



## MOBILE TECHNOLOGIES TO SUPPORT AGRIBUSINESS PROFESSIONALS

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### ABSTRACT

The proliferation of mobile devices and advances in wireless networking has created an always-connected society. One of the sectors of the economy that has made use of these technologies is agribusiness, through its need for traceability and geographical location, among others. Agribusiness managers work in transit, remotely and at various headquarters, and need access to information and constant communication to support decision making. This study aims to examine how mobile technologies have influenced everyday decisions in the perception of agribusiness professionals. The research was exploratory, using a qualitative approach to the data. Data collection was conducted through semi-structured interviews with eight agribusiness professionals. Data were analyzed through content analysis, considering mobile service categories. The results showed that the respondent agribusiness professionals use mobile technology in their specific everyday life for a variety of functions and needs. Respondents also reported using the features of the mobile service portfolio in different ways, according to availability in their region (e.g. connectivity) and their comfort with technology in general, and specific tasks (such as applications that assist in pest diagnosis).

**Keywords:** Mobile Technologies; Mobility; Managerial Decision; Agribusiness.

### 1. INTRODUCTION

The proliferation of mobile devices and advances in the wireless network have created an ever-connected society (SHEN *et al.*, 2012): mobile and wireless technologies are incorporated in the population's daily life, enabling new forms of interaction between individuals and between organizations and employees, leading to major changes in today's society. Technological progress enables the development of wireless sensor networks, which, combined with the Internet, have led to an increase in the quality of services in a variety of areas such as agriculture, transportation, medicine and logistics (Shuib *et al.*, 2015).

Services offered anytime and anywhere through mobile devices have great potential to offer to consumers a more convenient and personalized shopping experience, besides facilitating interactions (Shen *et al.*, 2012). For many professionals that work independently, it is crucial to be accessible and connected with the world around

them for their daily work (Kakihara *et Sorensen*, 2002). Thus, in addition to the organization's perception of and interaction with the changes caused by mobile technologies, professionals also end up being involved.

Kakihara *et Sorensen* (2004) argue that attention should be paid to the changes occurring around the postmodern "mobile professionals" and to their impact on contemporary business activities; the way these professionals work with organizations; and especially how mobile technologies are used in their working practices. As the number of smartphone users has been dramatically increasing and the IT environment rapidly becomes ubiquitous, smartphone-based mobile enterprise operations become more active (Kim *et al.*, 2015), and also, more and new challenges come to light.

One of the challenges faced by managers in all fields is decision making, which can be of many different types. One in particular stands out among mobile technologies: instant decision-making, which permeates the daily li-



ves of managers, because they do not always have the time and the necessary tools to analyze information and still handle large risk indices (Andriotti *et al.*, 2014). One of the areas of the economy that demands a lot from managers with regard to making instant decisions and the constant use of mobile technology is agribusiness (ABIEC, 2014).

The adoption and intensive use of various information and communication technologies (ICT) is an essential basis for various business activities (Kakihara *et Sorensen*, 2002): organizations have been incorporating these technologies in buying and selling activities, customer relationships, or even as a tool to improve the production process. The importance of being able to access the Internet anywhere at any time is the cornerstone of much of the previous mCommerce research (Hillman *et Neustaedter*, 2017), and for so many more applications and research on mobile technology.

While technology has an important role by itself, an interest emerges within this context in studying its effects in the routines where it is incorporated, and how it influences or even modifies the actions and decisions of managers, students, and consumers (Sorensen, 2010). Junges *et al.* (2014) mention the importance of studying the effects of the access to ubiquitous computing resources on executives' and managers' decision making: it is necessary to understand how individuals react to such use and how it affects their work and decision making.

In this research, we are interested in agribusiness managers interacting with their contexts by means of mobile technologies, both for working on the go, remotely, and in various headquarters; and for relating to a sector that requires traceability technology, geographic positioning, and constant communication. The Brazilian government is one of the promoters of the use of machines and technology in this industry by providing resources such as the *Inova Agro* program, seeking competitiveness and productivity in agribusiness (EXAME, 2013).

This paper aims to contribute to the field, examining aspects of decision making in the context and perception of managers under the influence of mobile technology, as well as offering practical tools to enable managers to make the most of mobile technologies in making instant decisions. The aim is to analyze how mobile technologies have influenced everyday decisions in the perception of agribusiness managers. To this end, this article continues with a review of the relevant theory (Section 2); the definition of and details about the research method (section 3); followed by an exploration of the collected qualitative data (section 4); and some conclusions (section 5).

## 2. LITERATURE REVIEW

This section provides theoretical elements that seek to bolster the essentials in terms of mobile technologies, management decision and decision in the context of mobile technology.

### 2.1 Mobile technologies and the current context

The technology revolution has been reported by scholars throughout its advances. Weiser (1991) described the computer of the *future* and the possible relations and interactions with great precision in his expectations: the computer would take many shapes and sizes bringing new features of interactivity and connectivity, showing a new horizon possible for computing as it was then known. The author already claimed that ubiquitous computing did not simply refer to the concept of a computer being everywhere, but being in all things. In this way, the computer itself could and would become imperceptible.

Greenfield (2006), intending to contextualize the current paradigm of technology, affirms the existence of a large quantity of objects provided with the power of processing: "They pump the brakes in our cars, cycle the compressors in our refrigerators, or adjust the water temperature in our washing machines, [...]" (Greenfield, 2006, p.18). Thus, the technology has been included in daily life and in the most ordinary objects and tasks, but it is the capacity to connect and interact with other technologies that makes it noticeable and interesting to users. And it is this interaction that enables the reality of the "everywhere" paradigm and ubiquitous computing (Weiser, 1991).

The term ubiquity entails the interaction and the perceived level of this interaction between the portability and pervasiveness of technology (Sorensen, 2011; Lyytinen *et Yoo*, 2002). A sensor measuring the water level in a tank that sends an SMS message to a server when the water level is below a certain level is an example of pervasive technology (Sorensen, 2011).

Mobile technology can bring many consequences for users and society. Everyday moments, as well as family and work moments, are all subject to change with the use of such technology. Mobility takes the form of a bridge, which makes a distant and absent reality present again (Pica *et Sorensen*; Allen, 2004). Thus, tasks can be moved between different contexts, such as answering business emails during a dinner, which can result in adjustments and sometimes changes due to the possibilities that the mobile technology offers. The understanding of the drivers to motivate the use of new technologies could enhance the quality of the learning process (Briz-Ponce



*et al.*, 2016), and it could also improve the relationship of the users and the technology.

Smartphones, notebooks, tablets, GPS systems, etc. use mobile technology. For Kakahara *et Sorensen* (2002), the mobile phone is a good example of mobile technology because it enables the transportation of a spatially distant or even absent reality containing people and objects and the interaction with them. The device has enough embedded technology to communicate over the network to other devices and to be taken along with the user's movements.

Sorensen (2011) sketched out the portfolio of mobile services with their capabilities, understood as the distinction between the opportunity to perform actions and the actual performance, i.e. the affordances, which mean resources for reflex actions: they are thus the opportunity for actions among the existing characteristics, which differentiates them from the performance, which is characterized by real action together with the artifact (Sorensen, 2011). Enterprise mobility is described as "the study of mobile communication technology in the context of mobile work" (Sorensen, 2011, p. 43): the author outlines the categories of interconnected services, explaining their characteristics and importance in the current context. There are six mobility categories that combine to form this portfolio: Intimacy, Connectivity, Priority, Pervasiveness, Memory, and Portability. These services (Table 1) are described as supports to understand mobile work, mobility, and mobile interactions.

## 2.2 The management decision

Simon (1960) was among the first to refute the economic model of perceiving human decisions as rational

and calculating: he criticizes the notion, describing the factors that affect real-life decisions and proposing the theory of bounded rationality. In this study, we seek to understand how the decision-making process takes place in the daily work of the professionals observed.

One aspect of the process is the occurrence of predictability (Freitas *et Kladis*, 1995): some decisions are repetitive, happening in cycles, while others occur unexpectedly; Simon (1960) categorizes these as programmed and non-programmed decisions. Another important concept in the decision-making process is immediacy, referring to a decision to which individuals are not prepared in advance, even briefly, and which requires a position in a referred time interval of less than a day (Freitas *et al.*, 2017). This puts professionals in responsible positions, as the decision-making process should take place in that short space of time and with limited information. Managers need to interact in a more complex environment, with greater access to information and required results in these environments filled with variables that compel them to act quickly. In this context, decisions call on managers' ability to deal with situations in which there is a clear sense of time urgency (Simon, 1960; Eisenhardt, 1989).

## 2.3 The manager and decision making in the context of mobile technologies

Professionals are leaving the workplace to find, outside the firms, independent and free environments, which provide career management, flexibility, and greater benefits (Kakahara *et Sorensen*, 2004). These professionals use the Internet and mobile technologies as tools; moreover, they made them their work. New professions that

**Table 1.** Description of mobility capabilities

Service Portfolio	Description
Connectivity	It is directly related to the overall technology and telecommunication infrastructure. The simultaneity of updates and the use of networks in mobile technologies are what differentiate the isolation of the connection.
Portability	Portability can be best exemplified by the mobile phone. It is possible due to the miniaturization of the technology and the popularization of devices. Furthermore, it entails the possibility of carrying or moving, which is the most observed characteristic insofar as the technology is so called.
Memory	It differentiates mobile technology in its relationship with the user. It allows a relationship with those who need it, searching recorded data, updating it as the user uses it, rather than unrelated encounters with no possibility of interaction.
Pervasiveness	It is defined as the capacity of relating to the technological environment. Thus, it can be pervasive, or unaware, i.e. unrelated to the environment, such as electronic organizers—and without internet access.
Intimacy	Intimacy presents itself as a proximity to the user. It is bodily close: it can support an intimate user-relationship due to memory and connectivity.
Priority	Priority is the combination of portability, connectivity, pervasiveness, and intimacy, enabling prioritization, formal or informal, of activities.

Source: Adapted from Sorensen (2011, p.17-31).

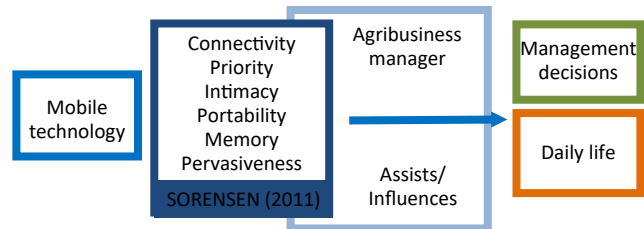


are linked mainly to the Internet exist, showing growth and increasing acceptance: they may be practiced from home; several them require trips that mix business and pleasure; they can inform, document, or update, such as bloggers, YouTubers, etc. Collaborative working activities such as group decision-making, conferencing and brainstorming not only can be performed by using electronic systems, but they may also be ameliorated by such technologies (Wang *et Reani*, 2017). The way people interact among them and the way they communicate to each other have evolved completely, incorporating the mobile gadgets and the mobile technologies as being part of them (Briz-Ponce *et al.*, 2016).

Interactions in the workplace, along with the social conventions surrounding the use of mobile technology, the gaps between individuals, and between individuals and work environment, generate an overload of interactions (Pica *et al.*, 2004): these interactions reflect the match among three dimensions (agent, technology and workplace). The sum of the actions mediated and unmediated by mobile technology represents the context, interfering with the manager's workspace. The environment in this context certainly presents interruptions and great interaction with the mobile technology in question. In addition to the disruptions, decisions must be made quickly, respecting the pace of an ever-connected environment and allowing managers flexibility until the last moment of decision (Eisenhardt, 1997).

Managers' contexts can be characterized as challenging because of their dynamism. The tools that managers have at hand are mainly mobile technologies which, connected and disseminated by organizations, have shown evidence of their influence in terms of how managers act and decide (Greenfield, 2006; Sorensen, 2011). Technology can assist with obtaining remote information when there is need to make a quick decision.

The conceptual framework of this study (Figure 1) resembles an overview of the context: it incorporates mobile technology capabilities (Sorensen 2011), opening then, within the context being studied (agribusiness manager), to the categories of services to be observed. These enterprises' mobility services allow the observation of attributes to the study of what mobile technology confers to the context, which are absorbed and incorporated into the decision-making and the daily lives of managers. An important mobility assumption is precisely the heterogeneous adoption of these properties, highlighting the concept of affordance, which expresses the relationship between the planned use of technology and the current social practices (Sorensen, 2011).



**Figure 1.** Conceptual Framework

Source: Adapted from Sorensen (2011) and Freitas *et al.* (2017)

Thus, it is of interest in this study to understand whether the context of mobile technologies helps and influences agribusiness managers in their daily lives and in their decisions.

### 3. METHOD

The nature of the research was defined as exploratory, the approach to the data was qualitative (Creswell, 2014), and data collection was delimited through semi-structured interviews. Thus, the main target was the respondents' speeches, as opposed to the number of respondents or quantifiable answers.

The data collection technique was defined as semi-structured interviews, in which researchers are free to exercise their initiative in monitoring the response to a question (Hair *et al.*, 2005). Based on this technique, in which the interview script becomes flexible, there may be information that will add quality and complexity to the data analysis. After defining the interview script, a validation was performed with experts, to ascertain the proper understanding of the questions and the relevance of the vocabulary used, among other aspects. The experts were chosen for their knowledge in terms of the main subjects of this research, those being: mobile technology, decision making processes and everyday management decisions. The group answered the questions according to the script, asked questions about the intention of the research and its questions while also suggesting some changes in the script as to make the interview process as clear as possible for the respondents. Next, the research was carried out, initially through a pre-test which, after analysis, revealed how the respondents behaved before the interview script, which was considered acceptable to move forward in the study, including these data as well.

Agribusiness is defined as a risky business, dependent on several uncontrollable factors, the most important of which is climate: it is a sector that accounts for much of the production and export of the country, and has therefore been addressed and studied by several areas



of knowledge. Schnorrenberger *et al.* (2008) state that climate characteristics, such as pests, diseases, and major productive and financial cycles require different debt and risk decisions from the sector. Agribusiness managers should consider various factors when making decisions and facing their daily work and they are the unit of analysis defined in this study. They were chosen because of the adversity they experience in their working environment, the dynamism of this environment, the geographical mobility incorporated into their work, and the importance of the primary sector to the Brazilian economy.

We sought agribusiness managers who were users of mobile technologies, i.e. who used cell phones and smartphones, laptops, GPS, tablets, and others as part of their routine. In addition, we selected respondents by looking up people from different areas to achieve some representation of the sector's diversity, such as sellers, owners, and consultants.

The context of mobile technologies for agricultural managers can benefit and help in daily life due to the fact that the organizational environment can change between open offices and fields on the same working day. Often, these different environments involve traveling, appointments, and purchasing, and can include other professionals and other environments. In these environments, we sought to find out how these professionals rely on mobile technology today, how they take advantage of it to do their jobs and make decisions, and how this industry perceives technology.

The data collection was carried out with agricultural professionals, who first went through a characterization prior to the interview in order to identify their profession and length of career in the business. This characterization occurred after we assessed the use of mobile technologies in the manager's daily life. All interviews were recorded: they lasted from ten minutes to more than an hour. Following the interview and with the recording at hand, we performed data transcription, followed by data analysis.

We interviewed eight agribusiness managers: six face-to-face in their workplaces in four cities of the state of Rio Grande do Sul and two of them by web conference. The managers initially contacted were those who had been awarded the 2014 *Campeador* Trophy by the RBS Group. We sought contact with all eight award winners; however, only two of them participated in the survey. After this, six other managers were contacted, either by referral by the respondents or via meetings in regional agribusiness fairs.

The interview script was developed based on the literature review. Four main sets of questions were es-

tablished: identification of the interviewee profile, the context of mobile technologies, managerial decisions, and aspects of mobile technology in this context. Some elements of the script proposed for the semi-structured interview are (Santos, 2014): identification (training, performance time, region, frequency of business travel, use of mobile technology, etc.); mobile technology context (which mobile technologies these are, whether in work routine, personal routine, the way it is used, how recently, advantages, difficulties, changes made, etc.); managerial decision (use of mobile technology, changes made, immediacy, frequency, time, etc.); and aspects of mobile technology in the context (part of the process, how it is used, use of phone's memory, how often it is carried, prioritization, connectivity, facility use, etc.).

Data analysis in qualitative research consists of the preparation and organization of data for further analysis of their content, noting that the steps may change as to the approach insofar as each study has different requirements (Freitas *et al.*, 2000; Hair *et al.*, 2005). The central steps of encoding data for qualitative research are (Bardin, 2009; Creswell, 2014): the encoding itself, i.e. reducing the data to significant segments and assigning names to the segments; combining the codes into categories or broader themes; and presenting the data in a relevant manner. Once transcribed and reread, the data were initially treated according to the three main study foci: the manager, the managerial decision, and the context of mobile technologies. Soon after, they were allocated to the categories defined for each pillar, which may be cited as: instant, unprecedented, routine decisions; manager's perception, advantages and disadvantages; over-time comparison; and the mobile technology portfolio features. Naturally, data analysis strongly depends on the researcher's integration power (Pozzebon *et al.*, 1998): data interpretation relies on researcher's intuition and their power of integration (Bardin, 2009; Creswell, 2014).

#### 4. DATA ANALYSIS AND RESULTS

In this section, the data collected from the eight managers are analyzed based on the review of the literature previously presented.

##### 4.1 The "experienced" agribusiness manager

The managers interviewed (I-1 to I-8) represent different branches of agribusiness: (a) the producer and the professional in the sector (I-1, I-7, and I-8); (b) cooperatives working together with agribusiness and the producer (I-2 and I-3); (c) projects and consultancies that specialize



in understanding the business and working in the sector, which, in this case, includes the stock exchange, as well as advising both government and small farmers through lectures, courses, and research (I-4); (d) and researchers in the sector (I-5 and I-6), which are aware of the newest technologies and also contribute to their development.

Some data about the respondents are: seven men and one woman; two aged between 30 and 40, five between 50 to 60, and one between 60 to 70 years. They are experienced and have worked in the area for quite some time. Two are from Porto Alegre, two from São Pedro do Sul, two from Pelotas, one from Santa Maria and one from Passo Fundo; two are veterinarian/farmers, two are researchers, two are from a cooperative bank, one is an entrepreneur/consultant, and one is a farmer. Despite their different branches and activities in agribusiness, together they represent areas that make up the large sector.

All eight respondents stated that they use mobile technology in their daily work; the most cited being the smartphone, which all respondents said to use. Tablets and notebooks were also mentioned, especially as the technologies that are used for the professional performance of these managers, but also for personal activities. The smartphone is used every day by seven of the eight respondents. The only interviewee who reported not using a smartphone uses instead a notebook and a tablet.

Most respondents (6 out of 8) have worked more than 15 years in the agribusiness sector. I-5 has been in the industry for only eight years, whereas I-8 did not say precisely how long, but stated over 10 years. This duration in the sector gives them authority to report the context of the agribusiness, and also to report the changes that have been perceived over their personal trajectory. Four of the respondents have been directly involved in agribusiness for over 24 years (I-1, I-2, I-4, and I-7), and can be considered veterans in the business.

When asked about commuting to work, most respondents (6 out of 8) reported having to commute or travel to work, or that trips are part of their daily work in order to meet clients, give lectures, or determine conditions of the soil and animals with research objectives or hands-on farm work. All respondents (8) claimed to use mobile technologies in their personal daily life, in addition to their daily work.

The definition of mobile work as a form of performing work outside the employer's premises (Sorensen, 2011) fits well with the characteristics of respondents. For the participants in this study and for much of the agribusiness, work can be characterized as "geographically distri-

buted", a feature that precedes mobile technologies; as for the remote mobility in this sector, it involves a wide mobility of the actors distributed and moving between them. Thus, mobile technologies easily entered the routine of agribusiness managers due to the geographical distribution of features and remote working, providing a tool to keep them constantly connected to information and communication, among others.

#### 4.2 Mobile technologies

The use of mobile technologies constituted one of the characteristics prior to the selection of respondents. This context can be seen in the adoption, use, and connection of technologies, especially the mobile ones, which have specific characteristics (Kakihara *et Sorensen*, 2002; Weiser, 1991). This context includes the interaction dimensions (Machado *et Freitas*, 2009), mainly: (a) spatial, due to the agribusiness manager's need to move and travel, without losing the flow of information; and, (b) contextual, due to the different tasks, positions, and personal interactions that are required of these managers, as could be observed when analyzing the data. The temporal interaction also provides for carrying out simultaneous tasks and the need to rapidly obtain information and communicate.

Regarding the characteristics of mobile technology, Sorensen (2011) states that one of the assumptions of the concept of enterprise mobility is the heterogeneous adoption of the six characteristics that he described, which was confirmed by the interviews: the possibility of using this portfolio exists for users of mobile technologies, but the adoption and usage of each feature are particular to each case.

Among the portfolio characteristics of mobile services, Sorensen (2011) describes **intimacy** as the way mobile technology is presented near to the user, and the relationship between technology and user: respondents were asked about their perception regarding their intimacy level with the mobile device, and asked to attribute a score between zero (0) and ten (10) for that intimacy. Seven of the eight respondents considered themselves to be intimate and as having a good relationship with this technology; their scores ranged from seven (7) to nine (9). These high marks reflect the interest and confidence of respondents when it comes to the use of technology.

Only one of the interviewees, I-7, did not consider himself to be intimate with the technology and rated his relationship with the device as a 4. The respondent commented: "I am not very tamed" (I-7), referring to the lack of practice and knowledge, and also reported that he ac-



tually uses technology, especially a notebook computer, but only for work. He also said that he used to have a secretary, who helped largely with system upgrades and tasks in the notebook, which greatly contributed to his keeping up with the work: "I am now very behind" (I-7).

One of the characteristics to consider about I-7 is his age. He is the oldest of the group of respondents, nearly seventy (70) years old, and despite having some difficulties with technology, he is interested in new technology and curious about it. He is one of the only dairy producers in the southern region of Rio Grande do Sul state, according to his interview, to have all his herd and its actions and transactions entered in the system used in the farm. The low score given to this aspect (4) reflects his own discomfort with using technology, despite his correct and daily employment thereof and his perception of its importance in the business.

One of the most noticeable and commented characteristics of mobile technology is precisely the mobility it provides. Sorensen (2011) observes that **portability** is the most observed characteristic in mobile technology and it is, in fact, homonymous with it. It is evidenced in the possibility of transporting and moving the technology, which was mainly provided by its miniaturization. When asked if they carried their mobile devices in their daily life, most (7 out of 8) of the respondents replied affirmatively. I-4 commented that he always carried at least two different cell phones with him, because he uses them for work and in his personal life a lot, adding, "I use the iPad mini to work in the evening at home [...] and all the time, all the time they are with me" (I-4). It is this possibility of movement that is becoming indispensable to these managers, who have many and varied uses for these devices in a single day of work.

On the other hand, I-7 commented that he does not carry his main technological tool, his notebook, with him, because he "lives in the farm," meaning that he lives in the same place where he works, and he is not on the move throughout his working day; thus, he does not need to carry his chosen mobile technology. However, throughout the interview, it was revealed that mobile technology was chosen for his daily work because of the practicality of working with the system around the property. Therefore, he uses the portability of devices such as the notebook and the tablet when moving around the property to assess the cattle, observe and examine new calves, or separate specific matrices for mating. Although he does not leave his farm property, he nonetheless covers a large area.

The **connectivity** of mobile technology is directly related to global technology and telecommunications in-

frastructure (Sorensen, 2011, p.18): the concurrency of updates and the use of networks in mobile technology is what distinguishes isolation from connection and, when questioned about the quality of connectivity of the mobile technology they use most in their daily lives, all respondents (8) commented having connection problems: I-1 mentioned that the 3G signal quality was bad in the farm (a little better on the cell phone and in one of the properties). I-4 commented on connection problems, even inside the office, but that was due to continuous use and Brazilians' outdated infrastructure. He was considering other possibilities (like having different carrier services).

Despite these difficulties, which deserve greater investment and attention from telecommunications companies, it is worth noting the argument in terms of the imperfect ubiquity of technology (Dourish *et Bell*, 2011). Despite the large number of connection problems reported, and with connectivity being essential to the use of mobile technology in the field, all respondents use it and seek ways to overcome this kind of issue. This confirms the aforementioned proposal that one cannot postpone the understanding and acceptance of the ubiquity of technology because of its imperfections; on the contrary, it is necessary to consider different levels of use and understanding, as well as solutions and workarounds to the "messy" infrastructure currently extant.

The machine's **memory**, on the other hand, is what differentiates mobile technology in its relationship with the user, because it allows a relationship with the one who needs it, according to Sorensen (2011). The devices search for recorded data, updating as the user utilizes them, replacing unrelated meetings without the possibility of interaction. Some of the respondents stated they regularly use the device memory feature to work. I-5 comments: "I participate in meetings and I take notes on the tablet and consult memory," (I-5) and can thus keep track of notes and seek more information if necessary. I-6 states that data back-up has become a routine, i.e. saving it on other platforms, because the device carries important information. Only I-1 and I-2 responded that they did not use the machine's memory in particular, despite both claiming to use smartphones to query and review e-mails and receive e-mail information and important files, thereby using the memory resource without their realizing it.

Sorensen (2011) defines **pervasiveness** as a computer's capacity to relate to its environment. Thus, computing can be pervasive or sensitive to its environment, or unaware, not related to the environment and lacking Internet access, such as electronic organizers. I-6 commented that one sub-sector of the agribusiness, pre-



cision farming, is the best example of pervasiveness in mobile technology: in the case of this practice, the technology is included in machinery, workplaces, and with managers and workers in the field or office, thereby exploiting the full potential of mobile technology.

As for **priority**, Sorensen (2011) states that it is seen as a combination of portability, connectivity, pervasiveness and intimacy, thus enabling formal or informal prioritization of interaction. Respondents I-5 and I-6 commented that they prioritize telephone calls because they seem more urgent and require full attention, referring to their smartphones. Among the other respondents, it was revealed that work is prioritized when there is a conflict with personal activities.

#### 4.3 Management decisions

When analyzing the interview data focused mainly on management decisions, it is noted that the management decisions of agribusiness managers, contextually determined, can include financing and investment options, drug requirements for animals, pest diagnosing and course of action to minimize damage, or hiring and managing employees — in other words, various and varied management decisions are involved.

Throughout their interviews, respondents I-4 and I-5 stressed the important role of information technology in the agribusiness decision-making process, which has to be fast and involves various aspects of uncertainty (Andriotti *et al.*, 2014; Keren *et Bruin*, 2003). I-4 commented that he is always seeking information, which will be the basis for his decisions, and that fully reflects on his work: “[...] no one needs to tell me what will happen; I seek my sources of information” (I-4). Being prepared for the unpredictability in the agribusiness environment can be facilitated, according to the respondent, by mobile technology. I-4 added that managers in general seek information to support decision-making. The possibility of being “linked” is here portrayed and allowed by the technologies that surround us today, and by mobile technology in particular since it means that work can be carried out from anywhere.

A manager and business owner, I-1 expresses his concern in terms of the very short time he has to make decisions: “I have time only to think.” With no time to make a decision, the respondent reports having “only time to think,” corroborating what Enseinhart (1989) and Andriotti *et al.* (2014) present in their studies. Hence, it is the information that can be collected at this moment of decision that will make the difference for managers, which he can obtain both from the smartphone over

a call, and the data and information he can collect throughout the day, through e-mails, international news, or reports from colleagues or neighbors.

About another environment, that of finance cooperatives, I-2 reports that he is primarily faced with routine decisions or those which already have some kind of direction. Simon (1960), categorizing decisions as programmed and non-programmed, but already with some prior direction, comments that these are the most common types of decisions managers may come across. Despite differing from instantaneous or the unprecedented non-programmed decisions, these decisions also benefit from mobile technology, allowing managers to take advantage of the resources of devices to access the company’s software, review e-mails, consult records of customers, and thus approach a task better and more calmly (Simon, 1960). As to whether the decision-making process is affected by mobile technology, I-6 stated that it is partially modified, since some confidence can be added to one’s intuition through information retrieved via smartphone applications.

The quality of the decision can be observed and evaluated by the quality of the process itself (Meissner *et Wulf*, 2013), and I-6 reported, in addition to enhanced information quality, improved confidence in terms of making decisions, which in turn improves the decision-making process. Such increased confidence can significantly assist in managing daily tasks troubled by uncertainties and multitasking, which many managers report finding (Keren *et Bruin*, 2003). According to I-5 and I-8, the decision-making process has been undergoing clear changes caused by the adoption of mobile technologies and for two different reasons: portability, as decisions can be made remotely (I-5) and the expansion of opportunities with the Internet (I-8).

#### 4.4 Perceived influence of mobile technologies in decisions and agribusiness managers’ daily life

The collected data has enabled the understanding of some of the difficulties of agribusiness in the state of Rio Grande do Sul over the past decades. I-4 described the hardships faced some 40 years ago when trying to make phone calls abroad, an important part of seeking information for agribusiness when it came to crops, markets, and weather events.

The difficulty in communication was not restricted to phone calls abroad, according to I-1. Because of the need for constant travel, communication was hindered when the radio was used to that end. I-1 also highlighted the hardships in planning work as a result of this lack





of communication: the work to be performed needed be scheduled well in advance, and was rarely called off or postponed. I-4 commented that the search for important information about climate and topography were difficult to find and even more difficult to share (obtaining this now takes seconds instead of days), "Today you go to the field, click and send the information immediately; so we showed that excessive rain caused erosion because no-till farming had not taken over yet, and that affected yield and international market prices [...], today I work with six monitors on my desk and three mobile phones"(I-4).

Respondents perceived advantages in the dissemination and access to information, both for decisions and for general knowledge and the improvement of management: "I moved from acting weekly to something instantaneous. (I-1); anytime and anywhere you have the information you are seeking in a nutshell, applied and in a very practical way." (I-6); "now mobile technology gives you summarized climate information very rapidly whenever you need [...]" (I-6); "you have excess to information... about the weather, I have 36 sites, but the most important is not the information, but to analyze the facts, project, develop strategies and decide" (I-4).

When asked about the perceived disadvantages of the use of mobile technologies, they pointed out a higher incidence of interruptions in daily life, more devices to charge, and difficulties in operation, especially when the technology is new. I-1 said that one of the major problems in agribusiness is the lack of commitment or issues meeting deadlines, due to the possibility of constant communication. For example, a supplier or dealer can use the device to postpone at the last minute, while the owner may have left his property and already moved the cattle in question on that day. I-6 stated that he did not see disadvantages for himself, although he can perceive an apparent dependency on the devices.

The area of precision agriculture and livestock farming was also mentioned because it deals with the search for greater efficiency in agribusiness, including technology implementation and management for this purpose, as stated by I-6: "We have another area, precision agriculture and livestock farming, whose activities have migrated to more efficient systems, resulting in higher production levels, and more technology. There are many applications for mobile devices today that provide this information in real time, for example, when weighing in animals in a farm, all can be performed using electronic systems (electronic scales) and this information is immediately present in tablets and phones anywhere in Brazil for farmers to make decisions. Thus, this allows agility and improved management information" (I-6).

Thus, the importance of agribusiness and the use of mobile technologies to improve the management of this sector are related: the acceptance and use of this technology is great in the sector, as can be seen in large fairs in the area and its increasing use by cooperatives.

## 5. DISCUSSION OF THE RESULTS

The technological trend envisioned by Mark Weiser resulted in changes and new understandings in terms of the computer's role in everyday life, just as he had anticipated (Dourish *et Bell*, 2011, p.41): this technology has proved to be important for the managers of agribusiness participants of this study. The eight respondents are managers in Rio Grande do Sul, who work in different positions in agribusiness, sometimes in more than one, including veterinarian, owner, cooperative manager, researcher, entrepreneur, lecturer, consultant, and agronomist. Their profile is of experienced professionals and users of mobile technology, which has given them greater confidence and expertise to speak about the change that mobile technology has brought to rural areas.

A major focus of the survey, mapping the context of mobile technologies in the agribusiness sector, took place through the respondents' perception about their use and influence of the technology at work and on the move. We can conclude that respondents use mobile technologies in their daily work for different functions, meeting different needs.

Respondents reported using the six mobile service features pointed out by Sorensen (2011) in different ways and according to the following factors: their availability in their region (e.g. connectivity); their intimacy with the technology as a whole; and specific tasks (such as applications that help in the diagnosis of pests). Different adoption of the categories was expected and shown throughout the study, and some points were highlighted as problematic based on the analysis of the data: the main sticking point is definitely connectivity insofar as various managers reported network problems, particularly in rural areas, but also on the move.

The service infrastructure may never become perfect in all places and times (Dourish *et Bell*, 2011, p.29), but it is important to report the need to invest and improve in this area as it will be increasingly used by all sectors. The rural sector, as a primary sector and the base for many businesses and regions, should not suffer when seeking to adapt to new technologies, since it can reap important benefits and, consequently, benefit its entire chain with such use.



The advantages noted by respondents in the use of mobile technologies were more numerous than the disadvantages. Advantages of access to information were often cited, which not only contributes to the best preparation of producers, managers, self-employed professionals, but also helps disseminate information faster and more efficiently through a network that is specialized for this industry. Another important advantage cited is mobile communication, the most important and recognized piece of technology in the form of smartphone. For professionals who travel multiple times in a week or who make sporadic trips, but need to continue managing their property or staff, mobile communication has become embedded and proved crucial for managers.

Communication and access to information while on the go are characteristics that fit well with the work style and the needs of the majority of agribusiness managers, since they visit different regions or move over large areas within the same property. This advantage is considered one of the most important concerning the initial adoption of the technology.

With regard to the decisions in their daily routine and how mobile technologies have affected them, respondents commented on the importance of access to information while on the go, which reduced uncertainty in the decision-making process, thereby increasing its quality (Keren *et al.*, 2003). Furthermore, they stated that, when faced with instant decisions—those more exacting, time-sensitive and with a high level of corporate uncertainty — in line with Andriotti *et al.* (2014), mobile technologies are of great assistance to communication, and again, in access to information.

Thus, mobile technology was presented as embedded in the daily life of the agribusiness managers interviewed. The use of mobile technology offers great benefits to managers and has been providing differentials to everyday practices. Many were the advantages listed, comparing the agribusiness before mobile technology and after its adoption. The advantage of knowledge dissemination has also emerged as important as access to certain rural areas by professionals, even if it is not always constant, and this range provided greater autonomy to managers, facilitating the daily tasks and providing networks of contacts and knowledge exchange.

Agribusiness managers were shown to be influenced and aided by mobile technologies in their decisions and daily lives. The influences in the sector are clearly seen in the changes that have occurred in the management of the property, i.e. in the way we treat animals and plants, in addition to the impact on communities and management decisions, as well as assisting managers with information wherever they are.

## 6. CONCLUSIONS

In this study, we sought to answer the question “How have mobile technologies influenced everyday decisions in the perception of agribusiness managers?” To this end, we interviewed eight managers from different areas of agribusiness, in order to give an overview of agribusiness from the interviewees’ points of view to enable a better understanding of the sector’s relationship with mobile technology. The proposed conceptual model has shown applicability throughout the data analysis. The influence and support of mobile technology in the decision making process of agribusiness managers is clear. However, as expected, based on theory, not all managers use technology in the same way, with the same goals, or using all of the features of the resource or their full potential, which is common to the vast majority of users.

Regarding the data collected, it is important to emphasize the difficulty in terms of accessing some of the respondents, which required multiple contacts within the period of data collection, and with time restriction for interviews because of the nature of their work. On the other hand, some respondents expressed enthusiasm, such as I-1, I-4 and I-6, who had a great participation in the data analysis section.

Throughout the study, it was possible to observe, listen to and learn about their opinions and business practices, which contributed to analyzing the data. When talking to individuals with great experience in the business world—not just agribusiness—the motivation and interest of managers to always improve management, attend trade shows, and connect with the community, despite personal difficulties, was conveyed in the interviews through reports of both problems and everyday achievements.

Thus, it was possible to understand the area of operation of these agribusiness managers and contribute to building a current picture of the use of these technologies by professionals in Rio Grande do Sul: agribusiness cooperatives foster the use of mobile technology, providing applications and specific systems through business fairs, which strive to offer lectures and training on various technologies for the community, who, in turn, communicate and exchange experiences. The use of mobile technology is becoming more popular in the daily life of these managers in search of best practices in the industry.

This study aimed to contribute by exploring a part of the country’s economy that has much to benefit from mobile technology, through precision agriculture, which can already be seen in action in developed and develo-



ping countries, and which is making its mark in Brazil and has been showing good results. In finding that even “traditional” managers, older and more experienced, seek mobile technology, learn from it, seek cooperatives to improve their management and often update it, it can be concluded that there is room for growth in the use of this technology, as well as potential to improve the quality of such use and the user’s experience.

The present study has certain limitations. The choice of a qualitative rather than a quantitative approach allows an analysis of data restricted to respondents, which were of a small number and with little diversity in each agribusiness field, even though that data was sufficient for the statements themselves. For future studies, we suggest a quantitative approach to similar studies, thus seeking a greater diversity of actors. Moreover, research should be conducted in countries of the Pampa region: Brazil, Argentina, and Uruguay, since these countries are significantly related by topography, vegetation type, climate, and fauna. Similarly, for future studies that intend to develop a qualitative approach, we suggest the choice of data collection techniques that seek greater quality and diversity on the data collected, such as direct observation or ethnography.

## REFERENCES

- Andriotti, F. K. et al. (2014). “Proposição de um Protocolo para Estudo sobre a Intuição e o Processo de Tomada de Decisão”. *REGE Revista de Gestão*, Vol. 21, pp. 163-181.
- Associação Brasileira de Indústrias Exportadoras de Carne - ABIEC (2014). “Mercado de carne bovina – exportações e importações”. Disponível em: <<http://www.abiec.com.br>>. Acesso em: 14 jan 2014.
- Bardin, L. (2009). *Análise de conteúdo*. 4. ed. Paris: PUF, pp. 121-169.
- Briz-Ponce, L., et al. (2016) “Learning with mobile technologies - students’ behavior”. *Computers in Human Behavior*, 2016. v. 72, p. 612–620.
- Creswell, J. H. (2014). *Investigação qualitativa e projeto de pesquisa: escolhendo entre cinco abordagens*. 3. ed. Porto Alegre: Penso.
- Dourish, P., Bell, G. (2011). *Divining a digital future, mess and mythology in ubiquitous computing*. Massachusetts Institute of Technology.
- Eisenhardt, K. (1989). “Making fast strategic decisions in high-velocity environments”. *Academy of Management Journal*, Vol. 32, No. 3, pp. 543-576.
- Eisenhardt, K. (1997). “Strategic decisions and all that jazz”. *Business Strategy Review*, Vol. 8, No. 3, pp. 1-3.
- Exame (2013). “PIB brasileiro do agronegócio deve crescer 3,56% em 2013”. Disponível em: <<http://exame.abril.com.br/economia/noticias/pib-brasileiro-do-agronegocio-deve-crescer-3-56-em-2013-diz-cna-2>>. Acesso em: 04 dez. 2013.
- Freitas, H. M. R. et al. (2017). “Visão executiva sobre a tomada de decisão instantânea”. *Desenvolvimento em Questão*, Vol. 15, No. 39, pp. 400-449.
- Freitas, H., Janissek, R. (2000). *Análise léxica e análise de conteúdo: técnicas complementares, sequenciais e recorrentes para exploração de dados qualitativos*. Porto Alegre: Sphinx: Editora Sagra Luzzatto, 2000, p. 176.
- Freitas, H., Kladis, C. (1995). “O processo decisório: modelos e dificuldades”. *Revista Decidir*, Rio de Janeiro, Ano II, No. 8, pp. 30-34.
- Greenfield, A. (2006). *Everyware – The Dawning Age of Ubiquitous Computing*. New Riders.
- Hair, J. et al. (2005). *Fundamentos de métodos de pesquisa em administração*. Bookman, Porto Alegre.
- Hillman, S. et Neustaedter, C. (2017) “Trust and mobile commerce in North America”. *Computers in Human Behavior*, vol. 70, pp. 10–21.
- Junges, F. M. et al. (2014). “Computação Ubíqua: Estado da Arte e Oportunidades de Pesquisa para a Área de Negócios”. *Revista Eletrônica de Sistemas de Informação*, Vol. 13, No. 1, pp. 1-22.
- Kakihara, M., Sorensen, C. (2002). “‘Post-Modern’ Professional Work and Mobile Technology new Ways of working”. In: XXV Information Systems Research Seminar, Copenhagen Business School, Denmark.
- Kakihara, M., Sorensen, C. (2004). “Practicing Mobile Professional Work: Tales of Locational, Operational, and Interactional Mobility”. *The Journal of Policy, Regulation and Strategy for Telecommunication, Information and Media*, Vol. 6, No. 3, 2004. pp. 180-187.
- Keren, G., Bruin, W. B. (2003). “On the assessment of decision quality: considerations regarding utility, conflict, and accountability, thinking”. *Psychological Perspectives on Reasoning, Judgment and Decision Making*. 2003, pp. 347-363.
- Kim H. J. et al. (2015) “An examination of work exhaustion in the mobile enterprise environment”. *Technological forecasting and social change*, 2015. vol. 100, pp. 255–266
- Machado, C. B., Freitas, H. M. R. (2009). “Planejamento de Iniciativas de Adoção de Tecnologias Móveis”. *GE-PROS. Gestão da Produção, Operações e Sistemas*, Ano 4, Vol. 1, pp. 101-115.
- Meissner, P., Wulf, T. (2013). “Cognitive benefits of scenario planning: Its impact on biases and decision quality”. *Technological Forecasting & Social Change*, pp. 801-814.



- Pica, D. et al. (2004). "On mobility and context of work: Exploring Mobile Police Work". In: XXXVII Hawaii International Conference on System Sciences, Big Island Hawaii, ed. R. Sprague Jr. IEEE.
- Pozzebon, M., Freitas, H. M. R. (1998). "Pela aplicabilidade – com maior rigor científico dos Estudos de Caso em Sistemas de Informação". RAC. Revista de Administração Contemporânea, Vol. 2, No. 2, pp. 143-170.
- Santos, L. G. (2014). "Decisão gerencial em contexto de tecnologias móveis: um estudo com gestores do agronegócio". Dissertação (Mestrado em Administração), UFRGS, PPGA, Porto Alegre.
- Schnorrenberger, A., Fensterseifer, J. E., Machado, J. A. D., Gravina, J. B., Schultz, G., Silva, N. M. (2008). "Decisões de endividamento e risco financeiro nas companhias do agronegócio listadas na Bovespa". Estudo & Debate, Vol. 15, pp. 115-135.
- Shen, X. L. et al. (2013). "Unleash the power of mobile word-of-mouth an empirical study of system and information characteristics in ubiquitous decision making". Online Information Review, Vol. 37, No. 1, 2013, pp. 42-60.
- Shuib, L. et al. (2015) "A review of mobile pervasive learning: applications and issues". Computers in Human Behavior, vol. 46, pp. 239–244.
- Simon, H. A. (1960). The new Science of management decision. New York: Harper & Row, Publishers, 50 p.
- Sørensen, C. (2011). Enterprise mobility: tiny technology with global impact on work. London: Palgrave Macmillan, 208 p.
- Sørensen, C. (2010). "Mobilities & Mobile Technologies. Conceptual Clearings in Search of Clarity?". In: II International Seminar on Methodologies for Mobilities Research: Challenges and Innovations, ed. A. D'Andrea, University of Limerick, Ireland.
- Wang, W., Reani, M. (2017) "The rise of mobile computing for group decision support systems: a comparative evaluation of mobile and desktop". International Journal of Human-Computer Studies, vol. 104, pp. 16–35.
- Weiser, M. (1991). "The Computer for the 21st century". Scientific American, Vol. 3, No. 265, pp. 94-104.