Università
Ca'Foscari
Venezia

Master's Degree
in Global Development & Entrepreneurship

Final Thesis

How Italian news affects downloads of two public applications.

App IO and App IMMUNI case study.

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Year

2021/2022

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INTRODUCTION

The aim of this thesis is the analysis of the theory of acceptance and diffusion of innovation and the analysis of the role of news and announcements in influencing the behavior of online users. These themes, apparently distant from each other, find a meeting point when they are inserted into the digital world. Indeed, what leads a consumer to accept and use a new technology? In our case, a new application?
In our smartphone there are an average of 80 applications but only half are used daily.
There are different reasons, different variables, external and internal factors that lead to the adoption of one technology over another.
Consumers can make an evaluation of costs and benefits, of utility or adopt it because it would be a detriment not to have it. But can there be different reasons? Ethical? Of privacy? Or common sense?
Understanding and assimilating these factors that can characterize the applications taken into consideration, the paper goes on to study the role of news in influencing consumers through a mixed approach. This was even more evident during the pandemic period. Given the high uncertainty, fear and confusion, news has played a fundamental role in both positive and negative. Throughout the lockdown, we could all rely solely on news, dodging fake news and avoiding panicking.

During the second half of 2020, two new applications were introduced in the online stores: Immuni with the aim of supporting the tracking of Covid-19 positives in Italy and App IO, an app for public services, which in the reference period (1 June 2020 - December 31, 2020) was required to obtain the so-called cashback and super cashback bonus. The first has had little success, recording just over ten million downloads since June 15, while the second has passed that milestone in just nine months (Canepa, 2021). Although the evidence of these discrepancies, in terms of downloads and uses, the paper in analysis has the goal of investigating the role of the news and announcements on consumer acceptance. The paper includes a statistical analysis of 703 news items from the two major newspapers in Italy "Corriere della Sera" and "Messaggero", and as many data regarding downloads and login within the period from 1 June 2020 to 31 December 2020.

To be more specific: the thesis is divided into three main chapters.

The first chapter provides a general overview of two main theories: technology adoption and diffusion of innovation. Starting from the fundamentals up to the studies of Everett Rogers, demonstrating how the cardinal principles of these are still valid even if influenced by technological and evolutionary progress. Subsequently, the issue of the role of news will be addressed. The event study is the reference study in these terms. This methodology is used in various fields, the paper will present several pioneering studies on the role of news in influencing the price of cryptocurrencies, the stock market and various international crowdfunding companies.

The second chapter focuses on the two applications, App IO (PagoPA S.p.A.) and Immuni (Sogei S.p.A.). The first part will describe App IO, app of public services. App capable of revolutionizing the relationship between citizens and public administrations. The focus will be on the cashback and super cashback program and on IO's ability to be able to create digital culture in Italy by shortening the digital divide gap. Subsequently, the COVID-19 contact tracing apps, the so-called digital contact tracing applications (DGT), will be considered. In this second paragraph, bringing a series of other pioneering studies, the lack of trust in the government will be referred to as one of the reasons why the tracking apps have not obtained the expected results, then identifying other possible reasons. Moving on to the Immuni case, developed to facilitate the tracing of Covid-19 contacts, the characteristics and problems of the Italian application will be discussed and game theory will be applied to the application to understand the social dilemma for the possible non-adoption and lack of civic sense of citizens.

The third and final chapter aims to summarize, through a case study, the theoretical issues addressed in the previous chapters. This case study refers to the introduction on the digital market of Immuni and IO during the reference period from 1 June 2020 to 31 December 2020. For this thesis, through a mixed approach we will study for first the different phases they have faced the two applications highlighting the main differences and characteristics and then moving on to data analysis. The data analyzed are a set of quantitative and qualitative data concerning the downloads of the two apps and the 703 news items collected by two of the major newspapers in Italy (Corriere della Sera and Messaggero). Through a multiple linear regression, we will understand if the effect of the independent variables (x) (news) will affect the downloads (x) of the two applications (dependent variables). Finally, through an event study we will try to understand if the news chosen

on 15 October 2020 (event date) "Picco di contagi, è iniziata la seconda ondata" affected the number of downloads of the two applications.

CHAPTER 1

TECHNOLOGY ADOPTION, DIFFUSION OF INNOVATION AND THE ROLE OF THE NEWS

1.1 Technology Adoption

Before understanding what are the main theories behind the adoption of new technologies, the diffusion of innovation, and what affects adoption behaviors, it is useful to understand what we are referring to, when talking about innovation.

We know innovation, we live it and see it every day. With the term “innovation” Rogers (2003) indicates an idea, a practice or an object perceived as new by an individual or by another unit of adoption. The novelty requirement attributed to innovation is not related to the time when it is placed on the market. Therefore, if an idea or an object seems new to an individual, then they can be defined as innovations. The "newness" aspect of an innovation may be expressed in terms of knowledge, persuasion, or a decision to adopt.

Furthermore, Rogers (2003) underlines how wrong it is to assume that the diffusion of innovations is necessarily pleasant for the whole community, since some of these may be desirable for one subject and undesirable for another even in reference to the same situation. Just think of man and machine in the workplace.

However, we do not realize how we came to adopt these innovations. When these have taken hold, how they have spread, often becoming mainstream, and above all what pushed us, what are the reasons that led us to adopt and accept that particular innovation.

In this first chapter I will study the theories underlying the concepts of technology adoption (TAM), diffusion of innovation (DIT) and how news affect price and behaviors in different markets. Technology adoption is one of the mature areas of research. Carr (1999) has defined technology adoption as the “stage of selecting a technology for use by an individual or an organization”. With rapid strides being made in technology innovations in every conceivable domain, the issues related to technology adoption have gained increasing prominence in recent times. Huge investments are made by organizations and governments for introducing new technologies that have the potential

of bringing a paradigm shift in the lifestyle of the users. However, these investments may not yield results if the innovations are not adopted by the intended users (Sharma, Mishra, 2014).

Several studies have revealed that technology adoption is not related to the aspects of technology alone but has evolved as a much more complex process involving dimensions of user attitude and personality, social influence (Ajzen and Fishbein 1975), trust (Gefen et al. 2003), and numerous facilitating conditions.

Literature review revealed interchangeable use of the terms adoption and diffusion although these terms are quite distinct from each other. Therefore, noting the difference between these two terms is in order. Adoption refers to "the stage in which a technology is selected for use by an individual or an organization" (Carr, 1999) while the term diffusion refers to "the stage in which the technology spreads to general use and application" (Rogers, 2003). Therefore, while the term adoption is used at individual level, diffusion can be thought of as adoption by the masses. (Sharma, Mishra, 2014)

Two major streams of research have evolved on adoption of technologies. One stream pertains to adoption at individual and the other at organizational level. Nel mio elaborato andrò a studiare l'adozione di nuove tecnologie a livello del singolo individuo.

1.1.1 Technology Acceptance Model

The technology acceptance model (TAM) (Davis, 1989) is the most influential and widely used theory for explaining an individual's acceptance of technology. TAM was originally tested in the context of the adoption of email service and file editor at IBM Canada with 14 items on each of the 2 constructs. The results of the survey on a sample of 112 users validated the model with the finding that perceived usefulness is a stronger factor than perceived ease of use that drives technology adoption. In the years, TAM became well-established as a robust, powerful, and parsimonious model for predicting user acceptance (Sharma, Mishra, 2014).

TAM determines user attitude and recognizes the role of perceived ease of use (PEOU) and perceived usefulness (PU) in understanding user acceptance in information systems. (Venkatesh & Davis, 2000).

PU is defined as “the degree to which a person believes using a particular system would enhance his or her job performance” (Davis, 1989), while PEOU is defined as “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989). Attitude refers to a person forming favorable or unfavorable feelings toward adopting a certain technology which leads to the intention to use a particular technology and determines the adoption of such technology (Kim, 2016).

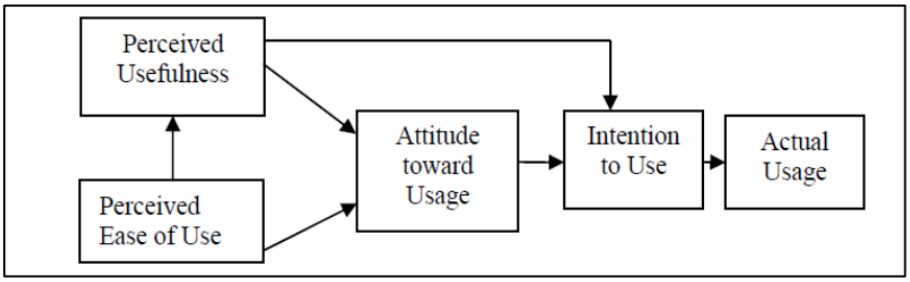


Figure 1: The technology acceptance model (TAM). Source: (Davis, 1989).

Going back to its origins, this influential framework is an adaptation of the Theory of Reasoned Action (TRA), according to which an actual behavior is the final result of a complex process developed by rational decision-makers that incorporate intentions determined both by subjective norms and by a person’s attitude towards the behavior itself (Fishbein and Ajzen, 1975).

Ajzen and Fishbein build this model of socio-psychological derivation which, through the elaboration of 3 constructs, aims to explain how individuals' behaviors are concretized, considering the intentions, the attitude of the individual himself and the subjective norms. At the basis of this theory there is therefore the identification of three predictive factors: a) "behavioral intention", b) "attitude toward the behavior" that is the personal attitude of an individual towards that particular behavior; c) "subjective norm" ie the influence that the opinions of others exert on the choices of the individual. (Fishbein and Ajzen, 1975).

Mathematically, it can be interpreted that behavioural intention is the summation of attitude and subjective norms. Moreover, intention of a person likely to convert to action if there is the intention to behave in a specific manner is strong enough. (Fishbein and Ajzen, 1975)

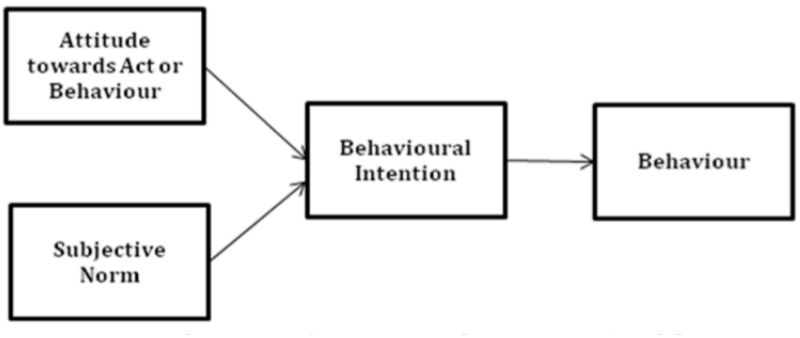


Figure 2: Theory of Reasoned Action, (TAR). Source: (Fishbein and Ajzen, 1975)

1.1.2 Technology Acceptance Model 2 (TAM2)

Venkatesh and Davis (2000) rework the TAM according to its original formulation creating an extension of the model itself giving rise to the Technology Acceptance Model 2 (TAM2).

As you can see from the image proposed below, this reworking of the model wants to demonstrate how the intention to use \ adopt a new technology is influenced by other factors besides Perceived Usefulness and perceived Ease of Use, which were the only determinants of the 1989 model.

Through TAM2 it is demonstrated how the acceptance of technology is influenced, not only by PU and PEOU but also by variables related to social processes such as subjective rules, and image; as well as instrumental cognitive processes such as "job relevance", "quality of the result obtained" and the provability of the result. As we can see from the image, the subjective rules affect both the perception of utility and directly the intention of use. Venkatesh and Davis affirm that in this case the previous experiences of users also play a decisive role (Venkatesh, Davis 2000).

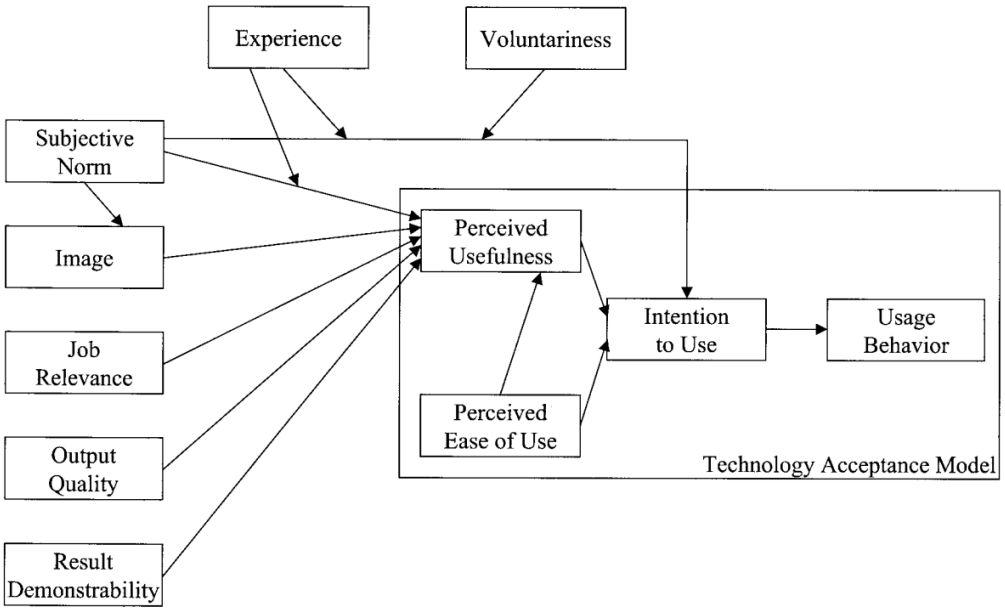


Figure 3: Technology Acceptance Model 2 (TAM2). Source: (Venkatesh, Davis 2000)

While previous studies have commonly adopted TAM to explain the user acceptance of technologies, it is uncertain if TAM sufficiently explains the adoption of different types of technology. Several studies have recommended integrating TAM with other theories, most notably diffusion of innovation theory by Rogers, to better understand the rapid changes in technology and to achieve a better explanatory power (Min, Kam Fung So & Jeong, 2018).

1.2 Diffusion of innovation Theory (DIT)

Everett Rogers (1931-2004) was an American sociologist, known mainly for the theory of the diffusion of innovations and for having coined the term early adopter, intended to indicate those who first adopt a new innovation. He grew up in Iowa and graduated from the University of Iowa State where he also earned a master's degree and a PhD, both in rural sociology. In 1962, at the age of 31, he published his work Diffusion of Innovations, thanks to which he obtained multiple awards, also testified by the numerous articles published as a result of his research and inspired by this. According to Rogers (2003) diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are. concerned with new ideas. Communication is a process in which participants create and share information in order to reach a mutual understanding. This

definition implies that communication is a process of convergence (or divergence) as two or more individuals exchange information in order to move toward each other (or apart) in the meanings that they ascribe to certain events (Rogers, 2003).

So, diffusion is a special type of communication, in which the messages are concerned with a new idea. It is this newness of the idea in the message content of communication that gives diffusion its special character. The newness means that some degree of uncertainty is involved.

According to Rogers (2003) uncertainty is the degree to which a number of alternatives are perceived with respect to the occurrence of an event and the relative probability of these alternatives. Uncertainty implies a lack of predictability, of structure, of information. Information is a difference in matter-energy that affects uncertainty in a situation where a choice exists among a set of alternatives. A technological innovation embodies information and thus reduces uncertainty about cause-effect relationships in problem solving. Is useful to conceptualize the diffusion and adoption of innovations in terms of a framework based on information and uncertainty. The use of these key concepts helps us to understand the diffusion of technological innovations as one type of communication process.

For a better explanation, we can say that the most important determinant of the benefits deriving from the adoption of a new technology is the degree of improvement it offers compared to the previous technology and how easily these benefits are identifiable by the adopter. Therefore, an explanation of the possible slowness in the adoption of a technology lies in the fact that the relative advantage of new technologies is often quite limited at the time of their first introduction. The uncertainty in adoption is often due to the fact that the benefits are usually diluted over time while the costs must be addressed immediately, and this makes it necessary to estimate the life cycle of the technology. Uncertainty slows the adoption rate.

Diffusion is a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system. When new ideas are invented, diffused, and are adopted or rejected, leading to certain consequences, social change occurs. Of course, sometimes change can happen in other ways too, for example, through a political revolution or pandemic (Rogers, 2003). An example of social change creates by a natural effect, like covid-19 pandemic, can be the remote working.

The four main elements that make up the diffusion theory of innovation (DIT) are: innovation, time, communication channels and the social system.

The first, innovation, presents five characteristics that are antecedents to any adoption: 1) relative advantages (economic gains or perceived convenience), 2) complexity (relatively free of effort to use or try), 3) compatibility (being consistent with the existing values, needs, and past experiences of potential adopters), 4) observability (assessment of implication), and 5) trialability (experimented with before adoption) (Rogers, 2003).

- Relative advantage indicates the perceived advantage of an individual towards a specific innovation, which makes it better than others, and the type of perceived advantage depends on the nature of the innovation itself (economic or social);
- Complexity determines the degree to which an innovation is perceived as difficult to understand and use, thus hindering its dissemination;
- Compatibility identifies the degree to which an innovation is in line with the principles, experiences and needs of an individual. Therefore, even if an innovation turns out to be advantageous, it can find an obstacle in its diffusion if in contrast with the needs and values of a subject;
- Observability refers to the degree to which the results of an innovation are visible to others. Therefore, an individual will be more inclined to adopt an innovation if it generates easily observable advantages.
- Trialability is the degree to which an individual can test an innovation before deciding whether to adopt it or not.

According to Rogers (2003), more innovations offer a greater relative advantage, a high compatibility with an individual's values, ease of use, the ability to be tested and the observability of the resulting benefits, the more they will record a faster adoption rate than other.

The second component of the diffusion process is time. The temporal variable plays a key role in Rogers theory, as it falls under multiple aspects. In fact, Rogers (2003), in line with other scholars, recognizes how an individual's choice to adopt an innovation does not correspond to an instant and quick act, but to a long process that develops over time consisting of several actions. Rogers calls this process “Innovation - Decision Process” and divides it into five different phases: knowledge, persuasion, decision, implementation

and confirmation. The first phase, knowledge, corresponds to the moment in which an individual comes into contact with innovation and learns how it works over time. In this phase, a subject does not always play an active role, as he could accidentally become aware of an innovation and in this case the information acquisition process could be longer and more complex. The second phase, persuasion, occurs when a person begins to develop a favorable or unfavorable attitude towards innovation. In this phase (and also in the following) the person carries out a much more in-depth research, identifying advantages and disadvantages and also relying on those who have primarily tested the innovation. Therefore, interpersonal channels play a central role during the persuasion phase. The third phase, the decision, determines whether the innovation will be adopted or not. Therefore, the decision-making process can lead to both the adoption of innovation and the rejection of the same, and in both cases the choice can change later. Next phase, is the implementation. Implementation corresponds to the moment in which a subject actually uses innovation. At this stage, problems may arise as a result of the use of innovation. Finally, the last phase, confirmation, indicates the moment in which a subject seeks theses to support his choice, so as to strengthen it.

The third key element of the diffusion process is the "communication channel", through which individuals exchange messages and share information. Communication channels are generally divided into two distinct types: mass media and interpersonal channels. Nonetheless, this does not assume that interpersonal channels are less effective than mass media. In fact, diffusion theory has always maintained that most individuals not only evaluate the objective advantages deriving from the use of an innovation, but rely on advice and information promoted by other subjects, who have primarily tested that specific innovation (Rogers, 2003). Indeed, social influence represents the extent to which members of a reference group influence one another's behavior (Kelman, 1958). The impacts of influential others are important in individuals' adoption decision process because people consider their social context when positioning their attitudes, behaviors, and beliefs (Salancik & Pfeffer, 1978). Thus, we claim that understanding the effect of social influence is critical when investigating consumers' adoption of an innovation.

In according to Young (2009) social influence is defined, as people adopting an innovation in a conformity motive, which occurs when enough number of influential others have adopted the innovation (Young, 2009). Social influence is impactful in

people's adoption decision process, because it reduces uncertainty and provides opportunities for individuals to have informational and normative social influences (Lu, Yao, & Yu, 2005). Consumers are exposed to a social system of their friends, families, members, and other connections, who can potentially influence one's decisions and behaviors toward innovation. Accordingly, consumers evaluate innovation by seeing and learning from other people using the innovation and decide if the innovation is worth adopting (Young, 2009). This influence can affect consumers' evaluation of the usefulness of an innovation. Also, social influence may affect individuals' internal aspects in shaping the decision of using innovation, such as one's confidence in using innovation or ability to use an innovation well (Lu et al., 2005).

The 'social system', the fourth and last component of the diffusion process, indicates the set of individuals, organizations and informal groups through which an innovation is spread. These individuals can be classified into different categories, depending on their time of adoption. Therefore, once again, the temporal dimension turns out to be fundamental in the diffusion process since it allows to trace the adoption curve (Rogers, 2003).

The literature on the diffusion of innovation, however, was born before Rogers, in fact it is precisely to the French sociologist Gabriel Tarde (1843-1904) who is credited with the first studies on innovation in the early 1900s. Tarde was a magistrate by profession, but he devoted most of his life to studies related to the social sciences and together with the first anthropologists he is considered one of the founding fathers of diffusion research. All of Tarde's thought was trying to answer a simple question. He wondered why, given a hundred innovations, only ten of these record an effective success spreading on the market, while the remaining ninety are forgotten. The reflection that emerged led him to describe the diffusion process, in three phases for: innovation, growth and maturity, through an S-shaped curve.

The curve shows the time on the abscissa axis and the number of adopters on the ordinates. The shape of this curve underlines that the number of subjects who adopt an innovation, when it is placed on the market, tends to be low, and then increases with the passage of time (Kinnunen, 1996). Why? Tarde considered diffusion a social process, according to which some subjects influence others, called imitations, thus leading to a general increase in the number of adopters and to the take-off of the diffusion curve

(Tarde, 1903). Therefore, the interaction between people is essential for the diffusion of an innovation such as communication within groups. The word "imitation" plays a key role in the thought of the French sociologist, as it underlines how a subject becomes aware of an innovation simply by copying the actions of another. The individuals from whom the imitationalists take inspiration are described by Tarde as an elite and correspond to those whom Rogers in his theory calls innovators and early adopters, precisely to indicate those who immediately adopt an innovation and significantly influence attitudes. and the opinions of others (Kinnunen, 1996).

To express this concept through a graph, Tarde (1903) referred to the diffusion of coffee. Indeed, the increasing number of coffee consumers can be graphically portrayed with an S-shaped diffusion curve, which Tarde had already realized. It means that over time only a few people adopt a new innovation at first. For example, rich people start enjoying coffee. According to Tarde s logical law it would fit their culture and resources better those the one of the poor. Then, the innovation becomes famous. According to an extra-logical principle, by drinking coffee the rich and famous set an example to be followed. Therefore, as the number of adopters (imitationists) increase greatly, prices sink and coffee becomes available for everyone. Finally, after most of the people have adopted the innovation, the number of new adopters decreases. (Tarde, 1903) (Kinnunen, 1996).

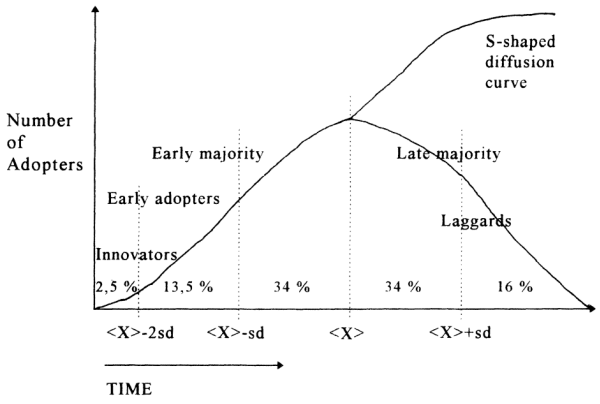


Figure 4: An imaginary S-shaped diffusion curve of coffee innovation and adopter categories. Surce: (Kinnunen, 1996).

Figure 5, shown below, shows the five categories of adoptees identified by Rogers (2003) along the S-curve.

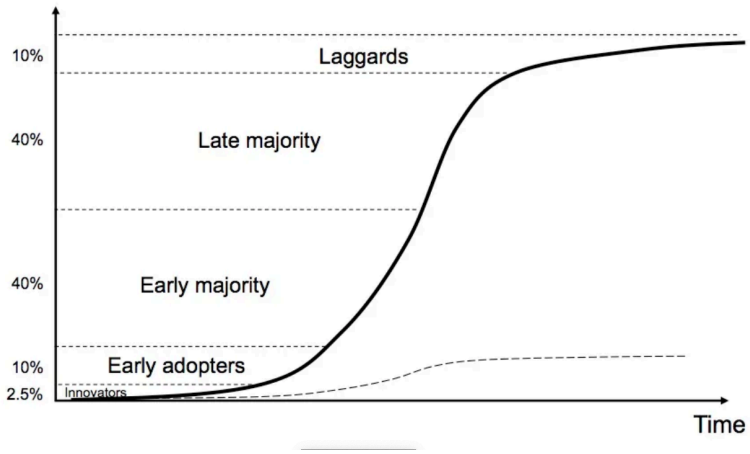


Figure 5. S curve with adopting categories. Surce: (Schilling & Izzo, 2017).

Placing the adoption quotas of each category on the ordinate axis and keeping the time variable on the abscissa axis, a bell curve is obtained, like the one we see in Figure 3.

Within this curve there are five categories, which differ in terms of adoption time, risk appetite and degree of involvement. The first category, the "innovators", are those who adopt an innovation as soon as it is placed on the market and therefore are characterized by a high propensity to risk. They usually have substantial financial resources, capable of absorbing the possible losses of an innovation that turns out to be unpromising. Rogers (2003) does not associate this category with a particular social class, but emphasizes how these subjects are fundamental in the diffusion process since they play the role of gatekeeper. They represent the main channel through which new ideas are transmitted in the social system. Despite their high importance, innovators cover only 2.5% of users. Instead of innovators, "early adopters", the second category, are much more integrated into the social system, which is why they are often classified as opinion leader, precisely to indicate the high influence that these subjects have towards high users. Rogers defines the importance of first adopters to emphasize the importance of their role in advertising innovation, thus accelerating the process of dissemination and attributes a share of 13.5% to this category. The third category, the "first majority" or "anticipating majority", covers 34% of the social system and corresponds to those subjects who slightly anticipate the average consumer. Therefore, although these users play an important role in the diffusion process, partly thanks to the continuous dialogue with their peers, they do not hold

opinion leaders positions like the previous category. In addition to the first majority, Rogers also identifies a “second majority” or “late majority”, and it also covers 34% of the market. As the name suggests, these are those subjects who have shown a certain degree of skepticism and uncertainty towards innovation, adopting it only when they feel increasing pressure from their peers. Finally, the last category, the “laggards”, are those who last adopt innovation. For these subjects, the decision-making process tends to be long and is based on a continuous comparison with the past. Furthermore, the resistance to innovations on the part of laggards may also derive from economic reasons, as these, having limited resources, must be sure that the innovation they are about to adopt will not fail in the future.

Therefore, this classification into categories shows how generally those who first adopt an innovation are characterized by a greater ability to manage risk and uncertainty and a high propensity for change. Indeed, they reveal a greater degree of involvement thanks to the continuous active search for innovations.

Several research studies attempted to study and analyze the factors that affect innovation diffusion. However, the focus was on the innovation attributes rather than the individual factors that help or prevent innovation acceptance and diffusion.

This paragraph examines how users, culture and communities affect both the development of innovation and modification. The role of “lead users” is fundamental to optimize the effect of functional attributes, such as relative advantage and complexity. Furthermore, while opinion leaders influence the diffusion of innovation, the role of lead users could be amplified at an earlier stage to influence social attributes.

Culture is believed to play a significant role in the diffusion of innovation (Rogers, 2003). In individualistic cultures, innovations take longer to be accepted than collectivist cultures. On the other hand, the spread is faster than in collectivist societies. However, as explained in the previous paragraphs, uncertainty has been found to slow down the acceptance and diffusion of innovation due to the inherent risk aversion in society. However, the role of lead users is critical to reduce complexity and increase relative benefit to attract users to adopt innovation; while opinion leaders are crucial in guiding the diffusion of innovation.

Communication is fundamental to the innovation adoption process, as it incorporates the role of word of mouth through both lead users and opinion leaders. Lead users are defined as being in advance of the market in terms of their needs, motivations and qualifications (Urban & von Hippel, 1988). As a result, they have unique characteristics in comparison with the mainstream consumers such as consumer knowledge, use experience, locus of control, motivation and innovativeness. In addition, another characteristic is the tendency to spread positive word-of-mouth about their innovation that results in increasing the rate of diffusion (von Hippel, 2005). This was empirically proven as lead users used to freely reveal information about the products that they have developed in order to enhance their reputation. Opinion leaders are identified as having greater access to mass media as well as interpersonal networks in comparison with their followers. In addition, they are perceived as having higher socio-economic status and tendency to adopt new innovative ideas before their followers (Rogers, 2003). Their main characteristics are knowledge, social influence, innovativeness and interpersonal factors (Rogers, 2003)

However, there are other interpersonal networks. For example, online communities. The "virtual community" (Rothaermel & Sugiyama 2001) is defined as a community where people gather around a common goal and share common interests using Internet channels such as email, chat rooms or Internet user groups (Hagel & Armstrong 1997; Williams & Cothrel 2000). Participants in online communities exchange information, knowledge and reviews on common services, products or interests. Virtual communities create a new medium where like-minded strangers meet regardless of their physical location and not bound by time. Through virtual communities, people have the opportunity to communicate, share experiences and learn from each other, meeting their social and commercial needs.

1.2.1 The Importance of Community

Research in various disciplines has recurrently documented the significant social influence of groups on member behavior.

The concept of social norm and social influence varies between different disciplines, but is commonly defined as a predominant behavioral model within a community, sustained and supported by the various members that compose it (Nyborg, et al., 2016). The same

theory of innovation of Rogers (2003) describes norms as standard models, which act as a guide to direct the behavior of members belonging to a social system.

At a theoretical level, the definition proposed by Tajfel (1978), which is most commonly cited, maintains that social identity is ". . . that part of an individual's self-concept which derives from his knowledge of his membership of a social group (or groups) together with the value and emotional significance attached to that membership."

An example of social influence of groups is that of open source software (OSS).

OSS refers to any computer software whose source code is made publically available under OSS licensing formats. The idea of open source software development can be traced back to 1960s when scientists and researchers (also known as hackers) relied on free and openly shared software code for their work due to the unavailability of commercial software solutions. In the 1980s when software vendors began to control source code, some hackers became offended by the loss of access to the source code, particularly to the code that they had been involved in developing. They were also distressed by a general trend towards the development of proprietary software released under licenses that prevented free access to the source code. To fight against closed source/proprietary software, a practice they deemed immoral, the Free Software Foundation (FSF) was created and various copyleft licensing was developed to preserve free access for all to the software developed by hackers. The goal of these initiatives was to promote ideologies such as:

1) information should be free 2) making the source code of computer programs freely available is more valuable to users and the society because it enables them to adapt, learn from, or base new work on the source code. Despite its appeal, the free software idea remained non-mainstream and the software industry was especially weary of it. To enhance its acceptance, prominent hackers such as Bruce Perens and Eric Raymond founded the OSS movement in the 1990s, which incorporates similar licensing practices as those pioneered by the FSF, but deemphasizes ideological concepts with regard to morality. Today, the OSS phenomenon has evolved into a significant force in the software landscape. In addition to the free access to source code, another unique feature of OSS is its communal nature. Since its inception, the hacker culture, which later evolved into the OSS movement, has differed substantially from the proprietary software culture. Specifically, in extremely distributed environments enabled by the internet, individuals from geographically dispersed locations form various OSS user groups. Through these groups individuals collaborate and interact online (occasionally face-to-face), and a wide

variety of OSS products and user support are developed and offered. Further, OSS development is marked by shared ideologies and values. In addition to the ones mentioned above, other well-developed and repeatedly cited OSS ideologies and values include: 1) sharing, cooperating, and helping should be valued and 2) OSS development model should produce higher quality software than the closed source software development model. Third, a strong sense of duty and obligation permeates many OSS development and user groups. This is exemplified by the reciprocal behavior widely observed in OSS groups and the member-funded promotion for various OSS projects. These characteristics–the establishment of social relationship through interaction and cooperation, innovation by and for the users, shared ideologies and values, and the strong sense of duty and obligation–epitomize the fundamental aspects of a community and distinctively mark OSS as a community-based innovation.

OSS applications certainly share many characteristics with other types of software, thus, factors identified as important in technology adoption and diffusion may play an equally important role in the adoption and use of OSS. Nevertheless, OSS applications also have certain key unique features. For instance, they are more than just computer programs; they are community-based innovations. Hence, an important question is whether individuals would think and act differently in their decisions to adopt OSS. Since its inception the OSS culture has been shaped by a strong sense of community. How we see, empirical work from sociology and marketing demonstrates that social identification positively impacts member behavior, including product evaluation, adoption, purchasing, word-of-mouth marketing, and member participation and engagement.
This continuing phenomenon of community-based innovation underscores the importance of adapting the technology acceptance theories to this trend and understanding how to use individuals' relationships with the community as a lever for increasing adoption and usage.

Gallegoa et al. (2008) propose and empirically examine a model of user acceptance towards OSS applications (using TAM). Based on a survey of 347 Linux operation systems users, their findings suggest that perceived usefulness and perceived ease of use exert a strong positive impact on intention to use Linux, which subsequently predicts usage behavior. Perceived ease of use is also found to positively impact perceived usefulness. User perceptions of the technological characteristics (flexibility, quality,

capability) are found to positively impact perceived usefulness and perceived ease of use while no significant relationship is found between social influence and users' beliefs on ease of use and usefulness. While the study by Gallegoa et al. (2008) has made important and unique contributions, the understanding of user acceptance of OSS can be deepened through the identification of other significant determinants that are unique to OSS adoption and use. This analysis it may lack adequate specificity to explain and enunciate OSS adoption given that OSS has some notable differences compared to traditional proprietary software. For instance, OSS adoption is often a voluntary decision and is hence less likely to be influenced by subjective norm pressure. This may explain why Gallegoa et al. (2008) did not find any relationship between social influence, measured as subjective norm pressure, and users' beliefs on ease of use and usefulness. On the other hand, the strong community-oriented OSS culture highlighted above implies that the effect of social influence on OSS adoption is more likely to manifest in the form of social identification with the OSS community. In the marketing and sociology literature, social identification with a brand community or a social movement has been shown to influence participation, word-of-mouth behavior, purchasing intention, and adoption behavior. This implies that understanding individuals' OSS adoption decisions needs to be expanded from its current focus on technology acceptance variables (i.e., usefulness, ease of use, and subjective norm) to encompass the social influences of the community.

According to the Social Identity Theory (SIT) (Tajfel, 1986), individual searching for identity tend to classify themselves and others into various social categories. The SIT literature also suggests that identification is likely to be associated with strong awareness of out-groups as it reinforces the awareness of one's in-group (Tajfel, 1986). Indeed, in the OSS case the salience of out-group is evident in OSS members' strong sentiments against firms selling proprietary software. The strong awareness of the proprietary firms increases in-group favoritism and leads to a stronger identification with the OSS community. According to the SIT literature (Tajfel, 1986), social interaction, similarity, and shared goals could all favorably affect the extent to which one identifies with the community. Taken together, the pervasiveness of the set of favorable conditions community distinctiveness and prestige, out-group salience, social interaction, similarity, and shared goals, suggests that social identification with the community is likely to be prevalent and play an important role in social identification and in shaping individual behavior.

To conclude, to better understand the adoption of new technologies, it is necessary to deepen one's studies through the integration of TAM, TAM2, SIT and the diffusion of innovation theory (DIT). However, it is necessary to consider all external variables, such as the role of communication discussed above, and all personal variables, such as personal motivations, belonging to a community, trust and common sense.

1.3 What are the impacts of news in the diffusion of innovation?

The question we are going to ask in this paragraph is very simple, it is discussed a lot but we do not have an evident bibliographic relevance in this theme. What is the role of news and announcements in the adoption and acceptance of a new digital technology? So how does the news that we can get from different media, blogs or platforms affect the choices of consumers and their motivation? We do not have bibliographic research that empirically highlights how news affects the acceptance of technology, digital technology and its diffusion but there are several more or less recent studies that in the financial field study how news impact the price of financial assets and stocks.

1.3.1 How news affects the crypto space and their diffusion

More pioneering research has gone into studying the effects of public announcements on the cryptocurrencies market which, being a much more volatile market, has a greater reaction to news.
I want to start from the crypto market. Cryptocurrencies have gained popularity as new economic investment assets globally in recent years.

From the crypto world, I like to remember the role that some "celebrities" have in influencing the market. We all know Elon musk, founder of Tesla and Space X, the richest man in the world who has always managed to make people talk about himself. In the early stages of 2021, Elon Musk had the cryptocurrency market wrapped around his finger. A single tweet about dogecoin by the Tesla and SpaceX founder sent prices flying as much as 50%. For a time, bitcoin price action seemed reliant on the opinion of Tesla's founder. Musk's tweets, while not necessarily posted for his own financial gain, can greatly affect investors in cryptocurrency. They also raise questions about the solidity of a market that

can be so easily swayed, especially as retail investors increasingly flock to cryptocurrencies (Molla, 2021).

The correlation between dogecoin's rise and Musk's praise is undeniable. An example? On Dec. 14 2021, Musk announced on Twitter that Tesla would accepting DOGE (Doge Coin) for merchandise and the price subsequently jumped 43% over the next two hours. (official Elon Musk's Twitter profile, 2021)

While other billionaires and celebrities hopped on the DOGE bandwagon, Musk was often the most outspoken in his attempts to raise the "meme coin".
Musk eventually found himself within the bitcoin conversation and Tesla played a vital role in price action throughout the spring 2021. On Jan. 29 2021 Musk adds "#bitcoin" to his Twitter bio, driving a 14% surge in the largest cryptocurrency (Shead, 2021).
Disclosing Tesla's purchase of BTC, accepting BTC as payment, eventually selling a portion of the BTC holdings and canceling BTC as a payment method all had significant effects on the market, amplifying crypto assets' already considerable volatility.
On Feb. 8 2021, Tesla announced its purchase of $1.5 billion in BTC and the price skyrocketed 19.5% from $38,850 to $46,400 within the day. The amount of BTC bought by Tesla and used to purchase its vehicles was relatively small compared to daily trading volume on the nearly $1 trillion asset, yet it controlled the narrative in the market for months. On May 12, an "Elon effect" of a different sort took place when the CEO announced Tesla would no longer accept BTC as payment. While the market had already fallen hard off of its highs in the months before, this tweet sending the price of BTC from $56,800 to $49,500 (Oosterbaan, 2021). Elon Musk is far from the only person to move the crypto market for no apparent reason other than making an endorsement. A sizable portion of the industry from "meme coins" to NFT's has proven to be highly responsive to celebrity announcement.

However, Musk's impact on prices diminished over the course of the year. Perhaps the billionaire wore out his welcome or perhaps the market became more rational. BTC was able to withstand a three-month bear market over the summer and retake April's highs this fall without the constant help from Musk. DOGE had fallen from its glory and "the dogefather's" latest dogecoin-themed tweets struggled to excite the market.

Using data from TradingView, this chart tracks influence on the Doge Coin by Elon Musk's tweet

Figure 6: Influence on over price on DOGE coin by Elon Musk's tweet. Source: www.coindesk.com

The power of social media in the crypto market is testament to the general lack of regulation and maturity. (Oosterbaan, 2021).

Leaving for a moment the influence of celebrities in the cryptocurrency market, do we really know how much news and announcements affect crypto prices and purchases? Cryptocurrencies, among which Bitcoin has been the largest by market capitalization, have become a mainstream investment asset in recent years. There are 13.357 different cryptocurrencies on the market as of March 2022, (coinGecko, 2022), and this number is still increasing. Cryptocurrencies are one of the most promising financial innovations of the last decade. Different from major stock indices and the commodities of gold and crude oil, the cryptocurrencies exhibit some characteristics of immature market assets, such as auto-correlated and non-stationary return series, higher volatility, and higher tail risks (Feng, Wang & Zhang, 2018).

According to Ciaian, Rajcaniova, and Kancs (2016) the arrival of new information has a positive effect on Bitcoin price, indeed the short-run price fluctuations are driven by online information search about Bitcoin in the first years after its introduction which may be a result of increasing trust among users. For the first period, the results suggest that, when Bitcoin was little known, the online information had a stronger impact on Bitcoin price (Ciaian, Rajcaniova, and Kancs, 2016).

For this reasons Joo, Nishikawa and Dandapani (2020) examine market reactions to major event announcements and news associated with cryptocurrencies.
In this study, they focus on the three largest cryptocurrencies by market capitalization: Bitcoin, Ethereum, and Ripple. These currencies have ample liquidity, are traded on multiple exchanges with substantial trading volume, and have a global market. In the article, major news from major US media announcements are categorized as positive or negative events. Positive events are defined as those events that are predicted to bring an expansionary effect to the cryptocurrency market, and therefore should expect a positive return from those events, such as: positive regulation, for example, the news of El Salvador or Lugano (Lugano Plan B) that declare Bitcoin a legal tender is considered a positive event as it has an expansionary effect bringing in more traders; exchange-related news can be a positive event because it indicates the expansion and availability of enhanced trading possibilities; Split, like news on currency splits or forks, and finally partnership.
Similarly, negative events are defined as those events that are expected to bring a contractionary effect to the cryptocurrency market, and therefore should expect a negative return from those events.
Such as Hacking, Negative Regulation like ban on cryptocurrencies; negative split news on one cryptocurrency and all news about comments made by significant market leaders in the financial or regulatory industry. While events in this category could have either a positive or a negative impact, it is typically apparent how the market will react to the news.

In conclusion form the analysis how high abnormal returns are observed on the event day (Day 0), indicating that there is a market reaction to major news events. Even three days before the event (Day −3), abnormal returns are detected in the same direction as the news

(positive or negative). This may imply that the market reacts to rumors of upcoming events. In general, cumulative abnormal returns (CAR) diverge during the event windows of (−3, 6) and (0, 6), suggesting that the information is not fully reflected in prices immediately after the events. This also indicates that there is a positive trade opportunity for an investor who begins trading even after the news comes out during the period examined. And thanks to this analysis we can understand that the market reaction to negative events is stronger than that to positive events.

Another pioneering research (Yue, S. Zhang, Q. Zhang, 2021) examines the liquidity (the ability to convert the cryptocurrency into cash without any difficulty) of cryptocurrency around the various market events which send different signal to the market participants by event study comparison. This study comparing the changes of liquidity around 5 positive and 5 negative news events in the cryptocurrency markets. This research extends a previous study (Zhang and Gregoriou, 2020) which was instead based only on negative news such as, the ban of Chinese government of coin offerings (ICOs) on the 4th of September 2017. The ICO rules prohibit buying or selling cryptocurrencies, setting prices, or other related agent services. They are also not allowed to convert legal tender into cryptocurrencies or vice versa. China was one of the most important cryptocurrency trading nations in the world.

Also, in the more recent study, like in the previous, the response of cryptocurrency liquidity to positive and negative news, using Top 5 and Top 100 cryptocurrencies, suggest that the news effects are asymmetric. The cryptocurrencies experience an increase in liquidity after positive news announcement and a decrease after negative one. The improvement of liquidity lasts at least 20 days subsequent to the positive news announcement whereas the negative news effects diminish in 4 days subsequent to the announcement. The market shows greater reaction to Top 5 cryptocurrencies than Top 100 ones.

However, there are also evidence of information leakage prior to the positive or negative news announcements by examining liquidity changes in the pre-event windows. Finally, the study find evidence that the positive and negative news lead to an increase or a decrease in the cryptocurrency returns (Yue, S. Zhang, Q. Zhang, 2021).

Same evidence also for an older research (Riordan R., Storkenmaier A., Wagener M., S. Sarah Zhang, 2013) which ends “this result is in line with psychological studies from the

field of impression formation showing that humans react stronger to negative information" (Riordan R., Storkenmaier A., Wagener M., S. Sarah Zhang, 2013).

1.3.2 How news affects traditional stock market

Moving on traditional stock market, another very interesting research (2006) studies the effects of E-business outsourcing announcements on the market. The research collect data between 2002 and 2009 when E-business initiatives receive lot of attention.
The study identifies 3 main hypotheses associated with E-business outsourcing announcements: strategic intent, execution swiftness, task complexity.
Thanks to data analysis they found that stock markets reacted positively to E-business outsourcing announcements with the strategic intent of commercial exploitation. Also, these projects that were planned to be swiftly executed to overcome the potential risks of business requirements obsolescence and technology change and obsolescence triggered positive stock market reactions. Finally, outsourced E-business projects with high task complexity achieved positive abnormal returns. The contradictory results for task complexity suggest that stock markets are not influenced by concerns over coordination (Agrawal, Kishore, Raghav Rao, 2006).

There are many other researches that analyze the effects of news or announcements in the traditional market, (Dimpfl, 2011), (Kun Li, 2018), from which it is clear, as is evident from the studies that I mentioned above, that the markets are not indifferent to news, indeed, the more the markets are volatile the more they react positively or negatively to the news.
How much does the news affect consumer behavior? With all the digital channels at our disposal, we must do our best to avoid fake news and rely on reliable channels. However, how much news and fake news influence our behavior?
We are overhung from news, we produce it, we share it, we comment on it; most of the time we do not even ask ourselves where they come from or if they are reliable: the web has expanded the audience of the information world, bringing more freedom, more news, but also less intermediation and less checks on the quality and truthfulness of information that travels on the net. The web and social media respond to three very specific needs that are present within the company: to have news at any time and in any place, to have a plurality of information sources that express different points of view and to make the

players protagonists too. users (RAPPORTO ITAL COMMUNICATIONS Censis, 2021).

The result is a communicative overcrowding made up of many news that are born and die quickly, some of which are not verified or are even invented with the risk that, rather than increasing the knowledge and awareness of a certain event, they generate anxiety, social alarm, distorted views of reality and / or wholly cause behaviors that may have consequences for individuals or the community.

The risks of going on the web but staying out of the truth are greater for the weaker segments of the population, those who have minors to recognize and select the truth of the news and who are more exposed to the lure of partial, misleading and false news.

But there is a further risk that has emerged strongly in the last period: even official information and that conveyed by traditional media and online media, in the presence of an unknown event of individual and global significance, produce so much confusion and generic misinformation. These risks are all the more widespread the more the news is specialized, sectorial, difficult to interpret and have repercussions on collective behavior: this is the case of the rules to follow for the prevention, diagnosis and treatment of Covid-19.

The pandemic represents a case on the bad example of how a sudden and unknown event, which has transversally impacted the life of the entire population, triggering a demand for unpublished information on a global level, be the subject of so much communication that, at best, confused the Italians on things to do, and in many cases, it has created misinformation.

50 million of Italians, equal to 99.4% of adult Italians, sought information on the pandemic.

For 49.7% the communication of the media on the health epidemic was confused, for 39.5% anxiety-producing, for 34.7% excessive. Only 13.9% think it was balanced (Rapporto ital communications Censis, 2021).

An interesting research has gone into studying how fake news during Covid-19 influenced the behavior of readers (Greene, Murphy, 2021).

In fact, this problem takes on a new urgency in the context of the coronavirus pandemic and the consequent wave of online disinformation. In this large study made up of a sample of 3.746 people, it was highlighted how the effect of exposure to fake news on COVID-19 affects the intentions of behavior. The study observed that there are small but measurable effects on some behavioral intentions, for example, participants who read a

fake news about the privacy issues of tracking apps reported a 5% reduction in willingness to download the applications. In the next chapter we will discuss about digital contact tracking apps. These data suggest that one-time exposure of fake news can have behavioral consequences, although the effects are not large. Furthermore, there was no effect of providing a general warning about the dangers of online disinformation on the response to fake news, regardless of whether the warning is framed in positive or negative terms. This suggests that generic online disinformation warnings, such as those used by governments and social media companies, are unlikely to be effective.

1.3.3 How news affects digital crowdfunding campaign and customer behavior

Pioneering research in terms of motivations for financing a crowdfunding company highlights how users, taking into account the limits of tangible earnings to stimulate funding, are motivated mainly by non-pecuniary motivations stimulated by the news that appeared during the analysis period in the blog associated with the game. The reference analysis was based on a crowdfunding campaign of the Natural Selection game, conceived by Cleveland Charlie founder of Unknown Worlds Entertainment, ended in 2009. The game's crowdfunding campaign was launched to support the continuous development and improvement of the game itself. The campaign description included brief explanations of the project, its background, a roadmap of the objectives and how the funds were used, as well as a biography of the entrepreneur. Lenders based their funding decision on an older version of the core product, not a pre-launch campaign as is usually seen. In this way the uncertainty factor was reduced. An essential element in this study was Cleveland's communication, as the founder of the project in fact, he maintained regular communication with the game's players through a blog associated with the game. It is precisely communication that is relevant in this analysis indeed to capture variation in empathy and a sense of common cause, communications are essential. Entrepreneur attitudes evidenced through project communications have been considered crucial stimuli for funder engagement. For example, Cleveland referred to game users as “community” “members” “we” and “us” for emphasize the common goals of all involved in seeing the project advance (Boudreau , Jeppesen , Reichstein , Rullani, 2021).

A research about 1726 crowdfunding campaigns from the famous platform Kickstarter, finding that entrepreneurs conveying positive psychological capital experience superior fundraising performance *(Anglin, Short, Drover, Stevenson, McKenny, Allison, 2018).*

With positive psychological Anglin et al. (2018) refers to hope, optimism, resilience, and confidence. This positive psychological capital would portray an entrepreneur that is confident, resilient, motivated, and positively oriented toward taking the needed steps to achieve their goals. Interactions between creators and supporters have also been found to influence crowdfunding performance positively. For example, frequent updates from the founder are associated with increased crowdfunding performance, and the number of comments posted also has a positive effect on project funding *(Wang, Li, Liang, Ye, Ge, 2018)*.

To concludes, similar with the voluntary contributions donated to charitable and philanthropic organizations and given the limits of offering monetary rewards as incentives, entrepreneurs pursuing funding through crowdfunding must arouse non-pecuniary motivations, stimulated by the communication and announcements of the founder and the community itself. Using the long history of similar funding in charitable and philanthropic donations as a benchmark, three broad categories of relevant non-monetary motivations are identified: psychic rewards, signaling-based rewards, or reciprocity *(Boudreau, Jeppesen, Reichstein, Rullani, 2021)*.

Taking charitable donations as an example, the motives could involve enjoying, for example, the "warm glow" of giving or a sense of selflessness. The research shows how, in the case of crowdfunding, evidence of a sense of empathy and "common cause" between lender and entrepreneur stimulated by the entrepreneur's communication can be highlighted. While charitable donations might involve reporting one's contribution, for example, to gain status or signal virtue. Analysis found that many crowdfunders are motivated by reciprocity in the sense of repaying entrepreneurs for the accumulated consumption of project *(Boudreau, Jeppesen, Reichstein, Rullani, 2021)*.

Therefore, we can think that, based on the theories widely explained in the first paragraphs regarding the evolution of the acceptance of a new technology, diffusion of innovations and in the analysis described above regarding the effects of news on the markets and on the behavior of individuals; social context, announcements and news have a strong impact on the diffusion and acceptance of a new technology. If we take a complex period like Covid-19 pandemic, fear, uncertainty, confusion make individuals even more sensitive to negative and positive news.

Positive communication, capable of conveying a sense of community and altruism could lead to positive choices by the individual just as we have seen in the case of crowdfunding. Instead, controversy, negative news or fake news could increase uncertainty, fear and cause negative effects in consumer choices.

In the following chapters I will try to answer the research question placed at the beginning of the last paragraph. Thus, I will try to understand how the Italian news, in the traditional media, stimulate the downloads of two different digital applications for public utility, in a positive or negative way. In the next chapter I will describe the two applications take into consideration, App IO (PagoPA S.p.A.) and App Immuni (Sogei S.p.A.) and finally, in the last chapter with an event study based on the collected data I will study the effects of news in downloads of these two digital applications.

CHAPTER 2

"THE INNOVATIVE STATE"

2.1 Two public utility applications App IO and App Immuni

As Mariana Mazzucato states in her book "The Entreprenurial State" (2020), public investments stimulate growth and innovation, cutting these investments damaging the growth and innovation of the country because the state is one of the key elements to foster growth in this sense. Obviously, it is necessary that there are competent, dynamic and innovative public organizations capable of creating value. Too often, says Mariana Mazzucato (2020), due to the ideology that portrays the state as old, slow and with a partial role in the economy and markets, one does not invest in the dynamic public capacities and structures that allow the state to be effective.

Over the past two years, governments around the world have spent their time tackling the pandemic, setting restrictions to slow the disease, creating stimuli for the economy and investing in research and development to find a cure and to develop innovative solutions to track the contagions. These interventions in emergency situations are necessary and foreseen. But, according to Mariana Mazzucato (2020), the role of the state must be to favor markets to ensure that they produce the necessary results in the long term, not only as a last solution in a crisis situation like the one we are facing. We can see the pandemic period we have experienced and are experiencing as an opportunity. For the recovery, governments must do more than stimulate economic growth, they must guide this growth to solve the problems that each of us faces: climate change, digital divide, holiness. Indeed, this is the role of the “Italia Domani” PNRR (National Recovery and Resilience Plan).

Italia Domani is part of Next Generation EU, an economic revitalization project dedicated to member states. Italy integrates the PNRR with the National Plan for complementary investments, with additional resources of 30.6 billion. For a total of 191.5 billion.
The Plan is divided into 6 Missions, thus six main thematic areas on which to intervene, identified in full coherence with the 6 pillars of the Next Generation EU. The Missions are divided into areas of intervention that address specific challenges, made up in turn of Investments and Reforms (Italia Domani).

Very often the state isolates itself from the private sector by outsourcing key tasks. This trend deprives him of a fundamental resource: knowledge. For this reason, public organizations are no longer able to attract talent.
"The less a state thinks big, the less it will be able to attract skilled skills, the worse its performance will be and the less it will be able to think big" (Mazzucato, 2020). Like a dog chasing its own tail.

Innovation is certainly not the main function of a state, but an innovative, dynamic public organization capable of playing an entrepreneurial role in society changes the way we talk and think about the public sector. Therefore, the State must not be a passive entity, it must lead change, incentivize private sector investments and play the role of innovator, investing in research, development and knowledge.

Thus, we just have to hope that Italy will make the most of these years to revolutionize the country. We can already see the progress made in the digital field. Minister Colao, former CEO of Vodafone, says that the results obtained are among the best in Europe. 43% of Italians have a digital identity compared to the 70% target set by the PNRR for 2026, there are currently 29 million SPIDs and over 27 million active CIEs. On the pagoPA platform, transactions exceed 4 billion per month with 9 million active users (Damiani, Italia Oggi, 2022).

The second chapter of my paper will present two digital public tools that have stood out for their innovation and their goals, achieving very different results and addressing relevant social issues. The purpose of my thesis will not be to ascertain losers and winners but, to understand what motivated the individual to adopt these applications or not.

In the following paragraphs, we will proceed with a description of the two applications, highlighting the strengths and weaknesses. But first, let's put some order, the two applications I have taken into consideration are App IO (PagoPA S.p.A) and IMMUNI app (Sogei S.p.A).

2.2 PagoPA S.p.A And IO

PagoPA S.p.A., created as a result of the Italian “Simplifications” Law Decree no. 135 of 14 December 2018, is the company wholly owned by the State through the Ministry of Economy and Finance (MEF) and subject to the supervision of the Prime Minister, through the Minister for Technological Innovation and Digitalisation. The Company's mission is to design and build infrastructures and technological solutions aimed at **promoting the widespread diffusion of digital public services** accessible to citizens and businesses in the simplest possible way, via mobile devices ("mobile first" approach) and according to the “once-only” principle, with secure, scalable, highly reliable architectures based on clearly defined application interfaces (API). PagoPA works in this direction in line with the evolution underway in the **European Union** and pays great attention at the international level to monitoring, to exchanging of good practices, as well as building synergies in the field of experimentation with new models and technologies (PagoPA S.p.A. – Company Profile).

Through a survey carried out by the Piepoli institute in February 2022 on a sample of the entire Italian population, divided by geographical area, sex and education, through the realization of 502 interviews have updated data on the participation of citizens in digital public services. From the study of the sample we see how 69% of respondents say they access public services through digital channels (online or via app), of which over half (36% of the total) express a clear preference for these channels when available. To these is added 10% of the sample that used digital channels at least once. (Medium PagoPA, 2022)

The starting point in this digital transformation process is represented by the pagoPA platform.

pagoPA is one of the enabling platforms provided for in the Three-Year Plan for IT in the Public Administration and conceived as solutions that offer fundamental, transversal and reusable functions, standardizing the methods of use of the services they provide. Specifically, pagoPA is an electronic payment system created to make any payment to the Public Administration easier, secure and transparent in a standardized way, both online and offline (Fact sheet pagoPA).

The platform allows citizens and businesses to choose how and with whom (which Payment Service Provider, PSP) to pay taxes, duties and public services with benefits for all those involved according to a win-win model.

As of 7 January 2022, almost 39 million citizens and over 2 million enterprises have used pagoPA to make payments to about 18,000 PAs that have actively joined the platform. On the same date, the connected Payment Service Providers (PSP) numbered approximately 450. The platform has experienced constant growth over the last five years, both in terms of transactions and the value of payments. In 2020, the platform handled over 101 million transactions for a value of over € 19.7 billion and, in 2021, transactions exceeded 182.5 million equals to around € 34 billion. (PagoPA S.p.A. – Company Profile)

The race to digital transition and development of a digital ecosystem of the PA with the citizen at the centre, in order to simplify the relationship between the State, citizens and businesses does not stop there for PagoPA S.p.A, the other infrastructures managed by the company are:

- Centro Stella of Electronic Payments
- Digital Notification Platform of Public Acts
- National Digital Data Platform (PDND)
- Check IBAN Platform
- "IO" platform (the public services app)

App IO (the public service app) is the app designed as the mobile access point to all digital public services, thanks to which the administrations contact citizens, allowing them to manage transactions related to a specific service quickly, punctually and securely, comfortably from their smartphone. Inclusiveness and accessibility are the two founding principles of the IO project. App IO make interaction between citizens and the public administration simpler and more direct, by leveraging the increasingly widespread use of smartphones across the Italian population to access the web. Allowing all citizens to have public services always available ‘in their own pocket’ and to manage complex operations in a few quick steps, the IO app can also serve as a helpful tool to reduce the digital divide among elderly people or citizens who are simply less accustomed to using technology (De Santi, 2019).

As of 7 January 2022, the app downloads were over 25 million, more than 6 million citizens on average had used IO each month and over 6,800 entities were offering services through the app. In terms of active services, the IO app offers a variety of national and local services that institutions can request to activate, for a total of almost 77.300 single services integrated on IO up to now.

All this has led "IO" to be the most downloaded free app of 2021 on IOS devices.

The first national initiatives, which had a strong media coverage and have driven the current diffusion of IO were the functionalities ensuring the registration and consultation **of the Holiday Bonus and the Cashback Programme.**

The former prime minister Giuseppe Conte on the bonus "Cashback program is a measure for the country's digital revolution, the benefits go beyond the period of pandemic. It is the first step for the digital transaction of the country."

The goals of the program are:

- create the conditions for the emergence of many illegal operations
- foster the development of digital payments.

The Cashback promised to get a 10% refund on the number of card purchases. As for the Super Cashback, every six months the first 100,000 who had made the most transactions would have obtained 1,500 euros (Carli, Ilsole24ore, 2020).

2.2.1 The Cashback Programme

All right, first thing first.
The Cashback project was born from the belief that the development of electronic payments is a basic component for the digital transformation of the entire country.
Established from art. 1 subparagraphs 288 and the following of legge n. 160 del 27 dicembre 2019 (legge di bilancio) (*Gazzetta Ufficiale, 27/12/2019*), and subsequently from d.L 34 del 2020 (Decreto Rilancio) (*Gazzetta Ufficiale, 19/05/2020*) and from d.L. 104 del 2020 (Decreto Agosto) (*Gazzetta Ufficiale, 14/08/2020*) the Cashback officially debuted with a first experimental phase on 8 December 2020, according to the provisions

of the Decreto 24 novembre 2020, n. 156 issued by the Minister of Economy and Finance. (*Gazzetta Ufficiale, 24/11/2020*)

How does it work? The program allows all those who have reached the age of 18, residing in Italy, to receive a refund equal to 10% of their spending made with credit cards, debit, prepaid cards, and payment apps in shops, bars and restaurants, supermarkets and large-scale distribution or for artisans and professionals, up to a maximum of € 150 (€ 300 per year) by making a minimum of 50 payments in a semester. purchases must be made in physical stores and not online.

Cashback is divided into four periods. The first experimental period, called "Christmas Extra Cashback", began on December 8, 2020 and ended on December 31, 2020. In February 2021, program participants received reimbursements (Italia Cashless)

Starting from 1 January 2021, three periods of six months each were envisaged, then suspended on 1 July 2021 (Decreto Legge 30 giugno 2021 n. 99).

This program has achieved considerable success, in fact, at the time of its launch, many users were unable to complete the registration procedure of their payment cards due to the high number of requests, over 6000 per second, which sent haywire banking services (Longo, 2020). Virgone and Cavaresi, respectively CEO and CIO of PagoPA SpA, (2020) commented, on the Medium platform, on the inefficiencies encountered between Monday 7 December and the following day, explaining how in less than 24 hours the number of users increased to more than 1 million reaching 7.6 million and card registration requests reached peaks of 14,000 transactions per second with 2.3 million people active in the app. These are very high numbers and above all, far from the estimates made in the weeks before the launch, which were based on the volumes that are normally recorded during the Black Friday period. In fact, the requests accepted in the app doubled the volumes of Black Friday, tripling those that occurred on a normal day.

Alongside the Cashback initiative, the Government has established two other forms of incentives, namely the Super-Cashback and the Receipt Lottery. These are interrelated programs, as the aim is always to accelerate the digitization process of the country. The first, or the Super-Cashback, is an initiative closely related to the Cashback program, since it guarantees a refund of up to a maximum of 3,000 euros over a year to those who are among the first 100,000 participants of the State Cashbak. Therefore, these are the subjects who have carried out the highest number of transactions with electronic payment (Italia

Cashless). This program does not impose any spending limit, therefore even the smallest transactions are valid if carried out by card.

• the fight against tax evasion (estimated at 29.5 billion euros the recovery potential of the shadow economy in the hypothesis of aligning cashless transactions per capita with the European average)
• the reduction of cash management costs (approximately € 7.4 billion per year in Italy)
• greater security of payments *(G.Virgone & M. Calvaresi, 2020*).

As Andrea Tironi mentioned in the "Agenda Digitale", the desired effects of an investment especially in the public sector must not and cannot be measured only economically, but must be measured with changes in behavior and culture. Cashback program, from this point of view, helps a lot. Despite the suspension wanted by the Draghi government, which came into force on 30 June 2021, the effects of the cashback have been positive and has become an example of how, by rewarding behavior, systems and culture are changed. The cashback as a reward to the citizens came after the holiday bonus. Both were provided through IO and have allowed its massive diffusion. The cashback also preceded the issuance of the vaccination Green Pass on IO. All 3 tools (holiday bonus, cashback, green pass) have therefore contributed to the spread of IO. This can be documented by looking at the application downloads and reading the data listed above.

Therefore, it's evident that cashback has been a winning move in the dissemination strategy, not only as a program on but also thanks to its effects on the culture of innovation. As a side effect, given that you enter IO with SPID or CIE, the spread of IO has led to an increase in requests for SPID and CIE (*spid.gov.it*). The adoption of cashback (of the holiday bonus and time of the green pass) is making the terms IO, state app, Spid, Cie, cashback, ATM, digital payment part of the common language in Italy. This means that people, in one way or another, while not participating or participating, talk about it and this creates digital culture *(A. Tironi, 2021*).

The complex and challenging goal will be to guarantee citizens a real digital citizenship, thanks to a platform that guarantees interoperability between the various public administration services and that makes the moment of payment and not only ever simpler fast and safe (Grampa & Fontanella, 2022).

2.3 Contract tracing's applications and Immuni

None of us will forget February 21 2020, the first Italian case affected by Covid-19 is identified in Codogno, a municipality in the province of Lodi, Lombardia.

Since that day a wave of news has hit us. 325 new cases in 3 days, state of emergency, universities and schools closed, national lockdown.

The Covid-19 pandemic represented an unprecedented challenge for Italy, the Union and its member states, their healthcare systems, their lifestyle, their economic stability and their values. Digital technologies and data have played an important role in fighting the Covid-19 crisis. Mobile applications usually installed on smartphones can help health authorities, at national and EU level, to monitor and contain the Covid-19 pandemic and are particularly important in the phase of lifting the containment measures. They can in fact provide direct information to citizens and support the contact tracing effort. In a number of countries, in the EU and in the rest of the world, national or regional authorities or developers have announced the launch of apps with different functionalities aimed at fighting the virus.

With the common European roadmap, the Commission, in cooperation with the President of the European Council, has established a set of guiding principles for the gradual lifting of the containment measures of the Covid pandemic. From test to vaccine. Mobile applications, including contact tracing capabilities, have played an important role in this context in some countries. They can have a significant impact on the diagnosis, treatment and management of Covid-19 in the hospital and outside, depending on the characteristics of the apps and how much the population uses them *(Joint European Roadmap towards lifting COVID-19 containment measures, European Union, 2020)*.
By contact tracing we mean the search and contact management of a confirmed COVID-19 case. This is an essential public health action to fight the ongoing epidemic.

Identifying and managing the contacts of confirmed COVID-19 cases allows you to quickly identify and isolate any secondary cases and thus interrupt the chain of transmission.

A COVID-19 contact is any person exposed to a probable or confirmed case of COVID-19 within a period of time ranging from 48 hours before the onset of symptoms up to 14 days after or until the time of diagnosis and isolation of the case.
If the case has no symptoms, contact is defined as a person who has had contact with the index case within a period of time ranging from 48 hours prior to the collection of the sample leading to confirmation and up to 14 days after or up to the moment. of the diagnosis and isolation of the case *(Ministero della Salute, 2022)*.

The digital contact tracing applications are particularly important when containment measures are withdrawn and when the risk of infection increases as contacts between people increase. These applications can help break chains of infection faster and more efficiently than general containment measures and can reduce the risk of the significant spread of the virus. They should therefore be an important element of the exit strategy, complementary to other measures such as increasing the ability to perform tests. *(Orientamenti sulle app a sostegno della lotta alla pandemia di covid-19 relativamente alla protezione dei dati, European Union, 2020)*

What is essential for the functioning and use of these applications by citizens? The trust!

That's what Europe has said, citizens need to rest assured that fundamental rights are guaranteed and that apps will only be used for specifically defined purposes, that they will not be used for mass surveillance, and that individuals will continue to have control of their data. The accuracy and effectiveness of these apps in containing the spread of the virus are based on this assumption. Therefore, it is essential to find solutions that are as least intrusive as possible and fully comply with the requirements set out in EU law on the confidentiality and protection of personal data (GDPR). Furthermore, the applications should be deactivated at the latest when the pandemic is declared under control. Applications will also need to contain the most advanced information security protections. *(Orientamenti sulle app a sostegno della lotta alla pandemia di covid-19 relativamente alla protezione dei dati, European Union, 2020).*

The idea behind these apps is great, we have all seen how the virus spreads and is also transmitted through asymptomatic subjects or long before their symptoms can be perceived. This makes it difficult to trace contacts by health personnel and we, first of all, during those long telephone interviews, had a hard time remembering all the contacts that

took place in the previous weeks. But if smartphones could detect when two users are close enough to share the virus, an app could alert one person as soon as the other gets sick even if those people are strangers who just happened to sit in adjacent subway seats.

Possible benefits associated with these technologies include forecasting new outbreaks, promptly alerting and isolating exposed individuals and thereby preventing or reducing new infections, improving quarantine measures, improving the efficiency of social care and vaccine development, and improving how information is communicated to citizens (*Gasser, Ienca, Scheibner, Sleigh, Vayena, 2020)*

There were different proposals and strong debate about what information an app should gather and how much it should share with health officials. The Chinese government has taken phone tracking to an extreme, monitoring citizens' locations and purchases to gauge their risk and restrict their movement. GPS data from phones can identify potential hot spots and indicate who has been exposed. Government programs in South Korea, India, Iceland, and U.S. states including North Dakota and Utah was using phone location data to monitor COVID-19's spread. But GPS technology isn't precise enough to gauge short distances between two phones but especially, automated GPS tracking raises privacy concerns that have led to legal challenges in some countries. For these reasons, many governments developed apps that identify recent contacts by the exchange of low-energy Bluetooth radio signals. Each phone generates a random numerical ID that it broadcasts to nearby phones, which record such Bluetooth "handshakes." If a user experiences symptoms or tests positive, they can trigger notifications to phones they've recently been near *(Science, 2020)*.

Our country was one of the first to equip itself with an application for digital contact tracking, Immuni app.

Immuni is the Italian national contact tracing platform managed on behalf of the Extraordinary Commissioner for the implementation and coordination of measures to contain the epidemiological emergency Covid-19, developed by Bending Spoons.

On May 16, 2020, the Agreement for the management of the "Immuni" Digital Contact Tracing National System was signed between:

• Sogei;

• the Extraordinary Commissioner;

• the Department for the digital transformation of the Presidency of the Council of Ministers;

• the Ministry of Health.

The main steps of the Immune initiative were:

• release in stores on 1/06/2020;

• the start of the experimentation in 4 pilot regions (Abruzzo, Liguria, Marche, Puglia) on 08/06/2020;

• extension throughout the national territory on 15/06/2020.

From 19 October, the solution cooperates with the other European contact tracing apps, based on the GAEN framework, through the European gateway, the so-called EFGS. *(Sogei)*

The Immuni app has a dual purpose, contact tracing and an aid tool in the epidemiological investigation for the Ministry of Health. Immuni represented a strong innovation from a methodological point of view, in terms of dissemination and experimentation of new sharing and collaboration methodologies, open source code and platforms made available by Sogei for communication between stakeholders, from a technological point of view. The app uses the decentralized model that follows the DP-3T (privacy preserving) protocol. *(Sogei)*

Specifically, the operation process of Immuni is simple and well described in the official website. When two or more users are in close contact, the devices on which the app is installed exchange non-identifying codes using Bluetooth Low Energy, therefore accessing sensitive information such as name, telephone, e-mail or using geolocation data without. These codes are stored by the respective smartphones, which also record the duration and power of the contact based on the signal received and generated by the mobile phones. In the event that one of the users contracts the virus, he must independently report his positivity, thus sharing the codes that his device had previously registered between the various contacts. Therefore, user information remains inside the

smartphone unless the latter, proving positive, decides to communicate it. Those who receive a notification must follow the instructions in the app (Immuni).

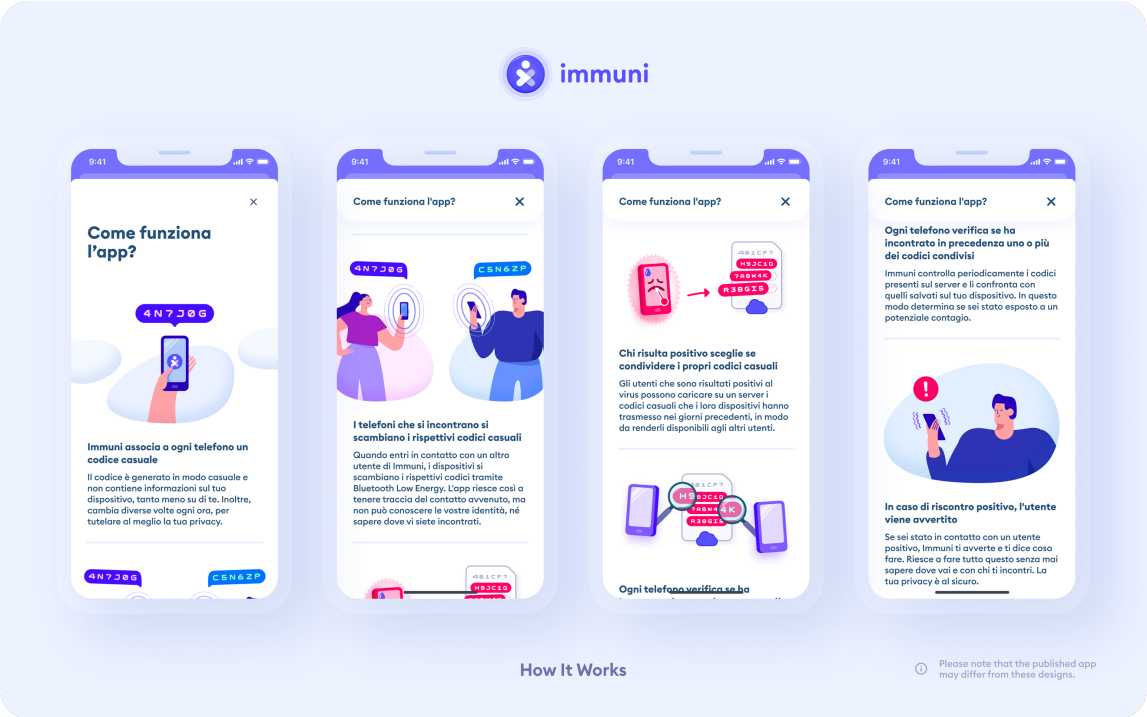


Figure 7: How Immuni works. Source: Immuni

Five months after its launch (data as of October 31, 2020), Immuni has been downloaded 9,505,834 times (about 12% of smartphones in Italy), has collected data from 1,926 positive users and sent 49,916 notifications. (Ròciola, 2020)
On October 30, 180 coronavirus positive users were able to upload their data to the app to send notifications. Also on 30 October, the infected in Italy were 31,079.

Today (2 March 2022) Immuni, looking at the official dashboard, it was downloaded from 21,294,357 but actually we do not know how many still use it assigned, and above all, there has never been an ascertained reduction in infections due to the use of this application in Italy.
If a user installs the app on an IPhone and subsequently deletes it, it is not reported, thus making an overall number of downloads appear greater than the actual one. Furthermore, the statistics reported on the official website do not report those who have actually

downloaded the app, but who actually keep it disabled, for example by turning off Bluetooth (Canepa, 2021).
Indeed, Angius and Zorloni (2020) have shown that the Italian government is not actually aware of the real number of people using Immuni, since unlike Google, Apple has not shared this information with the executive.

What was the impact of Immuni?
We cannot give an answer, while from other countries we have some indication that a tracking app can have an impact in managing the pandemic. On May 12, 2021, a study was published in Nature, where it is estimated that the NHS Covid-19 App, that is the British equivalent of Immuni, has allowed to avoid between 300,000 and 600,000 infections between September and December 2020. From its launch on 24 September 2020 to the end of December 2020. It was used regularly by approximately 16.5 million users (28% of the total population), and sent approximately 1.7 million exposure notifications estimated that for every percentage point increase in app uptake, the number of cases could be reduced by 2,3%. *(Nature 2021)*

What is the percentage of adoption that leads to a positive effect?
As previously stated, the success of these apps derives from trust in the state and therefore from public support.
The first studies stated that it was necessary to reach a threshold of 60% of adoption to observe good results, data also used by Italian politics to discredit Immuni.
However, subsequent research published in MIT Technology Review has denied these claims, underlining that reaching this threshold would be sufficient to defeat the pandemic without requiring further forms of intervention. Therefore, lower adoption rates do not indicate a total ineffectiveness of these tools, but rather suggest the need to institute other prevention and containment measures. These include social distancing, widespread testing, manual contact tracing, medical treatment, and regional shutdowns that is, many of the same processes already being used around the world. *(O 'Neil Howell, 2020)*.

Over time, Immuni has become a mysterious object. More a subject of political - and social - controversy than an essential part of the government's strategy. Also due to a lack of effective and united communication on the part of Italian political forces. (Ròciola, 2020).

Thus Ansa, on 3 October 2020, speaking of Immuni, reports the words of the former Premier Conte: "It is a useful tool because it facilitates contact tracing. While it is optional, it is definitely a moral imperative to participate in this program. The data becomes anonymous. The geolocation remains disabled, but downloading the app gives our prevention system the possibility to be more efficient" (ANSA, 2020).
Only a few days later, on October 28 (2020) on Giuseppe Conte's official Twitter profile, the "#TreSempliciRegole" to defeat the virus listed are:
wear face mask, keep distance, wash hands. (Twitter, 2020)
No mention of the Immuni application and so, in the following months and years, it was considered a "flop".
Even if it doesn't kill covid-19 on its own, digital contact tracing will be a part of the strategy against future disease outbreaks. The lessons we learn here will pay off if covid-19 takes years to control, and if there are other pandemics in years to come.

2.3.1 What went wrong?

Many governments have seen digital health technologies as a promising tool for tackling coronavirus disease. But the implementation of these systems never hit the expected treshold. This can be attributed to a number of uncertainties related to general awareness of contact tracing apps, privacy risks and actual effectiveness, as well as public attitudes towards a potentially pervasive form of digital surveillance. To sum up, lack of trust in institutions and lack of cooperation between citizens themselves during a global pandemic.

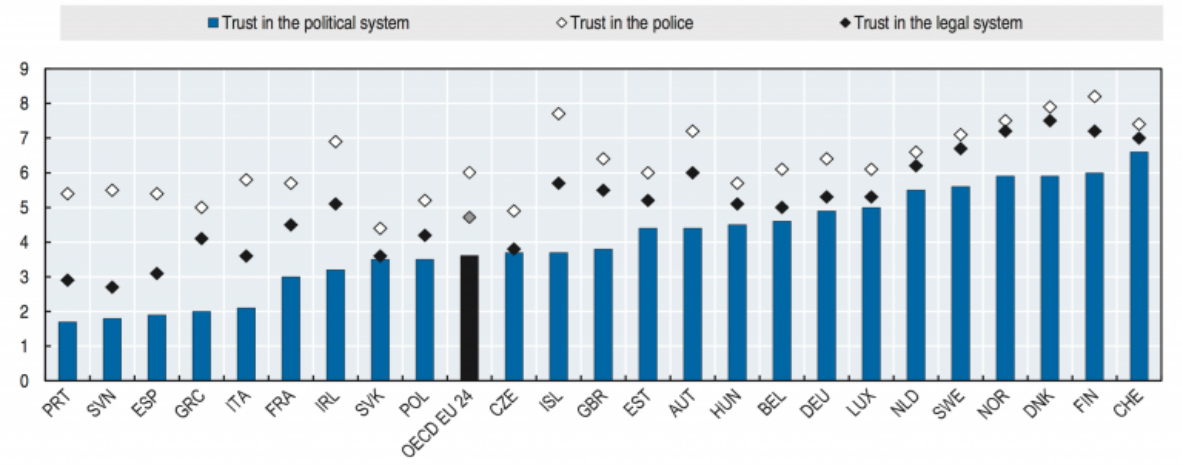
In their studies, Alessandro Blasimme and Effy Vayena justify this general 'flop' of digital contact tracing apps primarily with a general lack of adaptive governance. That is the inability shown by executives to act in an open and collaborative way. This has increased the climate of skepticism around apps. In subsequent investigations, it emerged that many people have expressed a fear about the use of data by governments and technology companies that have made the contact tracing protocol available. (Blasimme & Vayena, 2020).

Much of the literature states that overcoming this obstacle can only occur through a clear demonstration of the benefits that the use of tracking applications can create for the individual and for the entire community (Garousi, Cutting, & Felderer, 2020).

2.3.2 Can we trust?

Therefore, we can see the lack of trust in governments as a major factor in non-adoption. For that reason, the adoption barrier is purely personal rather than technical. Nowadays most individuals have a mobile phone suitable for installation, thus suggesting that the willingness or not to download the app depends on the single subject and not from the device. Furthermore, all the initial technical problems of the apps have been fixed over time.

Garousi, Cutting and Felderer (2020) analyzed how the number of downloads is not always directly proportional to the number of abitants, in fact there are countries such as Germany and Finland, which have recorded high adoption rates compared to the number of inhabitants. the reasons behind these exceptions depend precisely on the trust that individuals place in public institutions, it is in fact highlighted that the countries belonging to southern and eastern Europe report low levels of trust, compared to the northern European countries, thus confirming the hypothesis and suggesting that increased trust often implies high adoption (Ortiz-Ospina & Roser, 2016).
Therefore, trust is an extremely important factor in ensuring the efficiency of public applications, and the tracing system can work only through active collaboration by the population.
In according with this study we can easily see that Italy is one of the last countries for trust in the political system, and even if, in the last 7 years (2013-2020) there has been a general increase in trust in OECD countries since 35 % to 46%, Italy always records a level of trust in the government and others always below the European average. (OECD, 2022)



Note: Response options range from 0 ("No trust at all") to 10 ("Complete trust").The OECD EU average is the population-weighted average of the values included in the chart.

Source: Eurostat (2015), European Union Statistics on Income and Living Conditions (EU-SILC), *http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_pw03&lang=en.*

Figure 8: Trust in the political system. Source: Eurostat (2015).

In addition to analyzing trust in government, it is also important studying the role of social value orientation and dispositional trust (DoT).

DoT refers to consumers' personality disposition. It refers to individuals' propensity to trust other people. DoT is composed of two concepts: faith in humanity and a trusting attitude. Faith in humanity is the general assumption that all people are good-natured and dependable. From this point of view, there is no reason not to trust anyone. On the other hand, a trusting attitude assumes that if one deals with other people as if they are well meaning and reliable, then these people will act in a manner that promotes trustworthiness. (Richard Shambare, 2016).

DCTs seem to face a typical social dilemma by recognizing that technology adoption is an open-ended process that depends on social learning and the piecemeal building of public and other trust. The Italian government, in April 2020, launched a communication campaign on raising awareness of the use of the app: encouraging information for downloading the application was made available on the official website of the app. On the one hand, there is the fear of citizens for the spread of the virus, for the prospect of registering hundreds of deaths a day again, or for a new economic crisis. Faced with this scenario, the app could offer a concrete solution to monitor infections. But, on the other hand, citizens fear that someone may come into possession of sensitive data collected by the app, a risk that is not eliminated by the government decree which states that each piece of information collected by the app must be divided into various parts and each part

must be stored on different servers. Therefore, the dilemma is between using the app and not using it (Tomasi, 2022).

2.3.3 Adoption of Immuni like a social dilemma

I decided to start with this title, which in my opinion well describes a situation of uncertainty, doubt and bewilderment experienced during the pandemic. Situation also experienced for the adoption of a new technology such as Immuni.

The choice that Italian citizens are called to make regarding the Immuni app could be seen as analogous to the situation in which individuals find themselves in the famous Prisoner's dilemma.
Such a situation is a typical social dilemma which is, by definition, a situation in which every group member gets a higher outcome if he pursues his individual interest, but everyone in the group is better off if all group members further the common interest (Bicchieri, 2006). In social dilemmas, there is a huge difference between the costs and benefits accruing to an individual. Game theory has been applied, since the 1950s, to the analysis of issues with the aim of offering models to determine the choices that a rational individual should make, in the most diverse situations, given his goals and opinions *(Neumann & Morgenstern, 1944)*. In this perspective, 'games' are all those situations in which two individuals are involved in some strategic interaction and this theory offers us dynamic models for the simulation of actions by rational individuals. The use of the Immuni App is an example of what experimental subjects may face in the Prisoner's Dilemma, which is a clear example of a public good dilemma (Tomasi, 2022).

Adoption of Immuni is a case study that lends itself to being analyzed through the decisional model of the prisoner's dilemma, which typically falls into the category of dilemmas of the public good, in which the individual rational choice, defective, would lead to a negative social consequence, indeed if everyone refuses to cooperate, everyone will be worse off.
Everyone has to decide whether to use the app or not, and may find themselves thinking that:
(a) if at least 60% of Italians used the app, then it would be better for me not to use it, because in this way I would have two advantages: (1) most citizens would be traced and

therefore the curve would remain under control even if new outbreaks re-emerge, and (2) I would not take the risk of giving my data to unknown servers;
(b) if at least 60% of Italians did not use the app, then it would be better for me not to use it because (1) even if I were one of the few to use it, this would still not be enough to control the infection, and (2) I would not run the risk of giving my data to unknown servers.
Conclusion: whether others use the app or not, it is better for me not to use it. Interpreting the problem as a Prisoner's Dilemma, it might seem that no one has any incentive to use the app. Not using the app is, in fact, the most rational answer regardless of what others do (Tomasi, 2022).
If everyone behaves like free riders, hoping that others contribute to the costs of producing the public good, no public good will be produced (Festa, 2007)

In the prisoner's dilemma the paths of cooperation are obstructed by the rationality of the players, and by the trust in the rationality of their members. However, there are several sociology and psychology studies, which state that, within a society, the individual is led to cooperate with others and behaving cooperatively is a universal social norm. Cooperation levels everywhere are higher than predicted by economic rational choice theory, and even in anonymous, one-shot interactions, when no return is expected and the gain for reputation is zero, a significant proportion of people tends to cooperate *(Henrich et al., 2005).*
We can see this predisposition to cooperate with others an alternative view to the assumption of mainstream economics that all or most people are primarily self-regarding *(Fehr & Gintis, 2007)* (like the prisoner dilemma).
The rational economic principles are mainly applicable to individuals with proself-oriented social values. They need extrinsic incentives to align their self-interested inclination to the interest of the larger collective. Pro-socially oriented individuals, on the other hand, are especially sensitive to a more social rationality. *(Declerck, Boone, Seurinck & Achten, 2013)*

There is another game, called Stag hunt game (SH), which demonstrates the different mechanisms for achieving a cooperative balance which can be applied better to the Immuni case in analysis.

In the SH story told by philosopher Rousseau (1755), two hunters must choose whether to hunt the hare or the stag. While a hunter can hunt the hare alone, the stag hunt can only be implemented in collaboration with a partner; on the other hand, the reward that everyone can expect from the solitary decision to hunt the hare is rather small, while in agreeing to join the stag hunt, both hunters can expect a greater reward. The decision problem involves a choice between a minor goal, but achievable individually, and a major goal, but possible only if individuals are willing to collaborate. In this second case, the possibility of achieving the greatest goal depends not only on the individual, but on the decisions of others: the best choice depends on what others choose to do. Since the Stag Hunt is the move that, if implemented by both, leads to the result preferred by both, it can be understood as the cooperative move; on the contrary, hare hunting represents non-cooperation, that is, defection. The structure of the game-model applied to our case at hand is the following:

(a) If others use the app, we should use it.

(b) If others don't use it, we don't want to use it.

To sum up: I will go to adopt the application when others use it too

		2. User	
		Immuni	**NO Immuni**
1. User	**Immuni**	,	0,
	NO Immuni	, 0	**2, 2**

Table 1: Stung Hunt game for Immuni App. Source: Personal

The advantage of this model is to hypothesize two situations of equilibrium: one in which everyone uses the app and one in which no one uses it. Applying this model to the app case, the use of the app is not rationally excluded, depending on trust.

This game model admits the possibility that players, voluntarily, realize the public good as long as there is trust. The expectation of reciprocity increases the benefits for all participants: hence, mutual trust is the variable that influences the success of the strategy. Trust is, therefore, the essential success factor of the interaction (Tomasi, 2022).

To take a specific example of this situation, consider the basic structure of a public good experiment run by Fehr and Gächter (2000) in French. In this experiment, there are four group members who are each given 20 tokens. All four subjects decide simultaneously how many tokens to keep for themselves and how many tokens to invest in a common public good project. For each token that is privately kept by a subject, that subject earns exactly one token. For each token a subject invests into the project each of the four subjects, whether they have invested in the public good or not, earns 0.4 tokens. Thus, the private return for investing one additional token into the public good is 0.4 tokens while the social return is 1.6 tokens. Since the cost of investing one token is exactly one token while the private return is only 0.4 tokens, it is always in the material self-interest of a subject to keep all tokens. Yet, if all group members keep all tokens privately, each subject earns only 20 tokens, while if all invest their total endowment in the public good, each subject earns 32 tokens. Thus, in this simple example, the highest level of social welfare would be achieved if everyone contributed all of their assets to the public good, but it is in the self-interest of each individual to free ride, regardless of what others contribute, and to contribute nothing (Fehr & Gächter, 2000).

2.3.4 The importance of communication and trust speakers

According to Italian sociologist and economist Antonio Mutti, it is necessary to invest in "trusted speakers". Trusted Speakers are institutions and individuals who already enjoy trust and who certify the trustworthiness of other individuals and institutions that need trust (Mutti, 1998). Trust Speakers have the task of producing the multiplicative effects of trust. How we see in the first chapter, especially during a pandemic is difficult find a trust speaker because all the news can affect positively or in a negative way customers's behavior and create confusion.

Trust is defined as the expectation that arises within a community of cooperative behavior based on rules shared by its members *(Fukuyuma, 1996)*.

The diffusion of trust at the institutional level is expressed by managers and experts, but also by political leaders who are bearers of highly expressive values. The more the confidence enjoyed by the speakers is high and extended, the more effective and extended the induced propagator effect will be. There are many different interests and individual

evaluations: the task of institutional public communication would be to favor their coordination.

Therefore, for the communication campaign, aimed at inducing citizens to act collaboratively using the app, to maximize the chances of success, the preference should be assigned to the Stag Hunt model. “Public speeches must build trust: only through collaboration and mutual trust, it will be possible to overcome the crisis” *(Tomasi, 2022).*

Like Partha Dasgupta in "Trust as a Commodity" (2020) demonstrates, in the absence of trust, a series of mutually beneficial, hence cooperative, interactions would not take place. In other words, in the absence of trust, cooperative relationships can certainly be built, but their equilibrium is unstable; their size is suboptimal and their costs are high *(Dasgupta, 2020).*

More analytically, in everyday use, trust would be the willingness to consider a person or a group animated by a globally benevolent attitude towards us, so that we feel ready to bet on the fact that this person's behavior will be favorable or in any case not harmful.

Thanks to these studies, it can be hypothesized that one of the elements that influenced the non-adoption of immune was the lack of these "trust speakers", because the communication campaign did not help users in creating trust, but did only created social’s fear and lack of clarity.

Also, Christophe Fraser, Professor of Pathogen Dynamics at Oxford University’s Big Data Institute, Nuffield Department of Medicine, explains that public health is all about building trust and building an environment where people know that data is being shared and they share it. People fear misuse of data, and reliable infrastructure is needed to encourage positive use of data. “The power to do good things increases as information is shared” (Fraser, 2021).

To conclude, according to Blasimme & Vayena (2020) one way to foster the adoption of these technologies is to establish mechanisms to test their effectiveness, supervise the use of DCT apps, monitor public attitudes and adapt technology design to risks and expectations socially perceived.

In the third and final chapter these two digital public applications, Immuni and IO, will be studied more closely.

After a brief description of the methodologies and a description of the mixed approach used to study the data collected, we will move on to the interpretation of the data.

The goal will be to better contextualize our research question and through a statistical and empirical analysis to identify points of contact between downloads and news.

CHAPTER 3

“CASE STUDY”

3.1 Methodological background

The third chapter of this paper aims to apply the theoretical aspects, set out in the previous chapters, through the analysis of a case study relating to the introduction on the market of two applications: Immuni App aimed at supporting the tracking of Covid-19 and IO App and its cashback program. The first was released on the market on June 1, 2020, while the second, born in 2018, was released in beta in April 2020. For my analysis I will only consider the first period of Cashback program (December 2020), which caused an increase in the number of downloads and consequently increased awareness of the app.

Thus, both applications are available in online stores starting from 2020 but have produced different results. IO registered (and exceeded) the same number of downloads as Immuni in just nine months (Canepa, 2021). This difference is even more relevant if we consider the age thresholds that bind the adoption of the two apps; in fact, Immuni requires at least 14 years, on the other hand, IO offers services that can only be used by those who have completed or exceeded 18 years.

Although the evidence of these differences, the purpose of this paper is not to compare the two applications, because they are applications with a different history and born for very different goals. On the one hand, we have Immuni digital contact tracing app, which only comes alive in a pandemic time. On the other hand, we have IO, an app that will be the future of the digitization of public administration.

Therefore, I will focus on how news and announcements have affected users' downloads, to try to understand what are the reasons behind these differences. Although these are tools aimed at satisfying different purposes, both generate benefits for the entire community, so much so that they can be defined as 'public utility applications'.

We do not have bibliographic research that empirically highlights how news affects downloads by consumers of digital applications, but as we saw in the first chapter, news’s effects have been extensively studied and analyzed over the years. For these reasons

through a data analysis, we will try to understand what was the news of the major Italian newspapers that stimulated downloads by users in the six chosen reference months (1 June 2020 - 31 December 2020).

This analysis, which has as a reference period the six months ranging from 1 June 2020 to 31 December 2020, is based on a sample of 703 news items taken by the daily newspaper "Corriere Della Sera" and "Messagero" and a set of data about App IO and App Immuni which will subsequently be listed. But first, it is good to analyze the methodologies used for the analysis.

As already mentioned, before going into the main body of the discussion, it is appropriate to provide the main methodological guidelines relating to the work carried out for the realization of this paper. It is therefore important to present the data, motivations and capabilities behind the study logic adopted, as well as to briefly describe the operational methodologies and tools used.

For this analysis, a mixed approach was used based not only on multiple linear regression, but we dug deeper to understand the effects of the main news on downloads thanks to the event study methodology. Furthermore, during the analysis, the different phases of the IO app and the Immune app were commented and compared and these also helped to have a more complete view of the phenomenon studied.

3.1.1 Linear regression

The first method used was linear regression

In very general terms, regression is concerned with describing and evaluating the relationship between a given variable and one or more other variables. More specifically, regression is an attempt to explain movements in a variable by reference to movements in one or more other variables. To make this more concrete, denote the variable whose movements the regression seeks to explain by y and the variables which are used to explain those variations by x1, x2,..., xk. Hence, in this relatively simple setup, it would be said that variations in k variables (the xs) cause changes in some other variable, y (Brooks, 2014).

In regression, the dependent variable (y) and the independent variable(s) (x) are treated very differently. The y variable is assumed to be random or ‘stochastic’ in some way, i.e. to have a probability distribution. The x variables are, however, assumed to have fixed

('non-stochastic') values in repeated samples. This is the difference with correlation and for this reasons regression as a tool is more flexible and more powerful than correlation. It is possible to use the general equation for a straight line for describe a linear regression

$$y = \alpha + \beta x$$

However, this equation ($y = \alpha + \beta x$) is an exact one. Assuming that this equation is appropriate, if the values of α and β had been calculated, then given a value of x, it would be possible to determine with certainty what the value of y would be. Clearly this model is not realistic. Statistically, it would correspond to the case where the model fitted the data perfectly – that is, all of the data points lay exactly on a straight line. To make the model more realistic, a random disturbance term, denoted by u, is added to the equation. So:

$$yt = \alpha + \beta xt + u$$

In the simple linear regression model, the relationship between y and a single x is studied, i.e. only one explanatory variable can be included. In the multiple linear regression model, on the other hand, two or more explanatory variables are included to study the effect of more x on y at the same time (Brooks, 2014).

3.1.2 Event study

The second methodologic used for this study was the event study.

The study of events is a methodology that allows you to verify the efficiency of the market in incorporating new information. Using this method, it is possible to analyze the effects on yield and volatility in correspondence with the spread of news of the event (Fama et al. 1969).
In this case, "event" refers to facts or news that could significantly change the value of a listed company, resulting in a change in the price of shares or other securities referable to the company.
The usefulness of such a study comes from the fact that, given rationality in the marketplace, the effect of an event will be reflected immediately in asset prices. Thus, the

event's economic impact can be measured using asset prices observed over a relatively short time period. In contrast, direct measures may require many months or even years of observation. The general applicability of the event-study methodology has led to its wide use (Campbell et al. 1997).

One of the objectives of the study of events is, as we have seen in the first chapter in the cases studied with respect to the stock market and the crypto space, to verify the efficiency of the market in incorporating the information related to the event and to understand if this has had an impact. significant on the prices of the securities of the companies concerned. To this end, it is necessary to calculate the excess yield of the security, which results from the difference between the actual yield over a certain time interval (the so-called event window).

Event studies examine stock price movements around corporate events. These events can be voluntary firm announcements (e.g., new product introduction, alliance formation, channel restructuring) or announcements made by other entities such as regulatory bodies or competitors (e.g., new market entry).

The event study methodology was developed by finance researchers but has been widely adopted in other fields, including marketing, management but also how we see in crowdfunding decisions.

The Event Study Methodology is also increasingly used by managers to understand the actual economic return from the advertising choices implemented, in order to be able to better allocate advertising resources between the various media (Choong et al., 2003). Therefore, in the case analyzed by me, this tool will be applied in order to measure the actual effect of the news released during a critical period such as the last half of 2020, capturing the resulting anomalous returns, called Abnormal Returns.

Event studies have a long history. Perhaps the first published study is Dolley (1933). Dolley examined the price effects of stock splits, studying nominal price changes at the time of the split.

The Event Study Analysis methodology that is essentially still in use today was introduced in the late 1960s by Ball and Brown (1968) and Fama, Fisher, Jensen, and Roll (1969).

Fama, Fisher, Jensen and Roll (1969) developed this methodology on behalf of the CRSP (Center for Research in Security Prices), with the aim of analyzing data on monthly stock market returns for the New York Stock Exchange (Binder, 1998).

The fundamental theory underlying this procedure is the aforementioned efficient market hypothesis, according to which the share price is the present value of the company's future cash flows, given that, at any time, this price expresses and reflects all known information relating to the company's current and future profits. For this reason, the share price represents the true value of the company, given that it discounts future earnings and relevant information known in the market (Choong et al., 2003). Hence, the release of new information with an impact on future profitability will result in a change in the share price.

In the case of the applications analyzed, Immuni and IO, each news could be considered relevant information. In fact, in the case in question, any news regarding the pandemic, the economic and political situation, can be considered a signal, new information capable of influencing the user's decision to download the application or not. Especially since the pandemic created uncertainty, fear and confusion in people who were even more influenced by the media.

3.1.3 Event Study features

To conduct an Event Study Analysis, it is essential to understand the main features on which this methodology is based. There is no definitive structure but we can summarize it in seven steps:

1 Event definition.
2 Selection criteria.
3 Normal and abnomal returns.
4 Estimation procedure.
5 Testing procedure.
6 Empirical results.
7 Interpretation and conclusions.

First of all, it is essential to establish an objective event that releases potentially useful information for the analysis; examples may be M&A, a change in the regulatory

environment, a change in the company name, the release of a new product or, as in the case in question, the exposure of consumers to particularly relevant news.

Subsequently, the time window in which the data will be analyzed is established. The time window must be composed of two distinct periods, one called Event Window, usually 20 days, which goes from 10 days before to 10 days after the Event Day, or the day of the event itself, indicated as day 0 (day 0 is often identified from the first trading day after the event). The other period, identified as Estimation Window, prior to the event, is instead fundamental in determining the company's normal market price, necessary to calculate the Expected Returns, or the normal returns of the stock; usually this time interval covers a good part of the year preceding the event.

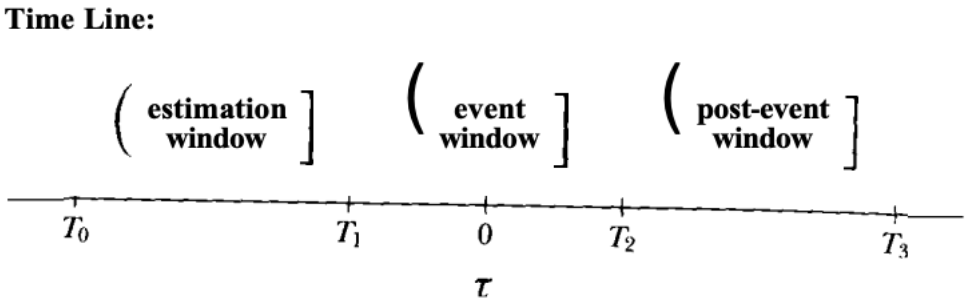


Figure 9: The line for an event study. Source: (Campbell et al. 1997).

However, it is essential to consider the eventuality in which the relevant information is announced before the event. In this case, given the likely anticipated reaction of the market, it is necessary to pay particular attention to the choice of the Event and the Event Window, since the announcement of the information becomes the event itself (Binder, 1998). The Event Window, depending on the needs, can still be modified.

It is also important to define the parameter to be analyzed: in this case, the downloads of the two applications. Consequently, the two hypotheses are formulated: the null hypothesis, indicated with H0, argues that the market efficiently includes information, and therefore will have a consequent reaction to the news transmitted during the reference period; the alternative hypothesis, indicated with H1, is instead the negation of the null hypothesis (Binder, 1998).

Normal and Abnormal Returns can be considered the key elements for the methodology under analysis. The normal return is defined as the return that would be expected if the event did not take place (Campbell et al. 1997).

On the contrary, Abnormal returns are, in essence, the difference between the returns recorded in the Event Window and the normal returns of the stock. You can then calculate the Abnormal Returns for each day of the Event Window.

Return event studies quantify the economic impact of an event in so-called abnormal returns. The anomalous returns are calculated by subtracting the returns that would have occurred if the event analyzed had not occurred (normal returns) from the actual returns of the shares. While actual returns can be observed empirically, normal returns need to be estimated. For this reason, the event study methodology makes use of expected return models, which are also common to other areas of finance research. (Mackinlay, 1997; Binder, 1998).

The market model is the most widely used expected return model. It is based on the actual returns of a target market and the correlation of the company's shares with the target market. The anomalous return on a separate day within the event window represents the difference between the actual return of the security (Ri, t) on that day and the normal return, which is predicted on the basis of two inputs; the typical ratio between the company's stock and its reference index (expressed by the parameters α and β), and the effective yield of the reference market (Rm, t).

To give an example of the market model, the main formulas used to arrive at Abnormal Returns are reported. To calculate the Abnormal Returns, for first is necessary to calculate the Expected Returns, which are obtained from the following equation:

$$E(R_{j,t}) = \alpha_j + \beta_j \cdot E(R_{M,t})$$

This equation indicates a relationship between the normal return expected from the share j and the market return. Indeed, E (R j, t), that is the expected normal return of the action j at time t, is given by the sum of the parameters of the market model, that is αj, which represents the estimate of the intercept of the action j, and βj, which is the estimate of the risk coefficient of share j, multiplied by the return of the market on day t.

The model is very similar to the CAPM, with the difference that the αj intercept is used as a constant, rather than the risk-free rate. In this model, the market parameters, αj and βj, can be calculated through a least squares regression. These parameters are obtained from the daily returns of the action j for each day of the Estimation Window (Binder, 1998).

Once the Expected Returns have been obtained, the Abnormal Returns can then be calculated:

$$\mathbf{ARi,t=Ri,t-(\alpha i+\beta iRm,t)}$$

The market model predicts what the normal returns of share j should be; through the difference between the current return and the normal return expected for action j at the same time t, within the Event Window, the Abnormal Returns will be found (Binder, 1998; Choong et al., 2003)
However, these findings can be further elaborated.
Indeed, starting from the Abnormal Returns (AR), the Average Abnormal Returns (AAR) can be calculated, i.e. the average of all the Abnormal Returns obtained by the various companies.
To calculate the Average Abnormal Returns the following formula is used, through which all the Abnormal Returns obtained are averaged:

$$\mathbf{AAR=1/N\sum ARi,t}$$

By aggregating these results, it is possible to obtain the average anomalous returns of all companies for each day of the period in question, and this allows to draw unambiguous conclusions on the event, eliminating the problem of idiosyncrasy.

Finally, the Cumulative Abnormal Returns (CAR) are calculated, thanks to which it is possible to analyze the aggregate effect of the anomalous returns in a given period of time of the Event Window. In the event that the AARs have been taken into account, it is more consistent to calculate the Cumulative Average Abnormal Returns (CAAR), in order to analyze the effect of the cumulative average anomalous returns.

To calculate the CAR and the CAAR, all the AR and AAR obtained are added together; the formulas are as follows:

$$CAR_t = \sum AR_t \; t=1$$

$$CAAR=1/n\sum i=1nCAR(t1,t2)$$

Using average indices such as AAR and CAAR is useful when analyzing the effect of a particular event on a sample of n companies: on the one hand it potentially reduces the specific risk deriving from each company, on the other it allows to obtain a unique result that considers all firms (Binder, 1998).

3.2 Data and procedure

First, it is good to identify the reference period. For the analysis, as previously reported, the second half of 2020 was chosen. From 1 June 2020 to 31 December 2020. There are two reasons for this choice. Firstly, during these six months we have experienced two particular phases of the pandemic, during the summer, the first real restart after the 169 days of national lockdown (9 March 2020 - 18 May 2020), fewer restrictions, holidays and a first return to normality. Nonetheless, since October the second wave of Covid-19 has taken Italy by surprise and has brought it back to its knees. In fact, the second wave of infections from Covid-19 affected a number of Italians 8 times higher than the first. In the first wave (from 24 February to 11 June) 236,134 people were infected: in the second wave (from 14 September to 31 December) the number of infected was equal to 1,822,841 (Giorgi, 2021).

On the other hand, in this period we are able to analyze the first months of operation of App Immuni, born among the controversies, the first bugs and the difficulties in tracking but also the great results obtained by the App IO and by the launch of its cashback program and Christmas supercashback.

During the year just ended, the main work carried out for this report was research and data collection. The data collected during the twelve months are of two types: quantitative and qualitative. All data was obtained and released from official sources.

Starting from the description of the quantitative data, I was able to find for App IO (PagoPA S.p.A.) for the six months of reference (June 2020- December 2020):

• daily downloads
• daily logins

The process of requesting and obtaining data in this case was very long.
Thanks to a research agreement between PagoPA S.p.A. and the Ca 'Foscari University of Venice I had the opportunity to apply and be chosen for a research internship within PagoPA S.p.A. lasting 12 months (March 2021 - March 2022) which had as its primary purpose the release and study of the data listed above. As will be better explained in this third chapter, the study was carried out by me, with the help of Professor Francesco Rullani, supervisor of the thesis.

For the data of App Immuni (Sogei S.p.A.) the process was faster and the data that I was able to find for the six months of reference (June 2020- December 2020) are:

• daily downloads
• daily downloads by operating system (IoS, Android)
• aggregate daily downloads
• daily uninstallations by operating system (IoS, Android)
• Average daily evaluation of the Android operating system (1-5 stars)

The data collected in this case are all available in open data in CSV and JSON version on Github.com/Immuni-App or through the official page of App Immuni and are updated daily.
All the data listed and studied in the draft are completely anonymized and respect all national and European privacy requirements.

The qualitative data, on the other hand, concerns the news and announcements released daily, from June 1, release date in the Immuni app stores (App IO was released in beta in April 2020) until December 31, 2020.

In this case the work done was organized in this way. The two most widely read newspapers in Italy, both in print and online, were chosen, “Corriere della Sera” and “Messaggero” both in the national version.
For each day, the front page of the newspaper was analyzed and the most relevant news was extrapolated and read that could have a positive or negative effect on the users of the two applications by encouraging or not downloading and creating variables for keywords (these can be divided in four generic groups, pandemic / covid19, economics, politics, other). Subsequently, news not relevant for the analysis (generally sports news, gossip, or entertainment) was discarded.
After having discarded the news unnecessary for the analysis for each day, the relevant news was analyzed one by one and created econometric variables. From a total of 43 variables created, these were reduced to 16 for analysis by eliminating those variables that had less than 25 observations because they would have been too few to obtain statistically significant results.

The final variables analyzed in the report are:

covid19
covid|riapertura
covid|aumento contagi
covid|vittime
covid|indice di contagio
covid|assembramenti
covid|controlli
covid|coprifuoco
covid|lockdown
covid|mondo
covid|stato di emergenza
nuova ondata
covid|scuola
economia
ripresa economica
politica

For ease of analysis, we can divide the news within these variables into 3 macro categories based on their nature. The 3 macro categories identified that will be useful to distinguish the news in a second moment of analysis to make order on the results are news:

- **emergencies**, in which we find the variables “covid|aumento contagi”, “covid|lockdown”, “covid|stato di emergenza” e “nuova ondata”;

- **discouraging or encouraging,** in which we find the variables “covid19”, “covid|vittime”, “covid|riapertura”, “covid|indice di contagio”, “covid|assembramenti”, “covid|controlli”, “covid|coprifuoco”, “covid|mondo”, “covid|scuola”;
- **economic / political,** in which we find the variables “economia”, “ripresa economica”, “politica”.

From this list we realize that in the 6 months considered most of the news, and the main observations resulted on issues related to Covid-19. This was an inevitable result, desired and that could be expected given the period under consideration, characterized by a first reopening after a national lockdown that lasted 3 months and a second wave in October 2020 until a gradual closure divided by zones over the christmas period.

In the table below an example of the breakdown of the news of the "Corriere della Sera" of 3/06/2020.

ANNO	MESE	GIORNO	NOTIZIA	TEMA	NOTIZIE S	covid19	covid|riapertura	covid|aumento contagi	covid | mascherine	covid|calo contagi
2020	6	3	"SI RIAPRE TRA LIMITI E CONTROLLI"	via libera agli sostamenti in tutt		1	1			1
2020	6	3	"COSI PECHINO TACQUE SUL VIRUS"	ritardi da Pechino nel condivider		1				
2020	6	3	SCARTATE		4					

Table 2: First Table. Source: Personal source

Once this first subdivision was completed, the table was rebuilt to make it easier to read and to analyze the data more easily.

Here is an example of the reshapede table.

ANNO	MESE	GIORNO	DATA	CORRIERE/ME	notize buone	scartate	covid19	covid| riap	covid| aum	covid | mascheri	covid| calo contagi	covid | asintoma	covid| vitti	covid| fase 2	covid| fase 3	covid| indi	covid| asse	covid| controlli	covid| co
2020	6	1	20200601	1															
2020	6	1	20200601	2	3	2	2	1										2	
2020	6	2	20200602	1															
2020	6	2	20200602	2	4	2	2	2						2					
2020	6	3	20200603	1	2	4	2	1			1		1	1					
2020	6	3	20200603	2	4	2	2	2						2			1		
2020	6	4	20200604	1	4	4	3	1			1			1				2	
2020	6	4	20200604	2	4	2		2		1								2	
2020	6	5	20200605	1	2	4	1							1				1	
2020	6	5	20200605	2	4	2	1	1		1								1	
2020	6	6	20200606	1	3	4	1						1		1				
2020	6	6	20200606	2	5	1	3		2	1									
2020	6	7	20200607	1	2	6										1			
2020	6	7	20200607	2	3	3	1		1										
2020	6	8	20200608	1	3	3	2		1		1		1			1			
2020	6	8	20200608	2	4	2	2		2								1	1	
2020	6	9	20200609	1															
2020	6	9	20200609	2	3	3	1												
2020	6	10	20200610	1															
2020	6	10	20200610	2	2	4	1												
2020	6	11	20200611	1	2	5	2					1							
2020	6	11	20200611	2	2	4	1												
2020	6	12	20200612	1															
2020	6	12	20200612	2															
2020	6	13	20200613	1	5	3	5	2	1					1	1			1	
2020	6	13	20200613	2															
2020	6	14	20200614	1															
2020	6	14	20200614	2	2	4													

Table 3: Reshaped table. Source: Personal source

Once the data collection was completed, the latter were analyzed by applying the theory and methodologies described above.
Thanks to a research agreement between PagoPA S.p.A. and the Ca 'Foscari University of Venice during the year 2021 I had the opportunity to apply and be chosen for a research internship within PagoPA S.p.A. lasting 12 months which had as its primary purpose the release and study of the data listed above.

I was hired within the company as a research analyst in the institutional affairs and communication department to study the project and the App IO phenomenon. My knowledge of the application is in fact direct, born in the field. The approach to the study was the direct observation of the data and results pursued by IO in the reference period and during the working year in which I was able to work and interact horizontally with all the teams and profiles that they created and conceived. App IO from scratch. this thesis is part of a project widely desired by PagoPA which involves several universities in Italy and abroad. The purpose of PagoPA, which is the purpose of this paper, is to create best practices through the study of open data and study the phenomenon of their products (pagoPA payments node, App IO, PND, PDND).

In the next paragraph of the thesis, all the results obtained will be commented and conclusions will be drawn to answer the research question.

By comparing the graphs of downloads, we will understand which are the phases that characterized the two public order applications and the results obtained in the six months. In the second part through the multiple linear regression we will try to understand how the independent variables listed above had an effect on the downloads.
Finally, through the event study chosen two of the most relevant news we will understand how these have influenced the choice of users to adopt the two applications.

3.3 Results

In this paragraph we will analyze and comment on the data and the results of the analysis, drawing conclusions and answering the research question.

3.3.1 Comparison charts

Below are the download charts of the two applications, App Immuni and App IO.

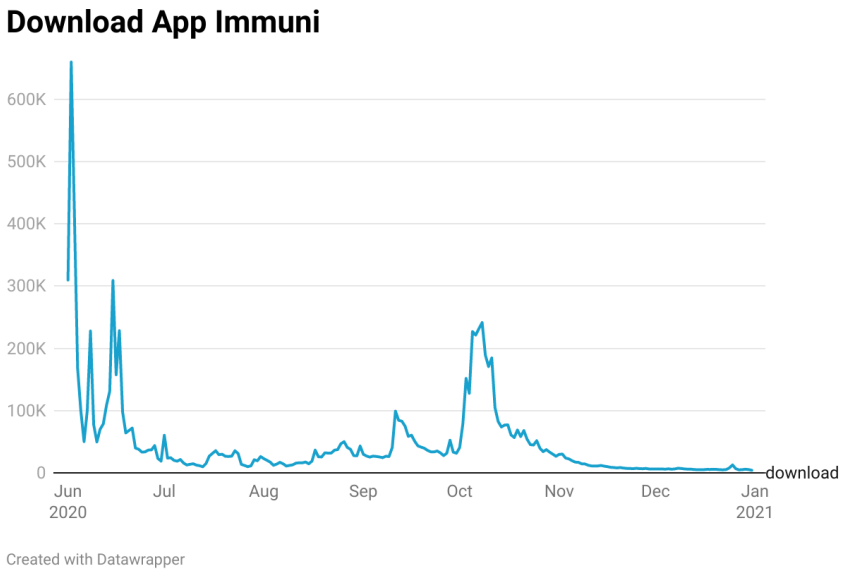


Figure 10: Download App Immuni. Source: Immuni

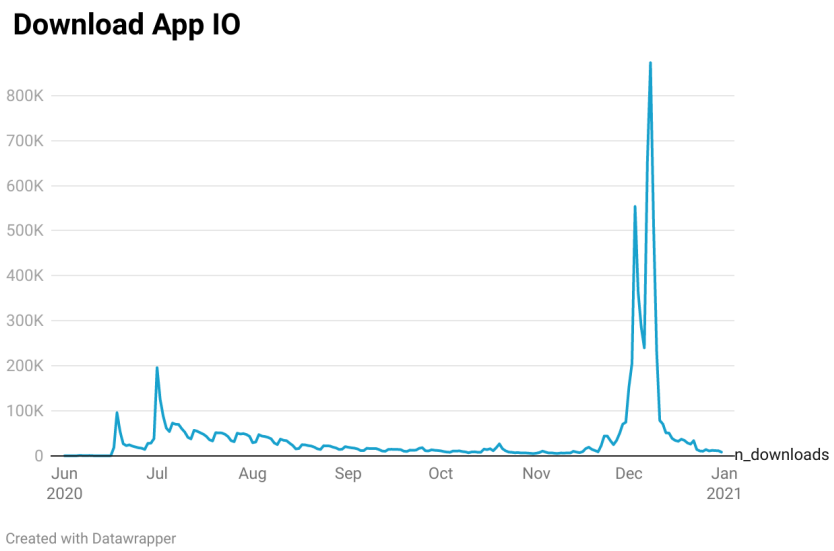


Figure 11: Download App IO. Source: Personal source

As we can see from the graphs, we can highlight, in the months taken into consideration, the different phases for both applications. This is caused, as we have seen in the previous chapters, both by the different trust that users have in the two public order applications and by the different objectives of the applications.

We immediately notice that Immuni had 2 main phases. The first is comparable to the launch of the application in online stores and the promotion made by political forces. In fact, in the very first days it had the maximum download peak by Italian citizens. As reported in the second chapter of the paper, communication even by the major politicians was not united and clear.

In fact, we remind you that App Immuni is an app born amid controversy and with several problems and bugs from day one.

One of the most common problems concerns the non-functioning, reported in numerous reviews, probably partly due to the urgent need to put the app on the market, which did not allow to evaluate the individual aspects. One of the most serious malfunctions for the Italian application is the notification problem. In fact, many users had not noticed that they had received an exposure notification. Therefore, if these subjects had not entered the app, they would probably never have learned that they had had contact with a positive person (Angius & Zorloni, 2020). Another problem encountered by Garousi, Cutting and Felderer (2020) concerns the use of the battery. Most of the tracking applications are based on the Bluetooth Low Energy system, which is designed to provide low energy

consumption and therefore should not cause any problems to the individual user allowing him to use his device without particular constraints. Despite this, some studies have found that such wear depends on the type of use and the movements of an individual, as the more a person is in motion, the more notifications that his device has to exchange with others and consequently the greater the consumption. battery.

Furthermore, another technical limitation of the Italian application is related to the incompatibility of this with some devices. In fact, Immuni is based on an exposure notification system developed by Apple, Google and Huawei, which to ensure proper functioning requires the use of relatively recent smartphones, capable of meeting certain requirements (Immuni). The incompatibility was found not only in Italy, but also in other states such as England, where reviews highlighted the difficulty of some users to download the tracking app on their smartphones (Garousi, Cutting, & Felderer , 2020). This aspect is extremely critical considering that the elderly, who normally contract the virus in a more serious form, often do not have the latest generation phones and therefore cannot download the tracking apps. (Rizzo, 2020).

Finally, another problem encountered by Garousi, Cutting and Felderer (2020) concerns the use of the battery. Most of the tracking applications are based on the Bluetooth Low Energy system, which is designed to provide low energy consumption and therefore should not cause any problems to the individual user allowing him to use his device without particular constraints. Despite this, some studies have found that such wear depends on the type of use and the movements of an individual, as the more a person is in motion, the more notifications that his device has to exchange with others and consequently the greater the consumption. battery.

Here is how the set of these problems, the controversies and the lack of trust towards the state have made the downloads decrease in just under a month, maintaining a low and constant trend throughout the summer period, also facilitated by the few restrictions and the idea that we were at the end of the Covid-19 pandemic which is still holding us back.

A second phase can be identified in autumn 2020, from September to November. Affected by the second wave, after the reopening, the confusion of news, uncertainty and fear led users to protect themselves and others by increasing the downloads of the contact tracing application.

Even in this case, however, the euphoria of the application lasted a few months until it diminished to a minimum with the arrival of Christmas and vaccines. Also in this case not helped by problems and institutional communication.

Moving on to the App IO graph, things change. In this case we can easily identify a first phase, characterized by the beta version of the app where the downloads are constant throughout the period. We remind you that, as explained in the second chapter, during this first period, all the public administrations that we find now were not present within the app and there was no extended service throughout Italy.
In fact, we have seen that it was, first the holiday bonus, and immediately after the Cashback and super Cashback program that made the application known and grown. In fact, we can identify the beginning of the second phase precisely with the launch of this program that has achieved results that no one would have imagined. As already described in the second chapter of the paper, on launch day in less than 24 hours the number of users increased to more than 1 million reaching 7.6 million and card registration requests reached peaks of 14,000 transactions per second with 2.3 million people active in the app. On the strength of institutional communication and the concreteness of the application, after the boom in downloads and credit card registrations in the first period, downloads fell but continued to increase throughout 2021 thanks to the many new services (Green pass, Carta Giovani National) inserted on IO; leading it to become the most downloaded free app of 2021 on IOS devices. Logins also continued to increase over the months, reaching 3,119,071 on December 8th. This demonstrates that not only downloads have increased but the application has also been used by users to obtain cashback.
We are faced, as we had already seen, with two very different applications, with different objectives, which during the period considered for the analysis went through two distinct development phases, positively and negatively helped by the period we lived through. able to talk about them and to develop best practices that are certainly the foundations for the digital development of our country.
We just have to comment on the results of the regression and the event study to understand how the news of the newspapers analyzed (Corriere della Sera, Messaggero) have positively or negatively affected the downloads of the applications.

3.3.2 Multi linear regression results

The multiple linear regression as described in the previous paragraphs was carried out by identifying the 16 most relevant dependent variables chosen on the basis of the greatest number of observations per created variable. In addition, during the analysis, in order to have a greater view of the results and better understand how the downloads of the two applications react to the stimuli of the news, two delays (lag) of 1 and 2 days were inserted.

Below are the results of App IO for the two newspapers. In order "Corriere della Sera" and "Messaggero".

	Coeff	*Coeff lag 1*	*Coeff lag 2*	*P-value*	*P-value lag1*	*P-value lag2*
covid19	-8073,3884	-5381,6358	-8490,453	0,47390669	0,63431339	0,44423283
covid|riapertura	-12598,065	-11694,829	-22908,98	0,51195365	0,54533957	0,22757854
covid|aumento contagi	-8974,0927	-8460,9434	-7992,16	0,60906724	0,63042358	0,64296982
covid|vittime	-6624,7959	-17098,552	-22970,79	0,75465978	0,42125151	0,2707996
covid|indice di contagio	32055,61	46178,411	61787,62	0,11629827	0,02445734	0,0022602
covid|assembramenti	25193,505	14722,223	14295,15	0,10313987	0,34124978	0,34591169
covid|controlli	4459,3661	8896,5759	24902,42	0,77586438	0,57103809	0,1068085
covid|coprifuoco	51931,871	25513,251	-32616,98	0,05064978	0,33629888	0,21030987
covid|lockdown	2267,5525	15908,105	35002	0,9280309	0,5273933	0,15695295
covid|mondo	-11530,401	-11967,941	-7787,737	0,60565711	0,59286153	0,72262852
covid|stato di emergenza	-45148,426	-38679,613	-13972,59	0,01607462	0,03922356	0,44532335
nuova ondata	11405,444	8601,8802	-600,3802	0,54226991	0,64645614	0,97394381
covid|scuola	-9698,7179	-7981,9062	16534,9	0,61601813	0,68571652	0,39287637
economia	16297,768	11424,349	11133,45	0,32542026	0,49127182	0,49388128
ripresa economica	12715,558	30025,613	37982,14	0,53491171	0,14586694	0,06106382
politica	13719,839	5487,7181	1695,43	0,28351926	0,66846706	0,89263027

Table 4: App IO Corriere results. Personal Source

	Coefficients	*Coefficients*	*Coefficients*	*P-value*	*P-value lag1*	*P-value lag2*
covid19	6034,7079	-2169,8847	3038,474	0,62457502	0,86156377	0,80416305
covid|riapertura	-26916,104	-21023,47	-24632,07	0,28303666	0,40583887	0,32140624
covid|aumento contagi	-20402,198	-17200,526	-29189,51	0,24021545	0,32634004	0,09060154
covid|vittime	37214,102	22157,129	29134,36	0,37580782	0,60112974	0,48409208
covid|indice di contagio	-41934,932	-29316,55	-27540,79	0,25941648	0,43433774	0,4545383
covid|assembramenti	-213,77841	4833,2803	10115,63	0,9920952	0,82438434	0,63638767
covid|controlli	-7660,1309	-4457,6874	4253,798	0,63032049	0,78136822	0,78749918
covid|coprifuoco	65104,33	30963,152	21534,45	0,01075022	0,22641399	0,39110314
covid|lockdown	-21099,704	-3127,7313	19915,5	0,41162834	0,9039425	0,43435161
covid|mondo	10675,838	8128,0647	5480,913	0,85346355	0,88919316	0,92380809
covid|stato di emergenza	-32304,55	-21111,029	-29259,05	0,09336161	0,27630909	0,12491886
nuova ondata	1953,3756	1855,4909	-776,6144	0,91043344	0,9156876	0,96400133
covid|scuola	-10373,95	2672,2609	-8559,356	0,59530095	0,89213221	0,65933075
economia	36011,728	50306,185	60372,13	0,06406953	0,01068879	0,00222633
ripresa economica	-19302,727	-34611,995	-42279,38	0,36282194	0,10674318	0,04793575
politica	-25579,408	-24875,893	-26771,48	0,09218224	0,10459748	0,07597653

Table 5: App IO Messaggero results. Personal Source

The data that are useful to us are the level of the P-value, which to be relevant must be <0.1, and the relative coefficient which can be positive or negative.

As we can see from the tables the relevant values have been highlighted. We can tell how IO app downloads react to precise and certain stimuli in both newspapers. On the day the news comes out, the greatest positive stimuli for the download derive from announcements that can cause greater fear and confusion in citizens deriving from the "covid | coprifuoco", "covid | stato di emergenza" and only for the newspaper Merssaggero "economia". This makes us understand how app IO responds more clearly to particular stimuli, also highlighted by the congruence between the two newspapers. If we add the delays (lag1, lag2) we see that things change slightly. In the newspaper "Corriere della sera" there is a greater positive reaction (positive coefficient) to the variable "covid | indice di contagio" highly relevant even with a delay of 2 days. This suggests that emergency news regarding increases or decreases in the contagion index (RT) stimulate the downloads of IO apps in a precise and positive way, making them grow.

The results for the daily Messaggero are also relevant, in fact in this case for all the variables "economia", "ripresa economica", "politica", therefore for all the information

collected in the economic / political macro variable, there is an evident positive response (positive coefficient). We can easily think that news regarding bonuses, economic recovery, reopening of shops and relevant political choices have stimulated the download of IO apps in the reference period in the days following the news.

Let's now pass to the comment on the results of the App Immuni regression, and then conclude this part of the analysis with a comparison between the two applications. Below are the tables with the results, also in this case a delay has been added (lag1, lag2).

	Coefficients	*Coefficients*	*Coefficients*	*P-value*	*P-value lag1*	*P-value lag2*
covid19	8644,51542	2509,20012	13635,9759	0,31472195	0,77055505	0,11023461
covid|riapertura	-1484,6332	-9139,3567	-15861,135	0,91919641	0,53435366	0,27615762
covid|aumento contagi	-13909,364	-12267,301	-20388,318	0,29888059	0,35942093	0,1243543
covid|vittime	4829,0587	-5615,5722	8161,83946	0,76504925	0,72820175	0,60970615
covid|indice di contagio	-4985,8309	-4953,4013	-17269,614	0,74787922	0,74948309	0,26112969
covid|assembramenti	-11189,531	-6796,9564	-7372,6813	0,34119594	0,56318395	0,52617955
covid|controlli	-9457,3963	-9076,269	-15919,33	0,42857794	0,44745563	0,17869459
covid|coprifuoco	-13515,212	-16343,297	-19728,973	0,50274218	0,41788788	0,32308624
covid|lockdown	-29830,053	-28330,624	-23727,231	0,12016031	0,13981816	0,21094192
covid|mondo	10900,4016	-3384,8548	-21182,377	0,52203505	0,84234535	0,20920741
covid|stato di emergenza	19148,8352	20337,5364	20647,2634	0,17820902	0,15288981	0,14244741
nuova ondata	17727,1707	22002,4911	18963,2883	0,21469229	0,12395278	0,17983122
covid|scuola	-710,01415	9811,47913	8189,60972	0,96157163	0,51323665	0,58112111
economia	-14056,267	-17218,371	-20790,955	0,26599893	0,17334535	0,09691577
ripresa economica	10597,6325	4773,73079	11961,5414	0,49749527	0,76052946	0,44040525
politica	-7132,8185	2946,71704	3310,27484	0,46413396	0,76235961	0,73131901

Table 6: IMMUNI Corriere results. Personal Source

	Coefficients	*Coefficients*	*Coefficients*	*P-value*	*P-value lag1*	*P-value lag2*
covid19	249,152155	2788,82497	-3680,2694	0,97426373	0,74517735	0,69062945
covid|riapertura	134454,26	76069,5269	31697,7134	2,75E-15	2,00E-05	0,09157928
covid|aumento contagi	29550,6086	19732,8874	28561,7426	0,00703879	0,10321111	0,02858571
covid|vittime	26534,3017	8616,43025	6836,38642	0,31359944	0,76807095	0,8276363
covid|indice di contagio	-19283,038	-8893,189	-8492,0262	0,40744226	0,73073349	0,75975273
covid|assembramenti	-17262,762	-39738,58	-33529,424	0,20252351	0,00871521	0,03881616
covid|controlli	-4871,3435	21542,5021	18778,3822	0,62516742	0,0528618	0,11588059
covid|coprifuoco	-3307,1436	-16127,379	-7363,0138	0,83481021	0,36047511	0,69733193
covid|lockdown	4977,69751	5060,70876	-4126,3545	0,75701263	0,77705484	0,82990123
covid|mondo	-41824,065	-39514,359	-46775,128	0,24886062	0,32653937	0,28008033
covid|stato di emergenza	-9481,7232	-8642,3034	-12172,064	0,43050462	0,51766322	0,39655503
nuova ondata	2873,04187	-690,44344	894,703127	0,79171473	0,95444038	0,94505996
covid|scuola	18528,1937	2081,88974	6047,37064	0,13092147	0,87822972	0,67975027
economia	-11366,875	-12855,677	-8573,8313	0,3492724	0,34066765	0,5603735
ripresa economica	9624,62528	7985,27715	1733,08214	0,46872443	0,5883192	0,9140028
politica	22064,9812	29994,3449	19452,571	0,02081441	0,00482049	0,08738042

Table 7: IMMUNI Messaggero results. Personal Source

For the Italian contact tracing application, we immediately notice different results, in fact Immuni does not respond clearly, and equal to precise stimuli for both newspapers, which are in fact incongruent. The results for the newspaper "Corriere della Sera" are not relevant, we can see that there are no P-values <0.1. However, by applying a two-day delay, the only variable that gives us a significant result is "economy" but taken so individually it does not help our analysis. Excluding the Corriere della Sera, let's go on to analyze the table of results regarding one of the most widely read newspapers in Italy: “Il Messagero”.

Here things get more interesting, the variables “covid | riapertura” and “covid | aumento contagi” are highly relevant and we see how the downloads respond positively (positive coefficient) to these stimuli in an evident way by increasing the downloads by users both on the day in which the news came out and in the days subsequent. The news within these two variables, however, is very different. Nonetheless, it can be thought that in a delicate period such as the one chosen, even news on the reopening, the end of the curfew or the end of the red zones can intimidate citizens for the possible return of a new wave, thus

leading them to increase the downloads of the application for protect yourself. The same answer can be obtained for news classified in the variable “covid | aumento contagi ".
If we apply the delay of one and two days, we can see how two other variables stimulate the download of the application. Here the story is similar, the variables considered are in fact “covid | assembramenti” and “covid | controlli” here too the relevant news can create strong fear in the citizen, a lot of uncertainty and confusion in this case by stimulating the downloads in a negative way (negative coefficient). In fact, we can think that in this case news belonging to the macro category identified above "discouraging" lead the citizen to abandon the idea of downloading the application due to a general lack of trust in other people who continue to gather without respecting the rules.
The result that remains most evident is that all these significant results occur only in a daily, not in both as we see in the App IO tables.
In summary, we can easily infer three main characteristics of the news analyzed in the report, we see how:

1. the news analyzed impact the downloads of the two applications in a more or less evident and more or less positive way;
2. different news items stimulate the downloads of the two applications in a different way;
3. the news has effects over time on the behavior of users and on their choices in using the applications.

At this point it is useful to understand how the downloads of the two applications react to a specific news and if there is a link between the two or if they behave differently as for multiple linear regression. In the next paragraph, through an event study, we will evaluate whether at the release of a particular announcement the download trend is influenced in some way in the days following the announcement. The results we can expect will be 3:

- the announcement positively influences users and increases downloads in the days following the news;
- the announcement negatively affects users and decreases downloads in the days following the news;
- the news creates no stimulus.

3.3.3 The Event Study

First of all, it is necessary to conduct a coherent search for data and main news to identify an event date consistent with the theme of the report. On the web you can easily find various more or less relevant news however it is necessary to pay attention to the various problems that may arise. Above all because in a period like the one chosen, it is difficult to understand whether or not a news is appreciated by the public. In fact, it is possible that news that creates fear and uncertainty produces greater effects than news that is appreciated. Taking into consideration the previous analysis where the major variables referred to news of closure, lockdown, increase in infections, an event was chosen that marked the two years of the pandemic just ended.

The chosen event was the news of the start of the second wave, on 15/10/2020 all the major newspapers opened with this news. "Peak of infections, never so high since April, the second wave began" and continued with news on possible curfews, regional lockdowns, red zones and intensive care and full hospitals. The news triggered panic throughout the country, bringing us back in a few months to a worse situation than that experienced in April 2020.

After identifying the event date, the Event Window and the Estimation Window are estimated. Following the procedure described above, a standard twenty-day Event Window is chosen, ranging from 10 days before to 10 days after the Event Day, therefore from October 5, 2020 (anticipation window) to October 25, 2020 (adjustment window). A further motivation to support this choice is given by a search on Google Trends, in fact it is identified precisely on October 15 as the beginning of the second wave of Covid-19. For the Estimation Window, on the other hand, a time interval of 125 days is used, covering almost the actual six months taken into consideration for the analysis. In fact, it runs from 2 June 2020 to 25 October 2020. By not treating share prices as in a normal analysis of this type, but the downloads of the two applications described above, the analysis approach will be simplified and shortened.

The theory we have seen tells us that the way in which technology spreads in the market and is accepted by consumers depends on several factors, one above all the framing. How

much, however, can an event impact the adoption of two applications such as those discussed in the report?

The purpose of the event study studied is in fact to understand how the download trend is influenced by one of the events that have most marked our days for two years now: the beginning of the second wave of Covid-19.

The results of the event study for App IO are:

period	standard deviation abnormal return	avarage abnormal return
anticipation window (10 days)	15%	-3%
adjustament window (10 days)	33%	9%
event window (21 days)	28%	

Table 8: App IO Event study results. Personal Source

Before the second wave the App IO download trend was slowly decreasing, in fact it was approaching 7.000 downloads per day. At the beginning of the second wave we see how, probably also favored by the first announcements on the release of the cashback bonus, the trend undergoes a slight surge in downloads, however characterized by a strong variability. In summary, we can see that users react to the event in the following days but not clearly. Since the IO app is characterized by a high economic and market perception, the event in question characterized by a strong emotion does not produce a positive or negative effect.

The results of the App Immuni event study are:

period	standard deviation abnormal return	avarage abnormal return
anticipation window (10 days)	32%	-8%
adjustament window (10 days)	16%	-9%
event window (21 days)	24%	

Table 9: IMMUNI Event study results. Personal Source

If we analyze the Immune app downloads we see that the download peak of the second cycle, described in the first paragraph, occurs around the first days of October before the news of the second wave. Hypothetically, this happens because consumers were assaulted

by numbers and news every day during that period and this led most people to imagine the results that then occurred in the following days. The fear of the red zones, the fear and the possibility of a new closure was in the air, and it is for this reason that the downloads of Immuni increased slightly before the event under consideration.

After the event studied, however, we see how the download trend decreases as if to mean that even after a social and health event of this magnitude, the trust of users in the Immuni app as a tool to contain infections is very low. The reasons for the lack of trust in a particular moment such as the one taken into consideration are different, one useful above all to be mentioned in the context of this paper is certainly the lack during the pandemic period of a structured communication and a figure, even political, named in chapter two as a "trust speaker" capable of spreading trust.

In fact, we have seen how Immuni was born amidst the controversy and in a few months from its release it went from being one of the most promoted tools to fight and limit the spread of the virus to become a national flop.

3.3.4 Discussion and Conclusion

This report was intended to analyze the influence of news on the choices of individuals in relation to the diffusion of two applications of public utility, namely App IO (PagoPA S.p.A.), which was necessary during the reference period (June 2020-December 20202) to obtain the cashback bonus and to date many other public services, and App Immuni (Sogei S.p.A.), aimed at supporting the tracking of Covid-19 contacts. The two apps were released to the market during the pandemic period, but found different results, as IO recorded the same number of Immuni downloads in just nine months (Canepa, 2021). Despite this, the purpose of this study was not to compare the two applications, nor to grasp the success of one over the other, in fact we have seen in this paper the strong differences between these two applications which are easily identifiable in the nature of the same.

Indeed, the ultimate goal was to try to understand what were the causes that led to these differences in their diffusion and acceptance. In this regard, a data analysis was conducted that investigated whether there was a stimulus or an effect of the main daily news taken by the two major newspapers of reference ("Corriere della Sera" and "Messaggero") in the downloads of these two applications.

The analysis has led to very interesting results. From the analysis we can find and define different theories studied in the first chapter. As we saw in the first chapter, the acceptance and diffusion of a new technology among individuals depends on several factors. Ajzen and Fishbein (1975) state that technology adoption is not related to the aspects of technology alone but has evolved as a much more complex process involving dimensions of user attitude and personality, social influence, trust and numerous facilitating conditions. As stated by Rogers (2003), a fundamental element in the diffusion of innovation is the level of uncertainty. Is useful to conceptualize the diffusion and adoption of innovations in terms of a framework based on information and uncertainty. The use of these key concepts helps us to understand the diffusion of technological innovations as one type of communication process. The period analyzed is a period of perhaps tension and uncertainty, institutional and traditional communication has not helped to eliminate fear but rather has increased it, creating confusion in citizens. All these factors, combined with the functionality and strengths and weaknesses of the two applications have influenced the behavior of consumers who have chosen to place greater trust and accept more an application that could bring greater economic and personal benefit than a community one and social.

Furthermore, from the analysis it is easy to understand how daily news of a certain type played an important role in influencing consumer choices.

Especially for emergency and encouraging news we noticed how the news analyzed impact the downloads of the two applications in a more or less evident and more or less positive way by increasing or decreasing the downloads and use of the application. The stimulus depends a lot on the type of news, indeed different news items stimulate the downloads of the two applications in a different way; and finally, we saw how the news has effects over time on the behavior of users and on their choices in using the applications. However, the results studied are not always considered as seen for Immuni in the daily Il Messaggero.

As we have seen in the previous chapters of the paper, the histories of the two applications have very different cycles, one stimulated more by purely economic and market variables, the other stimulated by variables social, panic and trust. From the data analysis, however, this is not easily perceptible. Let's see how App IO reacts much more to very specific stimuli, in both newspapers, unlike App Immuni which presents us with relevant results only with the "Messenger". In both cases, the news that stimulate downloads the most

seem to be negative news, this is due to the fact, As already said many times during this draft, in a period of uncertainty, fear, disorientation such as the pandemic period, they have an effect on individuals more the negative news. A factor that has led to a greater diffusion of App IO compared to App Immuni is the relationship of trust between users and digital applications. The reasons behind this result are closely related to the pandemic period and the meaning attributed to the word "trust", which implies that a person delegates to someone else the achievement of a particularly important goal for the one who expresses trust. Therefore, if an individual chooses not to trust someone, it means that he has all the tools needed to achieve and satisfy the desired goal. Considering the pandemic period that has just passed, the personal and public safety objectives required are not autonomously pursued by individuals, who inevitably have to rely on public authorities. On the other hand, institutions must also trust individual citizens, as only through active collaboration and the pursuit of regulations does the number of infections drop. Of course, the need for trust created by the pandemic does not translate into an exponential growth of trust in public institutions, which is why Italy is currently among the countries with the lowest adoption rate of the tracking application in Europe. In fact, in a relationship such as that between the State and Italian citizens, characterized by high levels of vulnerability, a small crisis is enough to break this fragile balance. So, if initially Immuni was discharged by almost 3 million Italians in just two days (Immuni), some malfunctioning and subsequent complications were enough to quickly deteriorate the trust that Italians had placed in the institutions, causing a drastic drop in the number of downloads (Zorloni, 2021).

To better understand the results of this research, it is useful to cite another study done on these two applications. The study was carried out as part of a larger university project, of which this contribution is also part, by the Ca'Foscai University of Venice led by Professor Rullani. The aim of the project is to define and study the phenomenon of the diffusion of public order applications and their relationship with citizens and the market; outlining the possible characteristics that these new technologies are designing for the near future

The objective of the assessment, in this case, was to outline the framing that characterizes the two apps, starting from a series of words that the participants had to associate with the two applications. From the analysis of these statements, a first substantial difference

emerged: Immuni appears to be characterized by a purely social framing, in fact, the main keyword that users linked to the Immuni app was "mutual benefit", thus indicating that a large part of the sample considers the tracking app to be a useful tool for preserving their own health and that of others. On the other hand, IO has an economic framing, purely of the market, also motivated by the use of the incentives that favored the spread of this app (Lorenzon, 2021). This is also easily visible in the analysis of this report, in fact the variables that most stimulate App IO are: "economia" "ripresa economica" "politica". This first distinction was further investigated thanks to the subsequent questions of the assessment, aimed at measuring the concerns of individuals regarding the data required by the two applications to be downloaded. The answers stated showed some discrepancy, as on the one hand users have associated privacy problems with the Immuni app, on the other hand they have expressed greater concerns about the data required by the IO app. The reason these discrepancies occurred is closely related to the framing that distinguishes the two applications. Immuni is characterized by a social dilemma, described in the second chapter of this paper, which leads individuals to prefer not to release their data and not to download the application. Unlike Immuni, the economic framing of IO is much more pragmatic, as the statements made by the sample suggest that the latter is moderately concerned with all the data related to this app, both on an ideological and practical level. Therefore, the framing that characterize the two applications are very different from each other. The introduction of the economic framing within the social context has greatly influenced the perceptions of individuals, on the other hand the inclusion of the social framing within the economic context has not caused any consequences. These results reveal that the framing effect is not always the same, since the market framing is stronger than a typically social framing (Lorenzon, 2021).

Based on the above considerations, this report highlights that making a comparison between the two apps based solely on the number of downloads totaled during the period and the news taken into consideration, could be misleading, since, as the survey results show, the results they are influenced by many other factors, perceptions, incentives, trust. In fact, relying only on news and announcements could be an understatement to understand the true effect on individuals.

In any case, this study only suggests some conjectures based on the theory and descriptive empirical evidence deriving from the data collected from the analysis, and which can therefore be retested in the future by applying them as best practices for future studies.

RINGRAZIAMENTI

È arrivato il momento dei ringraziamenti, volevo iniziare ringraziando l'università Ca' Foscari di Venezia che mi ha accompagnato durante i miei anni universitari dandomi l'opportunità di mettermi in gioco in diversi ambiti, non solo lavorativi ma anche nelle diverse associazioni che la caratterizzano e di cui sono e sono stato socio.

Desidero ringraziare successivamente di cuore il mio relatore, il Professore Francesco Rullani per l'attività di supporto e di guida durante l'intera stesura di questo elaborato, inoltre, per aver sempre ascoltato i miei dubbi e assecondato le mie idee per più di un anno e avermi consigliato e spronato per applicarmi per un tirocinio a PagoPA S.p.A.

Ringrazio poi PagoPA S.p.A., e tutti i miei compagni di viaggio, un grazie speciale a Max ed a tutto il team affari istituzionali e comunicazione di Patrizio Caligiuri, grazie a Benedetta, Chiara e tutti i ragazzi del WEO. Ringrazio poi App IO per farmi pagare facilmente i miei dovuti direttamente dal telefono in modo totalmente sicuro e semplice. Un grazie non meno importante ad Immuni che nel bene e nel male ha svolto il suo lavoro.

Ringrazio poi i nuovi colleghi e KPMG Advisory che ha creduto in me e mi ha assunto prima ancora di conseguire la mia laurea magistrale.

Ringrazio poi i miei amici, Martina la compagna di studio fin dai tempi dell'asilo, Rom, Fe, Carol.

Un enorme ringraziamento va a mia mamma e mio fratello, Alessandro, la nonna rosy e tutta la mia famiglia per il supporto e l'affetto incondizionato che non mi è mai stato fatto mancare.

Infine grazie a te, a cui dedico questa tesi, fatta meglio dell'altra, per avermi fatto crescere, per essere sempre stata la mia spalla, per averci aiutato a realizzare i nostri primi sogni INSIEME.

BIBLIOGRAPHY AND SITEGRAPHY

Angius, R., & Zorloni, L. (2020, Ottobre 31). Il governo non sa quanti sono gli utenti reali di Immuni. Tratto da Wired.it: https://www.wired.it

Angius, R., & Zorloni, L. (2020, Ottobre 29). Immuni ha un problema con le notifiche di contatti a rischio. Tratto da Wired.it: https://www.wired.it

Anglin A., Short j., Drover W., Stevenson R., McKenny A., Allison T., (2018). The power of positivity? The influence of positive psychological capital language on crowdfunding performance, Journal of Business Venturing, Volume 33, Issue 4, pp. 470-492.

Blasimme A., & Vayena E. (2020, November 13). What's next for COVID-19 apps? Governance and oversight. Science

Binder, J.J., 1998. 'The Event Study Methodology Since 1969', Review of Quantitative Finance and Accounting, Kluwer Academic Publishers, Boston, 11, pp. 111–137.

Bini F., (2020, December 10). App, IO batte Immuni: così il cashback ha spinto i download molto più dell'emergenza sanitaria. La Repubblica.

Brooks C., (2014). Introductory Econometrics for Finance, Cambridge University Press.

Canepa, C. (2021, Giugno 7). Chi ha ucciso l'app Immuni e perché. la Repubblica.

Carli, A. (2021, Marzo 17). Cashback, addio o stop al superpremio: le ipotesi in campo per il restyling. Il Sole 24 Ore.

Carr Jr, V. H. (1999). Technology adoption and diffusion. The Learning Center for Interactive Technology.

Ciaian, P., M. Rajcaniova, and D. Kancs. 2016. “The Economics of BitCoin Price Formation.” Applied Economics 48 (19): 1799–1815.

Choong, P. et al., 2003. An event study approach to evaluating the economic returns of advertising in the super bowl’, academy of marketing, 7(1), pp. 89–100.

D'Alessandro, J. (2020, Aprile 30). Immuni. Cos’è, a cosa serve e chi c’è dietro l'app per il tracciamento in arrivo a fine maggio. la Repubblica.

Dasgupta P. (2000). ‘Trust as a Commodity’, in Gambetta, Diego (ed.) Trust: Making and Breaking Cooperative Relations, Department of Sociology, University of Oxford, chapter 4, pp. 49-72

Damiani M., (2022, March 17). Multe senza costi di notifica. Con la nuova piattaforma quasi azzerate le spese extra. Italia Oggi

De Santi M., (2 December, 2019). App for citizens, designed with citizens. Based on: medium.com

Deci e R.M. Ryan, Intrinsic Motivation and Self-determination in Human Behavior, New York, Plenum Press, 1985

Deci e R. Flaste, Why we do what we do. The dynamics of personal autonomy, New York, Putnam, 1995.

Fama, Eugene F., Lawrence Fisher, Michael C. Jensen, and Richard Roll (1969): “The Adjustment of Stock Prices to New Information,” International Economic Review, vol. 10, pp. 1-21.

Fehr, E., Ga¨chter, S., 2000. Fairness and retaliation: The economics of reciprocity. Journal of Economic Perspectives 14 (3), 159–181.

Fishbein M., Ajzen, I.(1975). Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research, Addison-Wesley.

Garousi, V., Cutting, D., & Felderer, M. (2020). Mining user reviews of COVID contact- tracing apps: An exploratory analysis of nine European apps.

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: an integrated model. MIS quarterly, 27(1), 51-90.

Gneezy, U. (2003). The W effect of incentives. Working paper, University of Chicago, Graduate School of Business.

Gneezy, U., & Rustichini, A. (2000). A Fine is a Price. Journal of Legal Studies, 29, 1-18.

Gneezy, U., & Rustichini, A. (2000). Pay Enough or Don't Pay at All. The Quarterly Journal of Economics, 115(3), 791-810.

Gneezy, U., Meier, S., & Rey-Biel, P. (2011). When and Why Incentives (Don't) Work to Modify Behavior. Journal of Economic Perspectives, 25(4), 191-210.

Giorgi P. (2021, January 12). Tutte le notevoli differenze tra la prima e la seconda ondata di contagi. Based on: www.agi.it

Gasser U., Ienca M., Scheibner J., Sleigh J., Vayena E. (2020, June 29) Digital tools against COVID-19: taxonomy, ethical challenges, and navigation aid. Health Policy volume 2.

Grampa A., Fontanella T. (2022, March 7). Il Futuro Dei Pagamenti per la PA è Tutto Da Scrivere. Based on: https://www.wired.it/

Greco, T. (2021). Perché noi italiani (non) ubbidiamo alle leggi? Un problema per la cultura giuridica. Paradoxa, 15(1), 127–131.

Somang M., Kevin K. & Miyoung J., (2019). Consumer adoption of the Uber mobile application: Insights from diffusion of innovation theory and technology acceptance model, Journal of Travel & Tourism Marketing, 36:7, 770-783.

Immuni. (s.d.). Based on Immuni: https://www.immuni.italia.it (last access 01/03/2022).

Italia Domani (s.d). Besed on Italia Domani gov: https://italiadomani.gov.it/ (last access 17/03/2022).

IO - l'app dei servizi pubblici. (s.d.). Based on IO, l'app dei servizi pubblici: https://io.italia.it

Honglei L, (2004). Virtual Community Studies: A Literature Review, Synthesis and Research Agenda. AMCIS 2004 Proceedings. 324.

Longo, A., (2020, Dicembre 7). Cashback, oggi il via alla registrazione. App IO intasata: 6mila domande al secondo. La Repubblica.

Mazzucato M., (2020). Lo Stato Innovatore: Sfatare il mito del pubblico contro il privato. Laterza.

Mackinlay, C., 1997. 'Event Studies in Economics and Finance', Journal of Economic Literature, American Economic Association, 35(1), pp. 13–39.

Mellström, C., & Johannesson, M. (2010). Crowding out in blood donations: was Titmuss right? Journal of the European Economic Association, 6(4), 845-863.

Niza, C., Tung, B., & Marteau, T. M. (2013). Incentivizing Blood Donation: Systematic Review and Meta-Analysis to Test Titmuss' Hypotheses. Health Psychology, .941-949, 11(32).

Nyborg, K., Anderies, J. M., Dannenberg, A., Lindahl, T., Schill, C., Schlüter, M., . . . de Zeeuw, A. (2016). Social norms as solutions. Science, 354, 42-43.

O' Neil Howell, P. (2020, Giugno 5). No, coronavirus apps don’t need 60% adoption to be effective. Tratto da MIT Technology Review: https://www.technologyreview.com

pagoPA - Pagamenti semplici e sicuri per la Pubblica Amministrazione. (s.d.). Tratto da pagoPA: Home: https://www.pagopa.gov.it

Partecipa al Cashback con l'app IO. (s.d.). Tratto da Partecipa al Cashabck con l'app IO: https://io.italia.it/cashback

Rizzo, E. (2020). COVID-19 contact tracing apps: the 'elderly paradox'. Public Health, 185(127).

Servick K. (2020, May 21). COVID-19 contact tracing apps are coming to a phone near you. How will we know whether they work? Science

Jussi Kinnunen. (1996). Gabriel Tarde as a Founding Father of Innovation Diffusion Research. Acta Sociologica, 39(4), 431–442. http://www.jstor.org/stable/4194846

Ortiz-Ospina E., & Roser M. (2016) - "Trust". Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/trust

Kholekile L. Gwebu, Jing Wang, (2011). Adoption of Open Source Software: The role of social identification. Decision Support Systems, Volume 51, Issue 1, 220-229.

Tajfel H., Turner J., (1979). An integrative theory of intergroup conflict, in: W.G. Austin, S.

Worchel (Eds.), The Social Psychology of Intergroup Relations, Brooks-Cole, Monterey, CA, pp. 94–109.

Tajfel H., Turner J., (1986). The social identity theory of inter-group behavior, in psychology of intergroup relations. in: S. Worchel, W.G. Austin (Eds.), Psychology of Intergroup Relations, pp. 7–24

Tajfel, H. (1970). Experiments in Intergroup Discrimination. Scientific American, 223(5), 96–103.

Yi-Hsiu Cheng, Hui-Yi Ho, (2015). Social influence's impact on reader perceptions of online reviews. Journal of Business Research, Volume 68, Issue 4, pp. 883-887.

Oosterbaan E., (14 December 2021). The Elon Effect: How Musk's Tweets Move Crypto Markets. Based on: www.coindesk.com

Greene, C. M., & Murphy, G. (2021, June 10). Quantifying the Effects of Fake News on Behavior: Evidence From a Study of COVID-19 Misinformation. Journal of Experimental Psychology: Applied.

Mohammad Hashemi Joo, Yuka Nishikawa & Krishnan
Dandapani (2020) Announcement effects in the cryptocurrency market, Applied Economics, 52:44, 4794-4808.

Venkatesh V., & Davis F. (2000). A theoretical extension of the technology acceptance model: four longitudinal field studies. Management Science, 46(2), 186-204.

Virgone, G., & Attias, L. (2019, Luglio 31). pagoPA: nasce la società partecipata dallo Stato per i pagamenti digitali in Italia. Based on Medium: https://medium.com

Virgone, G., & Calvaresi, M. (2020, Dicembre 30). Cashback: retrospettiva su un avvio sfidante, con lo sguardo rivolto al futuro. Based on Medium: https://medium.com

Wenjun Feng, Yiming Wang & Zhengjun Zhang (2018) Can cryptocurrencies be a safe haven: a tail risk perspective analysis, Applied Economics, 50:44, 4745-4762,

Wei Yue, Sijia Zhang, Qiang Zhang, (2021). Asymmetric News Effects on Cryptocurrency Liquidity: an Event Study Perspective, Finance Research Letters, Volume 41.

Zhang S., Gregoriou A., (2020). The price and liquidity impact of China forbidding initial coin offerings on the cryptocurrency market. Applied Economics Letters, pp. 1-4

Riordan R., Storkenmaier A., Wagener M., S. Sarah Zhang, (2013). Public information arrival: Price discovery and liquidity in electronic limit order markets, Journal of Banking & Finance, Volume 37, Issue 4, pp. 1148-1159.

Shead S., (1 February 2021). Elon Musk's tweet are moving markets – and some investors are worried. Based on: www.cnbc.com

Manish Agrawal, Rajiv Kishore, H. Raghav Rao, (2006). Market reactions to E-business outsourcing announcements: An event study. Information & Management, Volume 43, Issue 7, pp. 861-873

Ministero della Salute, (2022). Test diagnostici e tracciamento dei contatti. Based on: www.salute.gov.it

Thomas Dimpfl, (2011). The impact of US news on the German stock market—An event study analysis. The Quarterly Review of Economics and Finance, Volume 51, Issue 4, pp. 389-398

Kun Li, (2018). Reaction to news in the Chinese stock market: A study on Xiong'an New Area Strategy, Journal of Behavioral and Experimental Finance, Volume 19, pp 36-38

Nianxin Wang, Qingxiang Li, Huigang Liang, Taofeng Ye, Shilun Ge, (2018). Understanding the importance of interaction between creators and backers in crowdfunding success, Electronic Commerce Research and Applications, Volume 27, pp. 106-117.

Rapporto Ital communications – Censis, (2021). Disinformazione e fake news durante la pandemia: il ruolo delle agenzie di comunicazione. Based on: www.censis.it

Zorloni, L. (2021, Marzo 22). I download di Immuni sono scesi a livelli irrisori. Tratto da Wired.it: https://www.wired.it