media. The results are shown in the bar chart in figure 11. Mostly the respondents agreed that the media (Television, radio and newspapers) had a neutral position in regard to the application whilst the image was a bit more mixed in social media, with a high level of negative image, but still an overall neutral position.
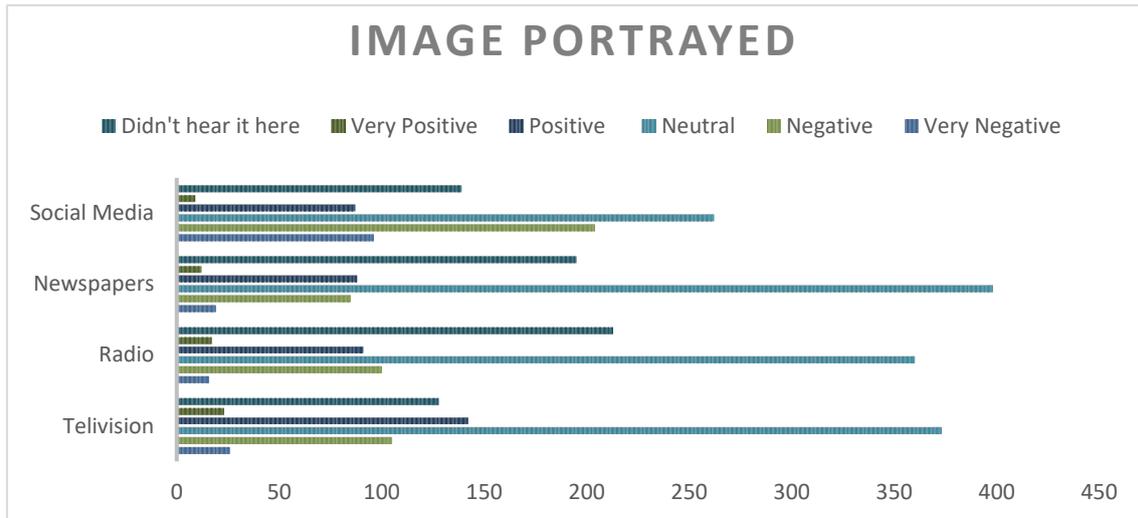
**Figure 11 Image portrayed by different news outlets**

It was interesting to see these results, as both interview A and B mentioned that the media had had a very intense negative or battling view regarding the application, a high distrust of the security measures and picking up on small mistakes or problems that arose with one of the version updates (Interviews A & B, 2020).

## 6.2    Social Influence

For this research, one of the factors affecting technology adoption, behavioral intention and motivation to co-produce is the effect others and the opinions of important others have on the topic. Also, extrinsic motivation related to the expression of appreciation from others.  The results related to what citizens perceive are the opinions others have on the CuidAR application can be described as follows. Firstly, two questions related to if they perceive the government to be promoting the application, and if the government wants you to use the application. The answers to these questions are shown in table 3.

| *Do you believe the government promotes the use of the application* | | |
|---|---|---|
| | Frequency | (%) |
| *Does not promote at all* | 25 | 3.1 |
| *Does not promote* | 138 | 17.3 |
| *Neutral* | 117 | 14.7 |
| *Promotes* | 385 | 48.3 |
| *Promotes a lot* | 132 | 16.6 |
| *Do you believe the government is interested in you using the application?* | | |
| | Frequency | (%) |
| *Not interested at all* | 16 | 2 |
| *Not interested* | 31 | 3.9 |
| *Neutral* | 148 | 18.6 |
| *Interested* | 310 | 38.9 |
| *Very Interested* | 292 | 36.6 |

**Table 3 Social Influence From Government Frequency Table**

The answers were formulated on a 5-point Likert scale, allowing respondents to have an exit option if they do not know, do not want to answer, or do not find the question relevant. Related to the government promoting the use of the application, almost 65% of the sample believe the government is promoting the use of the application to some extent, with 17% believing it is promoting it a lot. At the other extreme, only 3% believe that the government is not promoting its use at all, and 17%, believe that only a little. Almost 15% of the respondents were not sure about this or chose the opt-out option to this answer. A total of 75.5% of the respondents believe the government is either interested or very interested in citizens downloading the application. Only around 6% believe the government is not interested or not interested at all in citizens downloading the application. Around 18.6% of respondents chose the opt-out option, while not being sure about this aspect.

As mentioned previously, both Interviewees A and B, believe the communication strategy regarding the CuidAR application was very shaky (Interview A & B, 2020). Furthermore, interviewee B stated that had they been clearer about how the application works, and the importance of using the application, probably more people would use it (Interview B, 2020). Nevertheless, he also said that the time to communicate this had already passed, that people that use the application will continue to do so, but those that are not using it clearly do not need it, so it will be hard for the government to motivate them into using it (Interview B, 2020).

| *What do you believe is the opinion of your close circle regarding CuidAR?* | | |
|---|---|---|
| | Frequency | (%) |
| *Very Negative* | 105 | 13.2 |
| *Negative* | 275 | 34.5 |
| *I do not know* | 275 | 34.5 |
| *Positive* | 125 | 15.7 |
| *Very Positive* | 17 | 2.1 |
| *What do you believe is the opinion of society as a whole regarding CuidAR?* | | |
| | Frequency | (%) |
| *Very Negative* | 87 | 10.9 |
| *Negative* | 303 | 38 |
| *I do not know* | 277 | 34.8 |
| *Positive* | 115 | 14.4 |
| *Very Positive* | 15 | 1.9 |

**Table 4 Social Influence from Society**

Secondly, respondents were asked to give their perception of how their close acquaintances perceive the application, and what they believe society, in general, feels about the application. Regarding the close circle, as shown in table 4, almost 48% sense

that their close contacts have a mostly negative opinion of the application. Also, 34,5% do not know what their close acquaintances believe, and the positive opinion is only around 18%, with 2% having a very positive opinion. In order to answer the next question, citizens had to try and comprehend what the attitude society as a whole had about the application, the results are shown in table 4: 49% believe the general attitude is negative, 16% believe the general opinion is positive and 35% believes the opinion on the application is neutral.

|  | *BI* | *SI* | *Motivation* |
|---:|---|---|---|
| *BI* | | | |
| *SI* | .273** | | |
| *Motivation* | .216** | .264** | |

Note: N = 797 **p < .01

**Table 5 Correlation Matrix for Social Influence**

According to the correlation matrix for SI presented in Table 5, the correlation between this variable and motivation is weak, .264 and between SI and BI it is again a weak correlation of .273, slightly higher than motivation. Nevertheless, the null hypothesis can be discarded, as there seems to be a relationship between these variables, in spite the correlation to be weak. To be able to run this correlation the mean values for SI were used.

## 6.3    Trust

As aforementioned in the conceptual framework presented in chapter 3 of this research, trust is a key issue involved in the motivation of citizens to co-produce and in their behavioral intention to use a certain technology. There were three questions related to the aspect of trust which results are shown in table 6:

1) Do you trust the current government?

2) Do you trust the CuidAR application to be safe and contain the appropriate security measures for data protection? and

3) Do you trust that the data collected will only be used to tackle COVID-19 in the country?

| *Do you trust the current national government?* | | |
|---|---|---|
| | Frequency | (%) |
| *Complete Distrust* | 346 | 43.4 |
| *Distrust* | 208 | 26.1 |
| *Neutral* | 52 | 6.5 |
| *Trust* | 111 | 13.9 |
| *Trust Completely* | 80 | 10 |
| *Do you trust the CuidAR application to be safe and contain the appropriate security measures?* | | |
| | Frequency | (%) |
| *Complete Distrust* | 249 | 31.2 |
| *Distrust* | 270 | 33.9 |
| *No opinion* | 83 | 10.4 |
| *Trust* | 139 | 17.4 |
| *Trust Completely* | 56 | 7 |
| *Do you trust the data collected will only be used to tackle Covid-19?* | | |
| | Frequency | (%) |
| *Complete Distrust* | 271 | 34 |
| *Distrust* | 237 | 29.7 |
| *No opinion* | 90 | 11.3 |
| *Trust* | 123 | 15.4 |
| *Trust Completely* | 76 | 9.5 |
| *Does your trust in the national government impact your decision to use CuidAR?* | | |
| | Frequency | (%) |
| *Does not impact at all* | 190 | 23.8 |
| *Does not impact* | 128 | 16.1 |
| *Do not know* | 52 | 6.5 |
| *Impacts* | 235 | 29.5 |
| *Impacts a lot* | 192 | 24.1 |

**Table 6 Trust Frequency Table**

According to Latinobarómetro[5], trust in government for Argentina in 2018 was 22%, similar to the Latin American average (Latinobarómetro, 2018). Governments today are under increased pressure to deliver answers to citizens' expectations and it is worth mentioning that in 2009 the lowest government approval rate represents today's average (Latinobarómetro, 2018). Furthermore, the University of Torcuato Di Tella in Argentina, publishes a monthly Government Trust Index, that includes the following variables (a) Government image, (b) overall perception if the government is governing for the common good or for particular sectors (c) government expenditure efficiency (d) honesty of government members, and (e) governments capacity to resolve the country's problems (Universidad Torcuato Di Tella, 2018). The index, which ranges from 0 to 5, rated that during July 2020 the trust in government was 2.53 with a drop of 8.7% in regards to the previous month, but still 29% higher than that of the previous government under President Mauricio Macri (Índice de Confianza en el Gobierno, 2020). Having stated this, the trust in government according to the survey sample can be seen in the frequency Table 5. A

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[5] A non-profit organization based in Chile that is responsible for carrying out an annual public opinion survey that involves 20.000 interviews in 18 Latin American Countries, representing more than 600 million people (Latinobarómetro, 2018)

total of 69.5% distrust the government partially or completely whilst only 24% trust the government partially or completely, a small portion of 6.5% have no opinion on the topic.

Regarding technology-mediated trust, citizens had to answer if they trust the application to have the necessary security measures to protect their personal data. A total of 65% of respondents distrust or completely distrust this to be the case, 10% had no opinion about it, only 7% trust this to be the case completely and 17.5% trust it partially.

According to the terms and conditions of the application, all the data collected, except the anonymized data that will be used for statistical purposes will be deleted after the pandemic. Citizens were asked if they trusted that their data was only going to be used for this purpose. One-quarter of respondents trust this to be the case, either partially or totally. On the other hand, almost 64% do not trust data will be used only for this, with 34% of them not trusting this at all. Finally, 11% have no opinion on this.

Lastly, the survey asked the citizens, if they believed their trust in the national government influenced their decision to use the CuidAR application or not. Table 6 also shows the results of this question. Of these, 54% believe that their trust in government influences their decision to use the application, a lot or totally. Only 6,5% do not know if this would impact, and almost 40% believe it has little to no impact.

Interviewee B highlighted the importance of trust when using this kind of application. The information collected is highly sensitive and citizens' decision to download the application depends highly on who is managing that data, if people don't trust the government that is managing the data, they will be reluctant to use the application. He continues to explain that had he not been part of the consortium creating the application and known how the application really works, he would probably have the same doubts and trust issues (Interview B, 2020).

|  | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|
| 1. BI |  |  |  |  |  |
| 2. Motivation | .216** |  |  |  |  |
| 3. Trust in Technology | .223** | .512** |  |  |  |
| 4. Trust in Government | .216** | .396** | .627** |  |  |
| 5. Trust in data usage | .217** | .535** | .814** | .652** |  |

Note. N = 797 **p < .01

**Table 7 Correlation Matrix for Trust**

Table 7 presents the correlation Matrix for trust. The correlation between BI and the three different trust variables analysed are week, with trust in technology at .223, trust in government at .216 and trust in data usage at .217. The correlations become stronger when talking about trust and Motivation with trust in technology at .512, trust in government .396 and trust in data usage with .535. This means that the correlations with motivation are moderate. The null hypothesis can be discarded due to the p value assigned.

## 6.4    Information Level

One of the factors mentioned in the literature about allowing citizens to co-produce is the information available, citizens must have information about the service. This is why citizens were asked to answer some questions related to the not so obvious functionalities of the application such as:

1) Did you know that the government can offer you assistance through the application?

2) Did you know that by using this application you are helping the government have more reliable statistics about citizen mobility?

3) Did you know that by using this application the government can make decisions based on evidence?

4) Did you know that you can contact the COEPs to avoid the saturation of phone lines for people who don't have smartphones to use in case of an emergency?

Table 8 shows the response frequency to these questions. As is shown in  the table, the aspect that most people knew about was that by using the application they are helping the government have more reliable statistics, followed closely by the knowledge of the government being able to make decisions based on evidence. Regarding the government offering assistance through the application and contacting the COEPs, it seems the population was divided, half of them knew and the other half did not (this does not include those who decided to opt out of this question with the neutral option).

| | Yes, I knew | No, I did not know | I don't care |
|---|---|---|---|
| | Frequency | | |
| *Did you know that the government can offer you assistance through the application?* | 371 | 348 | 78 |
| *Did you know that by using this application you are helping the government have more reliable statistics about citizen mobility?* | 632 | 99 | 66 |
| *Did you know that by using this application the government can make decisions based on evidence?* | 536 | 180 | 81 |
| *Did you know that you can contact the COEPs to avoid the saturation of phone lines for people who don't have smartphones to use in case of an emergency?* | 372 | 358 | 67 |

**Table 8 Frecuency table for Information Level**

As mentioned by Interviewee B, there was a lack of information regarding the usefulness of the application, and the functionalities, and the end goal of the application to be able to contact people with symptoms and offer fast and effective services, alongside helping the government have a map of the main virus hotspots (Interview B, 2020).

| | *1* | *2* |
|---|---|---|
| *1. Motivation* | | |
| *2. Information* | -0.032 | |

Note. $N = 797$ **$p < .01$

**Table 9 Correlation Matrix for Information Level**

The correlation results between information level and motivation show that there exists almost no correlation between this variables. This can be seen because the relationship is very weak, and the p value is not assigned, theferore the null hypothesis must be accepted.

## 6.5      Social Salience

Corresponding to the conceptual framework presented in chapter 3 of this research, social salience relates to two main factors, external efficacy related to feeling that one's co-producing participation will somehow affect the decision-making process (Eijk & Steen, 2015) and benefiting society by one's actions.

The sample was asked whether they believed that by using the application they were benefiting society. The frequency table 10 shows the results. The respondent's position here is almost equal, with around 38% of the respondents believing that using the application they would somewhat benefit society, whereas 38% believe it does not benefit society at all, or not much. The remaining 23% chose the neutral option.

*Do you believe that downloading and using the application you are benefiting society?*

| | Frequency | (%) |
|---|---|---|
| *Not benefiting at all* | 146 | 18.3 |
| *Not benefiting* | 160 | 20.1 |
| *I do not know* | 186 | 23.3 |
| *Benefiting* | 208 | 26.1 |
| *Benefiting a lot* | 97 | 12.2 |

*Do you believe using the application will be useful for the government to better understand the COVID-19 pandemic in the country?*

| | Frequency | (%) |
|---|---|---|
| *Very unuseful* | 118 | 14.8 |
| *Unuseful* | 179 | 22.5 |
| *I do not know* | 177 | 22.2 |
| *Useful* | 228 | 28.6 |
| *Very useful* | 95 | 11.9 |

**Table 10 Frequency table for Social Salience**

Moreover, the respondents were asked, if they perceived the application to be useful for the government to better understand the COVID-19 pandemic in the country. This relates to the external efficacy of their participation. Almost 41% believe it to be useful or very useful, whilst 37.3% believe it to be useless, or very useless. A fifth of the respondents chose the opt-out option in this question, as shown in table 10.

Interviewee B mentioned that from the official government communication the message was not clear, "people understood that the application was there to control them, to make sure they were not leaving their homes" (Interview B, 2020). The social salience of the application, the positive side of having such digital tools in times of crisis and informing citizens of the benefits to society of using this application was not communicated (Interview B, 2020). Furthermore, he stated that the lack of awareness regarding the solidarity of helping each other out by using this application, by helping the government

collect data, but also helping my neighbour, by staying home if I feel sick, is still an aspect of solidarity that is missing in Argentine society (Interview B, 2020).

| | 1 | 2 | 3 |
|---|---|---|---|
| 1. BI | | | |
| 2. Motivation | .216** | | |
| 3. Social Salience | .185** | .591** | |

Note. N = 797 **p < .01

**Table 11 Correlation Matrix Social Salience**

As portrayed by the correlation matrix in table 11, there exists a very weak correlation between social salience and BI. On the other hand, the correlation between Social Salience and motivation is at the higher end of the moderate relationship.

## 6.6 Perceived Usefulness

Perceived usefulness is believed to be one of the main factors affecting the behavioral intent of citizens to use a new IT system, or e-government solution. Moreover, citizens motivation to co-produce relates closely to the ease with which it can be done (Pestoff, 2012).

| *Do you perceive CuidAR useful to download the CUHC?* | | |
|---|---|---|
| | Frequency | (%) |
| *Very unuseful* | 66 | 8.3 |
| *Unuseful* | 101 | 12.7 |
| *I do not know* | 125 | 15.7 |
| *Useful* | 306 | 38.4 |
| *Very useful* | 199 | 25 |
| *Do you perceive CuidAR useful to inform health authorities about possible COVID-19 symptoms?* | | |
| | Frequency | (%) |
| *Very unuseful* | 88 | 11 |
| *Unuseful* | 171 | 21.5 |
| *I do not know* | 173 | 21.7 |
| *Useful* | 250 | 31.4 |
| *Very useful* | 115 | 14.4 |
| *Do you perceive the CuidAR self-assessment useful?* | | |
| | Frequency | (%) |
| *Very unuseful* | 151 | 18.9 |
| *Unuseful* | 232 | 29.1 |
| *I do not know* | 161 | 20.2 |
| *Useful* | 182 | 22.8 |
| *Very useful* | 71 | 8.9 |

**Table 12 Perceived Usefulness Frequency Table**

Citizens answering the survey had to answer the following questions related to this variable. If they perceive the application to be useful to download the mobility permit or CUHC, if they believed the application was a useful tool to inform health authorities about possible COVID-19 symptoms and if they thought the health self-assessment in the application was useful. The results of these three questions are represented in table 12.

Regarding the CUHC permits, 63% of the respondents believe this feature to be useful or very useful, 21% find it to be absolutely useless or quite useless, while 16% were not sure, or used the opt-out option. Regarding informing health authorities about COVID-19 symptoms, almost 46% believe that the application is useful or very useful for this purpose, 32% believe the opposite and 21.7% do not know. When asked about the usefulness of the health self-diagnosis 48% of those who responded stated that it was useless to some extent. On the other hand, 32% believe this function is somewhat useful, or very useful. The remaining 20% of the people who answered stated they did not know.

Furthermore, those who actually downloaded and used the application had to answer whether they found the application useful overall. The results are shown in table 13. Almost 65% of users (391 of the respondents were users) believe that the application is useful or very useful. Almost 12 percent did not know or lacked an opinion on the application, and slightly over 22 percent believed the application to be quite useless or absolutely useless.

| *What is your perception regarding usefulness after using CuidAR?* | | |
|---|---|---|
| | Frequency | (%) |
| *Very unuseful* | 26 | 6.6 |
| *Unuseful* | 62 | 15.9 |
| *I do not know* | 46 | 11.8 |
| *Useful* | 186 | 47.6 |
| *Very useful* | 71 | 18.2 |

Note: N= 391 (actual Application users)

**Table 13 Frequency table for PU of users**

According to Interviewee A, he believed that people downloaded the application if they believe it was useful, people are not that worried about security issues, or quality, they will only use it if they find it useful (Interview A, 2020) Adding onto this, he mentioned that as time went by, they believed, as developers, that the health self-assessment was not as useful as they believed it would be for the government and that new features were in process of being developed (Interview A, 2020).

|  | *1* | *2* | *3* |
|---|---|---|---|
| *1. BI* | | | |
| *2. Motivation* | .216** | | |
| *3. PU* | .155** | .431** | |

Note. N = 797 **p < .01

**Table 14 Correlation Matrix for Perceived Uselfulness**

The correlation between PU and BI and Motivation can be seen in table 14. The correlation between PU and BI is very week, whilst the correlation between PU and motivation is moderate with .431.

## 6.7    Perceived Ease of Use

The PEOU in the survey showed some positive results. The answers seem to portray that most of the society believes the application easy to download and use. The results are shown in the frequency table 15.

| *Do you perceive CuidAR easy to use/download?* | | |
|---|---|---|
| | Frequency | (%) |
| *Very difficult* | 3 | 0.5 |
| *Difficult* | 7 | 0.9 |
| *I do not know* | 220 | 27.5 |
| *Easy* | 229 | 28.7 |
| *Very Easy* | 338 | 42.4 |

**Table 15 Frequency table for PEOU**

This is a very important result, because if the process to co-produce, is too hard, then the citizens will be de-motivated to do so. In addition, PEOU as mentioned in the TAM model affects PU, this means that if the application is hard to use, the benefits of using it must overcome the difficulty it presents.

Les than 1.5% of the respondents perceive the applicationt to be hard to use. Furthermore, 42.4% believe the application to be very easy, and 28.7 easy. It seems to be that the PEOU won't represent a barrier to the motivation to co-produce or download the application.

|  | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|
| *1. BI* |  |  |  |  |  |
| *2. Motivation* | .216** |  |  |  |  |
| *3. PU* | .155** | .431** |  |  |  |
| *4. PEOU* | .531** | .094** | .080* |  |  |

Note: N = 797 **p < .01 *p < .05

**Table 16 PEOU correlation matrix**

As shown in the PEOU correlation matrix represented in table 16, the correlation between PEOU and PU is almost non-existent, due to the low level of correlation, and the high p value. Furthemore there seems to be a moderate correlation between PEOU and BI with .531.

## 6.8 Summary of Findings

This section will try and create some meaning of the results by summarizing the main findings of the case study analysis. The hypotheses presented in chapter three will be contested, defining which ones are supported. By doing this, the research question posed in the introduction will be answered:

- *What are the factors affecting citizen motivation to co-produce and adopt the digital application CuidAR proposed by the Argentine government to aid the emergency measures of COVID-19 in the country?*

After a detailed analysis of the literature available on digital co-production and the factors affecting citizen motivation to co-produce, and the factors affecting technology adoption of IS systems or tools, some of the main factors were singled out as shown in the conceptual framework in chapter three. Additionally, there were some underlying concepts that do not directly affect motivation to co-produce, but must be preexistent. First of all, the definition used for co-production in this research was "a relationship between the employees of an organization and (groups of) individual citizens. It requires direct and active inputs from these citizens to the work of the organizations. The professional is a paid employee of the organization, whereas the citizens receive compensation below market value or no compensation at all" (Brandsen & Honingh, 2016). In the case at hand, we understand the citizens participation as co-production because, they can directly provide inputs to the COEPs through the application and receive no compensation for doing so. Moreover, the co-production is voluntary, and somehow creates public value in the process (Bracci et al., 2016) This citizen participation

is not co-creation, because the citizen are only participating in the implementation phase, to put it differently, they are not involved in the planning of the service or the strategic level of creation (Brandsen & Honingh, 2016). This way of co-producing is through the use of a digital technology, a mobile application. When citizens use the application, they are automatically co-producing with the government, so in this case, the use of digital technology leads to passive citizen co-production (Brandsen and Honingh, 2015; Bovaird et al., 2015).

Secondly, other key points mentioned in the literature are that citizens must perceive co-production as an option, having the opportunity to participate (Eijk & Steen, 2014) and the ease with which the co-participation can occur (Pestoff, 2012; Alford, 2009). With the CuidAR application the opportunity to co-produce is available to all citizens and residents of the Argentine territory: the only prerequisites are to have a national ID (for citizens and residents equally) or a residence permit in process, and a mobile phone with IOS or Android operating system. Also, the process of co-producing seems to be very easy, by downloading and using an application that can be useful for oneself, the citizen is already co-producing. Accordingly, more than 98% of the respondents had access to a mobile phone with the necessary operating system for CuidAR to work.

To be able to answer the aforementioned research question, it is important to first see which of the hypotheses presented in chapter 3 were supported with the results. Those correlations that had strong or very strong reason to reject the null hypothesis (p < .01 and p < .05) and with a Spearman's correlation rank above 0.2, were supported. This means that correlations ranked as very weak were not supported in this study. A summary of these findings can be found in table 17. For this reason, out of the 16 initial hypotheses 11 are supported. The hypotheses that were not supported were:

- **H3:** *There is a relationship between the information level and motivation*

- **H4a:** *There is a relationship between Social salience and behavioral intention*

- **H5a:** *There is a relationship between Perceived Usefulness and behavioral intention*

- **H6a:** *There is a relationship between Perceived ease of use and perceived usefulness*

- **H6c:** *There is a relationship between Perceived ease of use and motivation.*

Firstly, regarding H3, the literature was somehow divided on whether having more information would lead to motivation to co-produce: Pestoff (2012) mentioned it to be important for citizens to have information available on the service, while Porumbescu

(2016) states that too much information sometimes leads to increased criticism from citizens. As mentioned by the interviewees, the communication strategy from government was lacking (Interview A & B, 2020), probably an improved communication strategy and call to usage could improve this relationship. Secondly, regarding H4a, it was mentioned by interviewee B, that there is a need of social conscience for understanding that by using the application and following government instructions one is not only being egoistic, but should do it altruistically, but the sense of solidarity seems to still be a quality missing in the Argentine society (Interview B, 2020). Thirdly, H5a could be related to the fact that even if they find the application overall useful, they have not had the direct need to use it, therefore their BI is related to non-use. This relationship and the resulting non-supported hypothesis could most probably change when lockdown restrictions are relaxed, and mobility is increased but the need for CUHC increases as more people can move around the cities. Fourthly, there seems to be no relationship between PEOU and PU and with motivation. This could be because the application is easy to download, and most citizens know how to use simple interfaces like the one provided by CuidAR, therefore the PEOU does not affect the PU or motivation, due to the easiness associated to it. This could be an interesting study to conduct regarding digital co-production.

The results and the current discussion respond to the research question: the factors affecting behavioral intention are Social Influence, Trust, and PEOU. This means that from the originally proposed factors Social Salience and PU have been discarded. Furthermore, the factors affecting citizens motivation to co-produce are Social Influence, Trust, Social Salience and PU. Hence, Information Level and PEOU have been discarded as factors affecting motivation. Nevertheless, these results are consistent with the case study at hand, not necessarily extrapolatable to other examples. Furthermore, changes in perception through time could show different results once the lockdown measures are relaxed in the country. Without lockdown, but with social distancing the amount of CUHC needed will increase, so many citizens will probably find use in the application.

Finally, understanding the elements that influence individual's behavior can somehow aid researchers and implementors to better predict the likelihood of an individual engaging or not with a new technology. With this knowledge, different approaches can be taken in order to reduce the barriers to adoption and promote citizen participation.

| Summary of Hypotheses | BI & Motivation Correlation Rank | Null Hypothesis | Supported |
|---|---|---|---|
| **Social Influence** | - | - | - |
| **H1a:** There is a relationship between Social influence and behavioral intention. | Weak | No | Yes |
| **H1b:** There is a relationship between Social influence and motivation | Weak | No | Yes |
| | | | |
| **Trust** | - | - | - |
| **H2a**: There is a relationship between Trust in government and behavioral intention | Weak | No | Yes |
| **H2b:** There is a relationship between Technology mediated trust and behavioral intention | Weak | No | Yes |
| **H2c:** There is a relationship between Trust in the correct usage of data and behavioral intention | Weak | No | Yes |
| **H2d:** There is a relationship between Trust in the correct usage of data and motivation. | Moderate | No | Yes |
| **H2e:** There is a relationship between Technology mediated trust and motivation. | Moderate | No | Yes |
| **H2f**: There is a relationship between Trust in government and motivation | Weak/moderate | No | Yes |
| | | | |
| **Information Level** | - | - | - |
| **H3:** There is a relationship between the information level and motivation | Very weak | Yes | No |
| | | | |
| **Social Salience** | - | - | - |
| **H4a:** There is a relationship between Social salience and behavioral intention | Very weak | No | No |
| **H4b:** There is a relationship between social salience and motivation | Moderate | No | Yes |
| | | | |
| **Perceived Usefulness** | - | - | - |
| **H5a:** There is a relationship between Perceived Usefulness and behavioral intention | Very weak | No | No |
| **H5b:** There is a relationship between Perceived Usefulness and motivation. | Moderate | No | Yes |
| | | | |
| **Perceived Ease of Use** | - | - | - |
| **H6a:** There is a relationship between Perceived ease of use and perceived usefulness | Very weak | No | No |
| **H6b:** There is a relationship between Perceived ease of use and behavioral intention. | Moderate | No | Yes |
| **H6c:** There is a relationship between Perceived ease of use and motivation. | Very weak | No | No |

**Table 17 Summary of Hypothesis and Correlations**

# 7      Conclusion

The coronavirus pandemic that impacted the world in 2020 affected most countries and citizens everywhere. People were forced to rapidly adapt to new ways of living, new social rules, and increased restrictions imposed by national and local governments. This international health situation will continue to have ripple effects for many seasons to come. These effects are not only the immediate ones: health systems collapsing, and rising death tolls, but also socio-economic impacts from the drastic fall in economic activity and the reduction in tourism, due to quarantine and lockdown.

Different approaches were taken by different government institutions, both national and supranational, such as the European Union, to stop the spread of the virus. Alongside some of these measures, digital tools mostly related to mobile phone applications were introduced as an aid to control and manage the spread of COVID-19. Argentina moved in a different direction from many European and Asian countries that promoted and created contact-tracing applications. This less advanced version of the Latin American country sought to provide the government with alternative ways to contact citizens in need of assistance, collect relevant data regarding the infected population, virus hotspots, and mobility of citizens. This tool is useful for citizens as they are only allowed to move around if they hold   the CUHC permits which they can obtain through the application, and at the same time, is useful for the government.   By introducing their data, selecting the type of CUHC they need, and providing their health assessment, citizens are co-producing with the government. As mentioned by interviewee A, CuidAR was born out of the government's need to have fast, reliable, and accurate information (Interview A, 2020). Also, the application opens an alternative communication channel for citizens to be able to contact health institutions and for the government to contact citizens in need of assistance.

The goal of this research was to understand the elements affecting citizen digital co-production by seeing what are the factors that influence citizens' motivation to co-produce and to adopt new technologies. These two items were combined, as the citizen is co-producing when adopting the technology. Furthermore, the knowledge of co-producing with the government, in this case, is not straightforward, and therefore, if only motivations to co-produce were studied, there would be a significant gap in understanding what  the real factors were concerning the use of the application.

Based on the results portrayed in chapter 6, the research goal was achieved. There seem to be great similarities regarding these factors both in the empirical case study findings and in the literary analysis of these topics. Nevertheless, not all the factors present in the literature were supported. The lack of correlation between BI and Social Salience and BI

and PU, does not necessarily mean that these factors are definitely not affecting technology adoption, simply that in this case, they seem not to be related. Secondly, the lack of relationship between information level and motivation is related to the fact that sometimes too much information can hinder the desire of citizens to co-produce. Moreover, the numbers showed that many respondents did not know that they were passively co-producing when using the application. Thirdly, PEOU had a very weak correlation with PU and motivation, as mentioned in the previous chapter, this goes hand in hand with the fact that a mobile application does not represent new technology, just a new variant of known technology.

## 7.1 Future Research and Limitations

In chapter 4.4 some of the limitations to the research design were described. A few of the limitations derived from the completion of this research can be mentioned. Firstly, COVID-19 is still very much an ongoing situation, there are new spikes, outbreaks, and talk of a second wave of the virus is on the agenda. This represents a lack of academic research related to the topic, also, the effects and spread of the virus are still unknown. Interesting future research would be to see how the situation evolves in the coming months, verifying whether or not the levels of adoption of the application increase with the flexibilization of quarantine measures.

Another limitation would be the data analysis possibilities, with an increased number of interviews, and possibly some citizen interviews to better understand the quantitative results portrayed in the self-reported survey, the factors and the relationship between variables could be further explored.

Moreover, interesting future research would be a comparative analysis of different factors affecting citizen adoption of COVID-19 applications in different countries. These would have to take into account different external factors such as the socio-economic environment and of course the differences between the applications. Furthermore, understanding the barriers and enablers for the creation of an interoperable, supranational digital application would be interesting research: the virus has shown that it knows no borders; the solutions should also seek to overcome them.

Finally, the situation COVID-19 has imposed on countries is unprecedented, and the findings are relevant due to the impact the virus has had throughout the world. It would be interesting to see how the different academic fields continue to explore the changes in paradigms, in social behavior, in citizens' trust, in open data, and in government special powers during crisis periods.

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# Appendix

**A**      **Semi-Structured in-depth Interview Questionnaire**

1) What organization do you belong to? And what is your role in regard to the CuidAR application?

2) How was the work structured for creating the application?

3) How many downloads does the application have this day?

4) Do you believe people know that they are helping the government, co-producing with the government when using the application?

5) Why didn't you implement contact tracing? What about other solutions from other countries how do they apply or not to Argentina?

6) What security protocols were developed in the application?

7) Do you believe the government communicated the benefits and usefulness of using the application properly?

8) Do you believe trust in government affects the decision of citizens to download the application?

9) What is the government doing to promote the use of the application?

10) Are the statistics being recollected and used?

11) Why is this data useful?

12) What do you believe must be improved?

**B**      **Interview Details**

- Interview A: Fundación Sadosky – Leader of the group developing the application.

- Interview B: Hexacta – Owner and leading partner of one of the main companies involved in the creation of the application.

Both Interview transcripts are available in Spanish, Translations can be arrange upon request.

**C      Pre-Survey Questions**

When answering a Survey, what do you prefer?

1) Direct questions?

2) Statements you have to agree or disagree with?

Why? Explain your answer

**D      Survey Questions**

1) How old are you? (select only one option)

2) Where do you live? (Select only one option from the dropdown selection)

3) Do you have access to a mobile phone with Android or IOS (Apple) operating system? (Selection one option- 3 point likert scale)

4) Have you heard about the CuidAR application developed by the national government, private companies, and public sector organizations? (Yes/No)

5) Where did you hear about the CuidAR application? (you may select more than one option)

6) Do you think the government is interested in you downloading and using the CuidAR application?  (Selection one option- 5 point likert scale)

7) Do you think the government promotes the use of the CuidAR application? (Selection one option- 5 point likert scale)

8) What image do you feel the different media portrays regarding the CuidAR application? (Mark one oval per row)

9) What do you feel is the opinion of your close circle regarding the application? (Selection one option- 5 point likert scale)

10) What do you believe is the general opinion of society regarding this application? (Selection one option- 5 point likert scale)

11) Do you trust that the data collected will only be used to find solutions to the effect of COVID-19?  (Selection one option- 5 point likert scale)

12) Do you trust the current national Government? (Selection one option- 5 point likert scale)

13) Do you trust the CuidAR application to be safe and contain the appropriate security measures for data protection? (Selection one option- 5 point likert scale)

14) Do you trust that the data collected will only be used to tackle COVID-19 in the country? (Selection one option- 5 point likert scale)

15) Does your trust in the national government impact your decision to use CuidAR? (Selection one option- 5 point likert scale)

16) Did you know… (Select one option for each subquestion- 3 point likert scale)

   a. That the government can offer you assistance through the application?

   b. That by using this application you are helping the government have more reliable statistics about citizen mobility?

   c. That by using this application the government can make decisions based on evidence?

   d. That you can contact the COEPs to avoid the saturation of phone lines for people who don't have smartphones to use in case of an emergency?

17) Do you feel motivated to download the application? (Selection one option- 5 point likert scale)

18) Do you believe that downloading and using the application you are benefiting society? (Selection one option- 5 point likert scale)

19) Do you believe using the application will be useful for the government to better understand the COVID-19 pandemic in the country? (Selection one option- 5 point likert scale)

20) Do you perceive CuidAR useful to download the CUHC? (Selection one option- 5 point likert scale)

21) Do you perceive CuidAR useful to inform health authorities about possible COVID-19 symptoms? (Selection one option- 5 point likert scale)

22) Do you perceive CuidAR self-assessment useful? (Selection one option- 5 point likert scale)

23) For those using the application: What is your perception regarding usefulness after using CuidAR? (Selection one option- 5 point likert scale)

24) Do you perceive CuidAR easy to use/download? (Selection one option- 5 point likert scale)

25) Did you download the application? (Yes/No)

*Raw survey data is available but the number or respondents made it impossible to include in the current document.*

## Declaration of Authorship

I hereby declare that, to the best of my knowledge and belief, this Master Thesis titled "Digital Co-Production and Technology Adoption: The Case of CuidAR the Argentine digital application for COVID-19" is my own work. I confirm that each significant contribution to and quotation in this thesis that originates from the work or works of others is indicated by proper use of citation and references.

Tallinn, Estonia 10$^{th}$ August 2020

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