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THE INFLUENCE OF THE INFORMATION STIMULUS ON THE HUMAN INFORMATION BEHAVIOR

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Doctoral Dissertation in Administration presented to the Postgraduate Program in Administration of the Universidade Federal do Rio Grande do Sul, as final requirement to obtain the title of doctor.

Advisor: Antonio Carlos Gastaud Maçada

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To my wife Esabela, with love, my person every single day!!

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“We keep moving forward, opening new doors, and doing new things, because we're curious and curiosity keeps leading us down new paths.”

Walt Disney

ABSTRACT

The use of multiple digital technologies to perform tasks or solve problems become a regular practice in the corporate environment while the amount of information available to people grows at an impressive pace. However, scant studies dedicated to understanding the influence of the actual use of multiple digital technologies and the influence of information stimulus on human information behavior. Recent literature on the information system positions the study of human information behavior as a critical research area for its power to predict and explain the human behavior. For this reason, this research focus on the influence of information stimulus on human information behavior during the use of multiple digital technologies, precisely the individual behavior in the organizational setting. This study developed three articles, comprehending a literature review, qualitative research, and quantitative research to validate the conceptualized the information stimuli and the proposed cognitive model. The central objective is to understand the influence of the use of multiple digital technologies on human behavior. The findings showed that the information load and information diversity represent the information stimulus that influences the capacity of the information workers to determine their information need, their ability to seek for specific information, and the use of information while performing a task. The recognition of the negative influence of the use multiple technologies was expressed in behaviors such as the need to focus, the strategies to prioritize tasks, the development of self-control, and the uncertainty. The quantitative research with 565 information workers presented support on the hypotheses between information diversity, information load, information need, information seeking, and information use. The results are important once they represent the measurement of the perception about the influence of the information stimulus on the human behavior. Finally, this research makes significant contributions conceptualizing human information behavior in the information system literature and providing a new approach to evaluate human information behavior in the context of high information stimuli.

Keywords: Human Information Behavior, Information Stimulus, Cognitive model.

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LIST OF BREVIATURAS AND ACRONYMS

HIB – Human Information Behavior

MIS – Management Information Systems

IS – Information Systems

IT – Information Technology

IoT – Internet of Things

WoM – Word-of-Mouth

eWoM – Electronic Word-of-Mouth

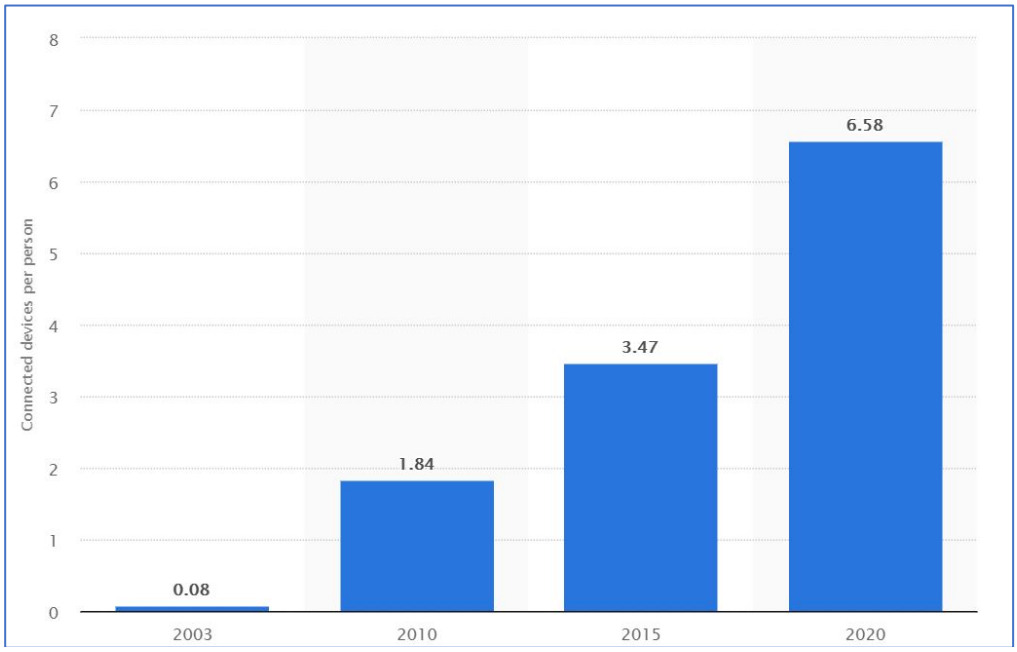
SUMMARY

1 INTRODUCTION

> The computer would ultimately not be primarily a device for computation but metamorphosize into a device for communication (Steve Jobs, 1995).

The advances in digital technologies occurred in an unprecedented speed on the last years. The development of new devices and apps that allow the access of several information sources changed the way that people communicate and interact. The human being is essentially an information seeker creature that consumes every piece of information received (GAZZALEY and ROSEN, 2016). The digital technologies allow the access to a large number of information sources, which people adopt and use for personal and professional activities. However, the use of more information sources may affect the human cognitive system once it has limits on information processing capacity.

Figure 1 – Forecast on connected devices per person



Source: Statista (2016)

Simon (1971) discussed the problem to allocate the cognitive attention, stating that “information consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention” (p. 40). The fact is that the amount of information

produced every day reached 2.5 quintillion bytes of data, and the pace is accelerating with the growth of the connected devices that produces data (FORBES, 2018). Bohn and Short (2012) estimated that the Americans consumed 34GB of data per day in 2008. Short (2015) updated the number in 2015 to 74GB of data consumed per person per day. The stunning numbers seem ordinary when analyzed individually, but they evidence the continued increase of information produced over the years, challenging human cognitive system and information processing capacity when consuming this information. The number of connected devices continues to increase along the years. In 2003, there were 0.08 connected devices per person; in 2010, the number increased to 1.84; in 2015, the number reached 3.47 devices per person. The forecast for 2020 is 6.58 devices connected per person (Figure 1). The users rely on multiple digital technologies (i.e., laptops, tablets, smartphones, and apps) to support a wide range of tasks (KARLSON et al., 2009). People have an innate information seeking behavior (GAZZALEY and ROSEN, 2016), thus the users consume information from multiple digital technologies wittingly or unwittingly (CASE, 2007).

The proliferation of digital technologies and consequent impact of information on human cognition was addressed by the academy with many approaches, for instance, technostress (AYYAGARI et al., 2011), computer anxiety (THATCHER and PERREWÈ, 2002), technology addiction (TUREL et al., 2011), technology interruptions (ADDAS and PINSONNEAULT, 2018) and information overload (BAWDEN and ROBINSON, 2009). While many concepts are specifically developed or adapted to analyze the current challenges created by the digital technologies, the information overload was used as a foundation to discuss the different approaches to analyze the phenomenon. The modern information overload research reportedly started in 1960's with studies in the human cognitive system and memory structure, and development of concepts such bounded rationality and satisficing (SIMON, 1971; ATKINSON and SHIFFRIN, 1968; BAWDEN and ROBINSON, 2009; ROETZEL, 2018). Information overload lacks a single generally accepted and agreed definition, with many researchers presenting definitions associated with individual's efficiency in using information and the feeling of overload related with loss of control over the situation (BAWDEN and ROBINSON, 2009). Roetzel (2018), for instance, developed the following definition for the information overload that connect several elements.

> Information overload is a state in which a decision maker faces a set of information (i.e., an information load with informational characteristics such as an amount, a complexity, and a level of redundancy, contradiction and inconsistency) comprising the accumulation of individual informational cues of differing size and complexity that inhibit the decision maker's ability to optimally determine the best possible decision. The probability of achieving the best possible decision is defined as decision-making performance. The suboptimal use of information is caused by the limitation of scarce individual resources. A scarce resource can be limited individual characteristics (such as serial processing ability, limited short-term memory) or limited task-related equipment (e.g., time to make a decision, budget) (ROETZEL, 2009, p.6).

The focus on decision-making is common on the current research when investigating the individuals consuming information. Jackson and Faraneh (2012) developed similar research as Roetzel, providing factors associated with information overload, and posit the decision-making performance as the dependent variable. Other studies such technostress, anxiety and interruptions employed similar aspects related with individual performance or a subset of use behavior related with technology adoption model (TAM) to explain the digital technologies effect. Therefore, the current theory is limited to define and, eventually, measure the information overload effect on human cognitive system and limit itself to individual performance aspects, which is important, but broadly investigated. Consequently, there is an opportunity to evolve the theory to explain both how people deal with the information produced while using multiple digital technologies and its outcome. The scientific research is always evolving towards the use of new theories that provide better explanations for the phenomena observed. For instance, in addition to decision-making, the people use the information to solve problems, learn, store for future use, and exchange with others (TAYLOR, 1996; CHOO, 2006). This study introduces one conceptualization developed to analyze the effect of the use of multiple digital technologies on the human behavior called information stimulus. Next, the human information behavior is introduced as a framework to observe the behavior resultant of the use of multiple technologies.

The information stimulus is defined in this research as the stimuli received through technology (notifications, alerts, messages) with information that demands cognitive attention. Informational stimuli occur when the users receive alerts on the smartphone or messages on the laptop from various apps that contain information, generating cognitive activity. The information stimuli were conceptualized as a response to the observation that people are exposed to at least three forms of stimuli

generated by the digital technologies. The three main senses stimulated are sight, hearing and touch in different combination that activate distinct cognitive areas (POMPER et al., 2014; HAGMANN and RUSSO, 2016). The information contained in the stimuli activate the need to know cognitive effect, that is, people need to consume every single piece of information received. The conceptualization developed on next sections and on the three articles contained in this dissertation propose to measure the information stimuli generated by the digital technologies using the information diversity and the information load. Differently from information overload, information load considers the load and complexity of the information consumed. It does not take for granted that people are constantly overload with the information. Instead, it aims to measure the perception of information load on the daily activities developed by the users. Similarly, the information diversity represents the number of distinct information sources used in a given time. Information diversity is composed by the number of information sources consumed and the level of unrelatedness of the information consumed in a given time. The choice for these two dimensions was arbitrary, that is, there are distinct ways to observe the information stimulus produced by the use of digital technologies. However, these two dimensions were chosen due to the previous research presenting a level of integration among the constructs, and the number of papers that explored these dimensions, mainly the information overload, which is closely related to information load. Additionally, the information stimulus conceptualization, as developed in the dissertation and in the three articles, considers the human cognitive capacity represented by the human memory system and its control processes developed (ATKINSON and SHIFFRIN, 1968) to elaborate the relationship between the information load, information diversity and its influence on the human information behavior.

The human information behavior (HIB) is a framework that allows the observation of the human behavior while the individual consumes information. Hemmer and Heinzl (2011) explain that “HIB can be understood as an overarching research trajectory trying to offer generalizable predictions about and explanations of behavioral phenomena observable when humans acquire and process information” (p. 223). The HIB was developed in the Information Science field and initially aimed to understand how people behaved while they searched for books in libraries. The studies developed between 1940 and 1970 are known as system oriented and were interested

in answer “how satisfied and successful are student searches of a university library’s catalog?” and “How does the public use a library for personal pleasure and growth: what they ask for, borrow, and read?” (CASE, 2007). The studies developed after 1970 included the people-oriented approach and aimed to answer questions such “what happens when a voter has too much information about a candidate or an issue?” and “why do people browse in stores when they have no explicit need in or intention to buy?” (CASE, 2007). The HIB research characterized to investigate the intervening factors that affect the information worker during the need, seeking and use of information. The studies concentrated on producing theories, concepts, relationships, and propositions to explain the people’s information behavior (CASE, 2007). HIB is defined as “the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use” (WILSON, 2000, p. 49). The HIB research helps to explain and anticipate the user behavior in a rich information environment when people acquire and process information (HEMMER and HEINZL, 2011). The use of multiple digital technologies increases the possibility of the user to seek for more information once new information sources are available to be queried, searched, and consumed. Yoo (2010) explains that the “users of information systems are socially embedded in networks of relationships that mobilize the exchange of information and the use of information systems” (p. 217). The ubiquitous computing and the evolution of digital technologies produce more information stimuli that influence the user’s experiences in several aspects and may influence the user behavior. The exploration and explanation of behavioral patterns happening when people interact with information in computer-mediated context have been the subject of investigation in the HIB (HEMMER and HEINZL, 2011). The infusion of technology into people’s professional and personal lives can influence the human behavior, and the analysis of information-related process allow to analyze the behaviors beyond the single decision-making and individual performance metrics. Hence, the present research aims to understand how the information stimuli mediated by the use of multiple digital technologies influence HIB. Precisely, the main cognitive aspects of interest are the influence on the information need, seeking, and use. The context of the research is the organization, so the study was developed investigating the behavior of information workers. Given the scenario of increasing infusion of technology of personal devices in the workplace

and with proven influence on human behavior, the argument put forward in this thesis is that the informational stimulus is represented by information load and information diversity and influences the HIB of information workers that use multiple digital technologies in the organizations.

1.1 Research Question and General Objective

Given the contextualization presented on the introduction section of this dissertation, the research question represents the simple connection of the use of multiple digital technologies, the information stimuli, and the HIB. Thus, the research question that guides this dissertation is: *how informational stimuli mediated by the use of multiple digital technologies influence human information behavior?*

Consequently, the general objective of this research is to investigate *the influence of the informational stimuli mediated by the use of multiple digital technologies on the human behavior information*.

1.2 Specific Objectives

The dissertation was elaborated with three articles presented in the next sections. Hence, the specific objectives of the dissertation represent the objectives of the three articles, reproduced on the statements below.

- Develop a literature review on concepts of information stimuli and human information behavior and propose a conceptual model to examine the influence of informational stimuli on HIB.
- Develop a qualitative research to investigate the influence of the information stimulus on the HIB during the use of multiple digital technologies.
- Develop a quantitative research to measure the influence of information stimulus on HIB during the user of multiple digital technologies.

1.3 Justification

The management research has been investigating the influence of a number of factors or dimensions on individual or organizational performance. Simon (1997) states

that "a general theory of management must include principles of organization that ensure correct decision-making, just as it must include principles that will ensure effective action" (p.1). The importance on variables such decision-making and individual/organizational performance is evident to evolve the management science toward the development of consistent theory and practice. On the other side, other research areas ‘imported’ concepts to improve the explanation of management phenomenon. For instance, the economy research took advantage on the human behavior to challenge and improve its axioms. Kahneman and Tversky (1979) challenged the expected utility theory, which was largely used to analyze decision making under risk, developing the prospect theory that covered the violation of the axioms of the utility theory. Similarly, the MIS research area traditionally employed theories from other areas to develop the conceptualization and improve the explanation of the MIS phenomenon. The cognitive IS research, for instance, focused on studies that use cognitive theories to provide explanation for IS phenomena (DAVERN et al., 2012). The “cognitive research in IS explores the interactions between cognition and context that influence behaviors and outcomes in the development and use of IS” (DAVERN et al., 2012, p. 274). Thus, in this dissertation, the HIB concepts are employed to evaluate not only the individual or organizational performance, but to expand the behaviors generated by the consumption of information.

The choice to employ the HIB conceptualization was due to its power on provide better prediction and explanation on the human behavior. Additionally, the MIS theory seldom developed studies conceptualizing the information (HEMMER and HEINZL, 2011; MCKINNEY and YOOS, 2010). While many studies investigated the effect of the hardware and software on the human behavior, the information-based studies have begun to emerge in some fields of research in the MIS area as a central element in the quest for productivity and innovation. One example is information governance research that recognizes it as an asset of strategic value in creating a sustainable competitive advantage for the business (TALLON et al., 2013). Relevant information is originated on the external sources to the organization, where it is important for the organization to establish information lifecycle processes encompassing the creation, evaluation, and collection of the information (KOOPER et al., 2010). The intelligent and innovative application of information in business strategy can lead to the creation of value for the customer in high speed, low cost and correct scale (BROADBENT et al., 2003).

Brynjolfsson and McAfee (2014) argue that three characteristics of digital progress enable one to understand the nature of the advancement of transformational technologies for information use: its exponential growth with Moore's Law, digitization and innovative recombination of information as a driver of economic growth. Once digitized, information can be transmitted and reproduced at low cost and high speed, creating innovation at scale and new opportunities from its application in different business areas (BRYNJOLFSSON, MCAFEE, 2014). Information, as an artifact, can influence human behavior in judgments and decision making (KAHNEMAN, 2013). Managing the flow of information has become vital to the success of organizations by enabling a new level of relationship with customers, employees, suppliers, and stakeholders of the company (HESS et al., 2016). An IS must deliver appropriate information to managers to make decision-making, eliminating the abundance of irrelevant information provided by poorly designed systems that overwhelm and overly repeat the same content (ACKOFF, 1967).

A permanent issue in IS managers' agendas is how to deal with digital technologies that arise daily and interfere with various IT dynamics in the work environment (SCHMITZ et al., 2016). The challenge is to find the appropriate balance to enable innovation, control, increased productivity and stimulate desired behaviors for digital transformation. A problem little perceived by most managers, however, is the influence of the information stimuli that digital technologies bring to the organization, the behaviors triggered and their influence on the quality of decision-making. This phenomenon occurs in information-rich environments, where multiple devices generate a high load and diversity of information while creating information asymmetry in work groups by limiting human cognitive ability and information processing capacity. Simon (1955) describes limited rationality as the tendency of individuals to make sub-optimal decisions due to cognitive limitation for decision-making. The term "wealth of information causes poverty of attention" (SIMON et al., 1971, pp. 40-41) summarizes the problem of allocation of human cognitive capacity, a scarce resource disputed by diverse sources of information in the context of the high informational load. This problem remains current in the 21st century as described by Levitin (2014), Goleman (2013), Kahneman (2013) and Ariely (2008). Increasing the number of information sources has increased the effects of information overload on human behavior. Managerial activity is an essential element of organizational action and depends on

the managers' cognitive capacity to perform it (SIMON, 1987). Kaplan (2008) argues that managers' cognitive ability, associated with organizational capabilities, defines a strategic action for technological evolution. An important finding of the author is that the cognitive ability of managers compensates for eventual failure in organizational factors to make decisions. Kahneman (2013) shows that people use cognitive shortcuts to simplify judgments and decision making without considering all the information available on the subject. The adaptive behavior observed in the availability heuristic has an impact on the performance of the business completely ignored by the managers, given the information flow outside the organizational environment generated by digital technologies. Information-focused strategies, rather than technology, are one way to address this problem (GARTNER, 2016).

Studies involving information concepts are scarce in the area of MIS (Carter et al., 2015; McKinney & Yoos, 2010), but they are beginning to gain relevance with the digital transformation and commoditization of technology. The HIB studies aim to understand information need, seeking and use for modeling and design of the information systems (COURTRIGHT, 2007; WILSON, 1999). The advantage of this approach is to develop studies that analyze these three behaviors in a single dimension. However, if on the one hand, HIB develops consistent research focusing on the behavior of the individual in the information science area, on the other, studies do not always address business issues because they are not close to the area of organizational studies. Benbasat (2010) argues that MIS research using interdisciplinary concepts must differentiate itself from other sciences through the focus on organizational science. This approach addresses managerial aspects such as decision making, system adoption, IS impact on virtual groups and consumer relationships, and organizational aspects such as systems adoption and communication between work teams (BENBASAT, 2010). Thus, understanding how information stimuli influence human information behavior and its consequences for the organization regarding productivity, judgments and decision making are dimensions that are of interest to organizational studies. Simon (1997) reinforces this argument by stating that "the task of 'deciding' [what will be done] pervades the entire administrative organization as much as it does the task of doing '(p.1). Given the context of digital transformation and the importance of information, the present study is justified in addressing the role of information stimuli and their influence on human information

behavior in the organization. This research aims to help in the analysis of HIB, in the adoption and use of SI and in the design of systems to fit the individual capacities and characteristics of the user (BENBASAT and TAYLOR, 1978).

The study of Human Information Behavior (HIB) emerged in the early twentieth century, addressing the information sources used to meet the need for information, information seeking, and information use behavior (CASE, 2007). Research in the MIS field seldom employed HIB concepts to its studies as little attention is given to the study of information phenomena itself (MCKINNEY and YOOS, 2010; DETLOR, 2003). The concept of information has great importance as a dependent variable in evaluating the effectiveness of IS used in firms (Carter et al, 2015). As the number of digital technologies increases inside the organization, the same happened with the number of information sources that influence human behavior, impacting the quality of strategic decision making (KAPLAN, 2008).

Scant studies were designed to investigate the influence of multiple digital technologies on the human behavior (HEMMER and HEINZL, 2011). There is a lack of research on the influence of information stimuli generated by digital technologies on the individual's cognitive system. Recent literature on the information system (IS) positions the study of the human information behavior (HIB) as a critical research area. Hemmer and Heinlz (2011) explain that "HIB can be understood as an overarching research trajectory trying to offer generalizable predictions about and explanations of behavioral phenomena observable when humans acquire and process information" (p. 223). Thus, HIB can act as a frame of reference to investigate the influence of information phenomena on behavioral and cognitive aspects.

The HIB model allows the investigation of how individuals, groups, organizations, and society relate to the information that they need, seek, receive, share, and use (WESSEL et al., 2017). In that sense, the HIB is part of broader human and social activity that depends on user's context of information use, including the individual's action, and the subjective construction created in the individual's cognitive system (CHOO, 2006). The HIB is a process with distinct stages that involve cognitive and affective components influencing the human behavior (WILSON, 1999). The three primary processes are information need, information seeking, and information use, operationalized in this research. The information phenomena open venues to expand the research on system use.

The behavioral studies in the Management Information Systems (MIS) field have been exploring cognitive theories to explain the effects of information systems (IS) artifacts on human behavior. Davern et al. (2012) postulate that “cognitive research in IS explores the interactions between cognition and context that influence behaviors and outcomes in the development and use of IS” (p. 274). Some researchers investigated the effect of the stimuli on the user behavior, employing cognitive and psychological models (i.e., TAM and HO, 2006; ZHANG, 2000; LEE at al., 2012; DENG and POOLE, 2010; ADDAS and PINSONNEAULT, 2018). However, the current cognitive research is limited to the isolated consideration of the specific types of behaviors in the computer-mediated context (HEMMER and HEINZL, 2011). The influence of the information and the cognitive processes has received little attention from the extant literature (MCKINNEY and YOOS, 2010). The HIB has provided major and important contributions to the study of human behavior while interacting with information, describing the conceptual processes and stages that influence the acquisition and processing of information (HEMMER and HEINZL, 2011).

1.4 Dissertation Structure

The dissertation is structured as illustrated in figure 2. Chapter 2 is a general literature review, which aims to provide clarity on the information stimulus and HIB conceptualization.

Chapter 2 is divided into three sections. Section 2.2 provides an overview of the Information Stimulus conceptualization, and the observable dimensions called information diversity and information load. The section 2.3 presents the literature review for HIB, introducing a broad view of the information definition that is related with the human knowledge and communication capacity, and introduces the main elements of the HIB literature: information need, information seeking, and information use. Additionally, the information source and other elements present on the HIB literature are explored.

Chapter 3 contains the first article developed during the research called “The Information of Information Stimulus Event on Human Information Behavior,” accepted on Diffusion Interest Group in Information Technology (DIGIT) 2016, organized by the

Figure 2 – Dissertation Structure

Source: Prepared by the author

Special Interest Group on the Adoption and Diffusion of Information Technology (SIGADIT). The DIGIT workshop is a Pre-International Conference on Information Systems (ICIS) event, and the theme in 2016 was Technology Adoption, Use and Diffusion Research at the Crossroad. The author decided to present the paper precisely as accepted and published in the DIGIT 2016. As the paper is presented exactly as submitted, the research model contains the Information Asymmetry dimension, which was removed later on the final research due to the lack of consistency between the measurement of the effect of information stimulus on the human cognitive systems and memory structure.

Chapter 4 contains the paper “The Influence of Information Stimulus on the Human Information Behavior: A Qualitative Approach.” This paper was submitted to the European Conference on Information Systems (ECIS) 2019. A version of this paper was previously submitted to the International Conference on Information Systems (2018) and accepted for the Paper-A-Thon track. The paper is presented as submitted to ECIS 2019.

Chapter 5 contains the paper “When We Need to Know Everything: The Impact of Information Stimulus on the Human Information Behavior,” submitted to the European Conference on Information Systems (ECIS) 2019. This paper is also reproduced in the dissertation as submitted. The quantitative methodology was expanded in Appendix A. Appendix A also presents an expanded version of the Data Analysis section on the paper, complementing the findings and explained the scale development and validation procedures.

Finally, section 6 presents the General Conclusion of the dissertation. Appendix B contains the qualitative study protocol used during the interview process with the information workers. The Appendix C and D contain the quantitative survey answered by the information workers in English and Portuguese, respectively.

2 GENERAL LITERATURE REVIEW

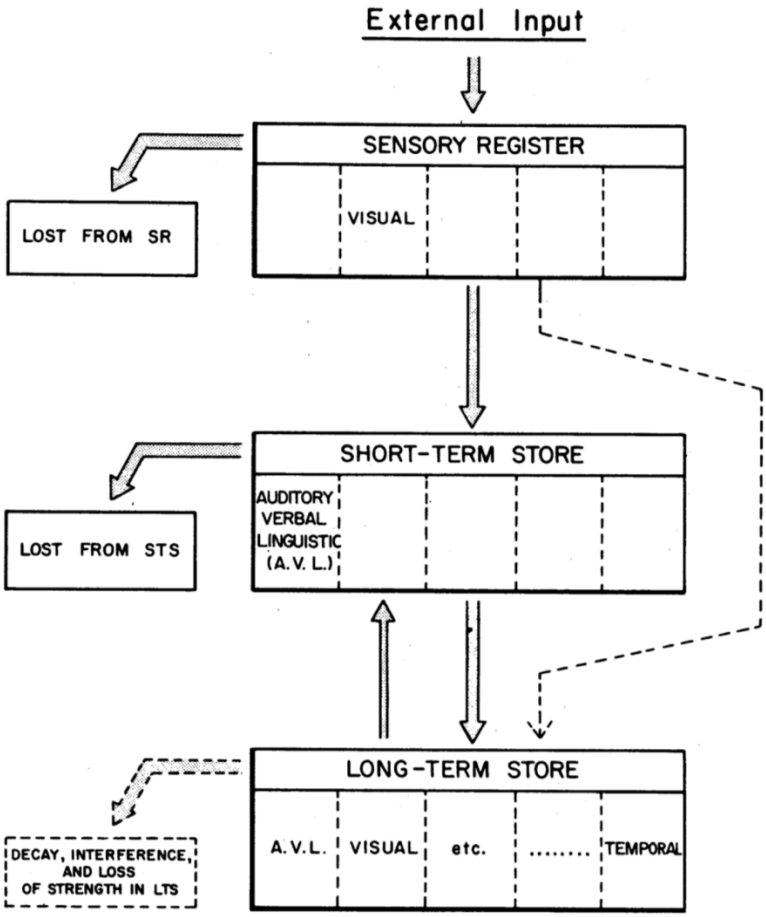
2.2 Information Stimulus

The information stimulus is conceptualized to describe the intensive use of multiple digital technologies during the performance of professional activities. It is defined in this research as the stimuli received through technology (notifications, alerts, messages) with information that demands cognitive attention. During the use of multiple digital technologies, many senses of the human cognitive system may be stimulated, generating activities in the memory to receive, retrieve, and interpret the stimulus (MARKUS, 1977). People act and react based on different types of stimulus received in the human cognitive system. The human memory system is an integral part of the cognitive system for information processing.

The human memory system is responsible for coping with the data received from the cognitive agents. Sun (2012) argues that the “memory systems serve the purpose of supplying useful information relevant to the current activities of the cognitive agent in a pertinent and timely manner” (p. 227). The memory system is structured three main areas: the sensorial registry, the short-term or working memory, and the long-term memory (ATKINSON and SHIFFRIN, 1968). The information stored in the memory is electrical impulses that flow among neurons’ arms, creating patterns of connections between neurons (HEUER, 1999). The memories are built by the stimulus received in the brain through the set of senses that allow the interaction of the human being with the environmental experiences. The experiences and stimuli cause physical changes in the brain, once “new circuits are formed that can change forever the way you think about the world” (JOHNSON, 1992, p. xi). The cognitive psychology developed a concept to explain the memory stored called schema and schemata. “A schema is *any pattern of relationships* among data stored in memory” (HEUER, 1999, p. 22). The schemata are abstracted concepts referred to as the mental model of an individual and are composed by sets of schemas (MARKUS, 1977; HEUER, 1999). People use schemata as “internal cognitive structures which allow the individual to process the incoming information with some degree of efficiency” (p. 63). The schemas and schemata are stored in the long-term memory and transferred to working memory

by the control system when information is needed. Figure 3 presents the structure of the human memory system.

Figure 3 – Structure of the Memory System



Source: Atkinson and Shiffrin (1968)

“When a stimulus is presented there is an immediate registration of that stimulus within the appropriate sensory dimensions” (ATKINSON and SHIFFRIN, 1968, p. 92). The stimulus received in the sensory registry trigger control processes of the memory system, transferring schemas between the working and long-term memory, or are completely ignored and discarded once the stimulus received in the sensory registry decays very quickly (ATKINSON and SHIFFRIN, 1968). If the stimulus takes the individual’s attention, it is processed in the working memory and can interact with schemas directly on the long-term memory. For instance, if the individual receives a stimulus that is a smoke vision or smell, the schema associated with fire and risk to the

individual's life is retrieved from the memory system. Thus, the appropriate schema is retrieved to cope with the risk identified. The stimulus may also be unknown by the individual, which trigger the learning process to create new schemas or connections between neurons that represent the information (COLE, 2011; HEUER, 1999). Cole (2011) gives the following example: "for a person who has never experienced a room, they have no room frame [schema] stored in memory and therefore cannot effectively use the stimuli they receive when entering a room, any room, for the first time" (p. 1221-1222). The memory's control processes start the learning process to store the new stimuli received, supplying a beginning schema from adjacent spheres of the individual's experience (MINSKY, 1980). "With constant experience of rooms, however, the person will build a room-frame, with default settings for prototypical rooms so that the person can predict what she/he will find when entering a new room" (COLE, 2011, p. 1222). Therefore, the stimulus is an essential part of knowledge creation and learning processes that allow the interaction of the individual's experience with her/his internal memories to create, modify, or elaborate the knowledge structures (COLE, 2011).

Markus (1977) states that "the quantity and variety of social stimulations available at any time are vastly greater than a person can process or even attend to" (p. 63). To allow the summarization of this vast social stimulation, schemata are used to interpret the stimulus and connect the schemas. For instance, "schemata for phenomena such as success or failure in making an accurate intelligence estimate will include links to those elements of memory that explain typical causes and implications of success or failure" (HEUER, 1999, p. 22). The schemas associated with the specific subject are interconnected to facilitate the interpretation of the stimuli received thru the human cognitive system. The constant consumption of stimuli activating the same schemas and schemata strengthen these connections (HEUER, 1999). "Constant stimuli force people to stop responding and pay attention only to other more powerful social or informational stimuli" (BAUMAN and DONSKIS, 2014, p. 49). Thus, the schemata represent the mental models that are reinforced by the constant consumption of information stimuli and contribute for the knowledge formation.

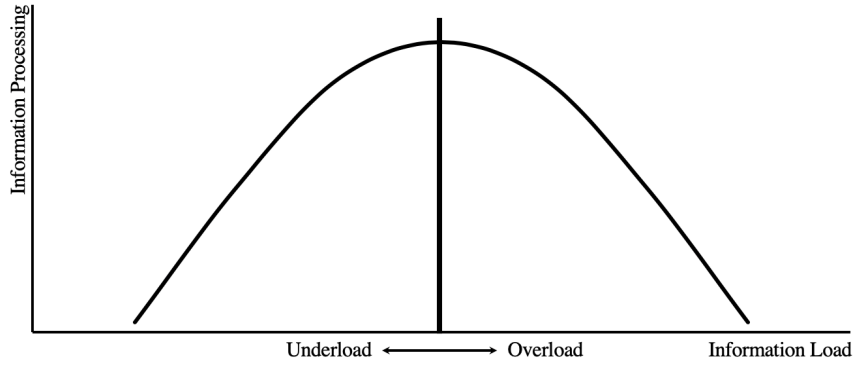
The information stimulus is conceptualized in this research as a particular type of stimulus that always generates cognitive activity due to the need to know effect. The need to know effect is human being need to consume all information received actively

or passively (CASE et al. 2005; MASLOW, 1963; SIMON, 1971). For instance, when people are next to a source of information (billboard, newspaper stands, TVs, and electronic devices), they will read the information presented almost automatically unless their attention is focused on another source of information. The need to know effect was characterized by Maslow (1963) as an instinct of the human being to know and understand profoundly rooted in the human biological nature. “The needs to know and to understand are seen in infancy and childhood nakedly and openly, perhaps even more strongly than in average adults. Most children are dangerously curious. As a matter of fact, the lack of curiosity and interest in environment means pathology” (MASLOW, 1963, p. 114). Simon (1971) sustains that the attitudes toward information reflect the culture of poverty in which great part of society save the information for later consumption. “Most of us are constitutionally unable to throw a bound volume into the wastebasket. We have trouble enough disposing of magazines and newspapers. Some of us are so obsessed with the need to know that we feel compelled to read everything that falls into our hands” (SIMON, 1971, p. 44). Case et al. (2005) also recognized the assumption that people want to know about the information, citing Aristotle’s statement that “all men, by nature, desire to know” (p. 354).

The information stimuli resulted from the use of digital technologies (mobile devices and apps executed on these devices). The digital technologies provide constant access to information from different sources that capture the individual’s attention. They are a source of information stimulus, and the individual is the agent receiving the stimuli. The difference between the information stimuli and the simple stimuli is its content. In both types of stimuli, they are received in the human brain by the sensorial register in which the five human senses are stimulated, but the information stimuli interact mainly with three senses – auditory (tones from speakers), visual (sinusoidal contrast gratings), and somatosensory (fingertip vibrations) (HAGMANN and RUSSO, 2016). Once an information stimulus arrives at the sensorial register, its content facilitates the recall of schemata from long-term and working memory due to the need to know effect (ATKINSON and SHIFFRIN, 1968; MASLOW, 1963; SIMON, 1971; CASE et al., 2005). Since most of the information is processed on the working memory, the expected consequence of a large amount of information stimuli is the cognitive load. The cognitive load model postulates that cognitive activities, such as learning, are hampered when the learning task exceed the working

memory capacity (JONG, 2009). Simon (1971) discussed the impact of information overload due to the scarce attention available, explaining that an information processing system (i.e., computer) can reduce the demand for attention as long as it absorbs (or process) more information than it produces. However, the stimuli complexity is the primary factor that influences user behavior (DUNCAN, 1972). For instance, in the case of web stimuli complexity, the number of links, number of graphics, homepage length, and animation influence the information complexity perception (GEISSLER et al., 2001). This result is in line with previous psychological research developed by Miller (1956) that asserts that the human information processing capacity is limited by seven, plus or minus two chunks of information at the time. Duncan (1972) also demonstrated that the number of factor and components (i.e., the source of information and number of sources) determine the level of complexity analyzing the information. The information processing capacity can be summarized in an inverted U-curve, that is, the information processing capacity is optimal by a certain point, and suboptimal after this point (HWANG and LIN, 1999), as illustrated in figure 4.

Figure 4 – Information Processing Capacity



Source: Hwang and Lin (1999)

In summary, the information load on the working memory affects the information processing capacity when the U-curve reaches the optimal point and enter in the overload area. To observe the influence of information stimulus caused by the use of multiple digital technologies, two latent variables were operationalized: information diversity and information load. While the first allows the observation of the influence of

unrelated information sources, the second takes the amount of information on the individuals working memory during the use of technology. The next two sections present an overview of both variables.

2.2.1 Information Diversity

Information diversity is conceptualized as the diverse, unrelated, or distinct types of information available for a person or a population. Information diversity represents the number of alternative information options users may or may not process in a given context (CAMPBELL, 1988). Dissimilar or heterogeneous environments are characteristics of complex systems with many factors and components located in different environments (DUNCAN, 1972). The information diversity may negatively influence the information need and consequent user adaption behavior when it provides a large set of cues for the working memory. The study developed by Iselin (1989) demonstrated that as the number of cues or unrelated variables set increases, typically beyond ten unrelated variables, the decision-making performance falls. The working memory is responsible for maintaining the cues sets during information processing to perform the tasks (JONG, 2009). The information diversity represents the number of apps and devices, which allow access to multiple contexts and situations. The result is more stimuli, increasing task complexity and influencing the information need process.

When the information worker is using his smartphone, she/he can receive notifications from different apps, such as instant messages from family and friends, financial data about the use of her/his credit card from the mobile banking app, emails from the company, and so on. Duncan (1972) relates the large numbers of unrelated information sources used with the higher complexity for decision making. The empirical studies sustain that the information overload effect occurs when the individual receives approximately ten items of information, and the higher the information diversity, the larger the information overload (ISELIN, 1988). Thus, the information diversity may represent an effect of information stimuli on the human cognitive system.

2.2.2 Information Load

The information load is an essential concept due to the rapidly increasing quantity of environmental information (BENSELIN and RAGSDELL, 2016). The amount of information stimulus in people's context increase the complexity of tasks and require adaptation strategies to assimilate the information. Technology is the principal driver of information load, including the devices such as smartphones, and applications, like email, mobile communication tools, social media, and internet-based apps (BENSELIN and RAGSDELL, 2016). The push systems that actively send new data to the user without request, increasing the density of information stimuli on the environment, are evidence of the role of technology in the information load (BAWDEN and ROBINSON, 2009). The factors associated with information load are the volume of information, information processing capacity, available time, characteristics of information, task parameters, personal factors, and sources of information (formal and informal, push and pull systems) (JACKSON and FARZANEH, 2012). The underlying assumption is the human information processing capacity has a finite limit to assimilate and process information in a given period of time (MALHOTRA et al. 1982).

The information load is related to the information processing capacity of an individual (JACKSON and FARZANEH, 2012; HWANG and LIN, 1999; SIMON, 1971). The human information processing capacity decreases after a certain amount of information load, represented in the central inflection point on the inverted U-curve (figure 4) (HWANG and LIN, 1999). The overload on information processing is caused by the quantity of information available for consumption of individuals and is responsible for many problems that affect the effectiveness, and even the health, of information workers (BAWDEN and ROBINSON, 2009).

Studies demonstrate a gap in acceptance between the utilitarian and hedonic systems, the first related to the workplace for productivity improvement and the later with leisure and self-fulfillment value (SCHMITZ et al., 2016). The informal sources of information can both be internal and external to the organization, including colleagues and personal advisors (KAYE, 1995). The characteristic of informal sources of information relates to the bring your own device (BYOD) phenomenon in which employees adapt their personal devices to perform work tasks (SCHMITZ et al., 2016). The personal device usage simplifies the access to the internal and external sources of informal information, generating more information load unrelated to work. The users have a preference to adopt the personal system due to the affective trait on stimuli

generated by the devices and apps (COLE, 2011). Emotions form a well know neural circuit designed to act as a response system to feelings that motivate the cognition and action (INZLICHT et al., 2015). When the user faces stimuli generated by formal and informal systems, their primary focus may go to an affective stimulus due to the well-known neural circuits paths existing for it. Under a high information load environment, the user may prefer to informal systems to use the information available.

2.3 Human Information Behavior

Human information behavior (HIB) deals with concepts such as the information need, seeking and use, analyzing the psychological, cognitive and affective issues of individuals when interacting with different types of information, whether in the physical environment (i.e., books in libraries) or electronic (for example, data in information systems) (CASE, 2007). This research focuses on the cognitive aspects of HIB. Table 1 presents a brief description of these concepts. Taylor (1968) discusses the information seeking and the necessary skills for the librarian to assist the seeking process that meets the users' needs. It uses the terms library user and library system to contextualize information seeking but generalizes the application using the term information system to refer to the information retrieval system. The use of the terms information system and user broadens the discussion and allows the appropriation of this concept by the area of MIS, as it happens with several other areas of studies that used the main concepts of HIB. The cognitive IS research is also an important area of studies that leverage theories of other areas to develop MIS field and explain the user behavior (DAVERN et al., 2012). The objective of this research is to take HIB concepts to develop a cognitive model that explains the use of multiple digital technologies in organizations.

Several authors developed cognitive research with HIB concepts since the 1940s, notably Dervin (1983), Ellis (1989), Kuhlthau (1993), Wilson (1981), Taylor (1968) and Belkin (1978). The first stage of HIB studies addressed the physical elements that influence the individual human information behavior while need, seeking and use information, such as library catalog and library system. In the 1970s, the HIB

Table 1 – Definitions of core concepts in HIB

CONCEPT	DEFINITION
Information Need	An information need is a recognition that the individual's knowledge is inadequate to satisfy a goal that her/his have. The information need often is signalized by mild anxiety and a need to act.
Information Seeking	Information seeking is a conscious effort to acquire information in response to a need or gap in the knowledge. The information seeking can be "satisficing" (finding a good-enough alternative); politically motivated (gathering information to support a position), or process driven (extensive search for a solution).
Information Use	Information use tends to be shaped by existing mental structures or cognitive schemas. The information use has highly interconnected processes, like interpretation, conversation, processing, sense-making, knowledge building, and decision making. Information use occurs when the individual selects and processes information which leads to a change in the individual's capacity to make sense of the experience and to act or respond in the light of that new understanding.

Source: Based on Case (2007) and Choo (2006)

research started to study the user behavior instead of the system artifact, developing concepts such as information seeking and use, and analyzing the cognitive and affective aspects related to these activities (CHOO, 2006). Other concepts are applied in HIB studies to understand human behavior, such as information retrieval, information avoidance, information anxiety, serendipitous information collection, information search, information source, information competence, information overload, information exchange, information transfer, information processing, information sharing, information diversity, and information feeling (WILSON, 1999; HAUSSMAN et al., 2012; SCHWARZ, 2010; WU, 2013). These concepts are used in the contextualization of the information need, seeking, and use to understand the relationship between the user's behavior and the HIB.

The concept of information is central to research on HIB, giving grounds for the other concepts (CASE, 2007). Science becomes effective only with the definition of basic concepts (BELKIN, 1978) and, for this reason, this theoretical review initially addresses the concept of information and its relationship with knowledge formation. The HIB processes are presented next to address the main concepts of HIB, such information need, seeking, and use and cognitive implications.

2.3.1 Information

The MIS research recognized the strategic nature of information as an element of competitive advantage and value generation for the organizations. The use of information collected and processed by the organization is probably the only non-imitable resource that can create a sustainable competitive advantage to firms in the digital transformation era (TALLON et al., 2013). The importance of information technology is not in hardware and software, but in the application of information as a key to business success (BROADBENT et al., 2003). Albert Einstein (1879-1955), in a phrase attributed to him, states that “knowing where to find the information and how to use it – this is the secret of success.” These definitions emphasize the importance of information to business research and is an important element for MIS research that connects individuals and technology. An information system exists to structure and organize the information flow and represent the organizational realities (DESANCTIS and POOLE, 1994). The remaining of the section explores the information definition and its influence on human behavior.

The information definition in human behavior research associate the information with the learning, knowledge, and flow of information and as a source of meaning to represent the reality (MCKINNEY and YOOS, 2010). The HIB research deal with behavioral aspects that determine the information need, seeking, and use, and how these elements influence the individual’s life. Information definition is a central term in various disciplines such physics, biology, philosophy, linguistics, economics, artificial intelligence, and statistics (MCKINNEY and YOOS, 2010; KAHNEMAN, 2013; SHANNON, 1949). The information science perspective on information definition addresses its influence on human behavior. A generic definition of information is “any difference that makes a difference to a conscious, human mind” (CASE, 2007, p. 40). Miller (1951) defined information as “any stimuli we recognize in our environment” (p. 41). These definitions imply that information is subject to individual perception and involve the human cognition to interpret and understand the environmental stimulus. Information is a source of reality and influences the individual behavior with a stimulus that generates cognitive activity to build the realities and, as explained by Wilson (2000), influence the way that people interact with information, in processes know as information need, seeking, and use. The concept of information was famously

developed by Shannon (1949) who applied the concept for communication field. He used the statistical probability to estimate errors and corrections in the signals transmitted in telephone lines, originating the Information Theory, where the essential concern was how a message would be transmitted using physical media and how to guarantee the integrity of this transmission to inform the content of the information effectively. The Information Theory was used to analyze the effectiveness of the communication between the source, the transmitter, the receiver, and the destination of the message, verifying if the data transmission was consistency (SHANNON, 1949). Shannon's primary goal was to solve the problem of the integrity of information transmitted by physical media, which could be hampered by the noise that changes its content. The Information Theory influenced the first HIB researches with the assumption that the same information transmitted to different individuals would generate the same behavior (DERVIN, 1983). The application of communication concepts to address human issues was a problem identified by the Information Science researchers in the 1970s and represented the first major paradigm shift that occurred in HIB studies. The concepts of the social sciences began to be applied to the HIB studies, that is, the human behavior vision as a central element rather than the mathematical vision, with new concepts and assumptions emerging with the evolution of the Information Sciences research. For instance, Dervin (1983) proposes the sense-making paradigm to explain the internalization process of information obtained or received by the individuals, allowing the understanding and learning, and the production of meaning. Consequently, the understanding, learning, and production of meaning resulted in different behavior in different individuals once the mental models (schemata) are distinct (DERVIN, 1983). The individual interpreted the external information using her/his mental model (schemata), which implies that the similar external information creates different realities, following the individual cognitive map with a structure that organizes this reality in the individual’s mind (CASE, 2007). Therefore, sense-making is an important concept to explain the information effect on the individuals once it represents the internalization and the understanding reality, according to the cognitive maps of the individual. Sense-making is only one of the paradigms used on HIB research in addition to social psychology theory. The other paradigms include the Principle of Least Effort, Uses and Gratification, Constructionism, Play Theory and Entertainment Theory (CASE, 2007).

The fundamental premise for differentiating behavior between two individuals receiving the same information is to understand that previous information accumulated by two individuals results in different behaviors. Dervin (1983) also observes that analyzing the behavior of two individuals immediately after the exposure of the same information can bring the perception that the behaviors are homogeneous, but in the long-term, the way this information influences the daily life of these individuals is completely different and determined by several events. “[Information] has a given relationship with reality. It can be poured as is from one bucket (the system) to another (the user). Its value is obvious - it describes reality, and anything that describes the reality is of value for it allows better adaptation to reality” (DERVIN, 1983, p. 163). Table 2 summarizes information definition found in the literature.

Table 2 – Information Concept

AUTHOR	AREA	CONCEPT
Bateson (1972)	Anthropology	Information is any difference in which it makes a difference in some later event.
Belkin (1978)	Human Information Behavior	The concept of information depends on methodological, behavioral and definitional requirements.
Case (2007)	Human Information Behavior	Information is any difference that makes a difference to a conscious human mind. Information is all that seems significant to a human being, whether it comes from an external or internal (cognitive) environment.
Dervin (1983)	Human Information Behavior	Information has two possible meanings from the individual’s standpoint. The first is to treat information as an observer construct, like a brick. The second is treat information as a user construct, like an empty bucket into which bricks can be throw to the user interpret the reality.
Shannon (1949)	Communication	Information is described in mathematical form, a number of bits transmitted by a physical medium. Choice, uncertainty, and entropy are elements to characterize information.
Miller (1951)	Social Psychology	Information is any stimuli we recognize in our environment.

Source: Prepared by the author

Many authors treat the information definition simplistically with definitions in a single line (BELKIN, 1978). The information definition is the foundation that provides meaning to other studies in the Information Sciences and MIS areas. McKinney and Yoos (2010) developed a taxonomy of information views to cover different aspects of information used in the MIS literature. The four views were information as a token, a

syntax, a representation, and an adaptation. The summary of these views is presented in table 3.

Table 3 – Information Taxonomy Definitions

CHARACTERISTIC	DEFINITION
Token	Information and data are both tokens manipulated by processes. The software allowed team members to create, store, retrieve, distribute, and analyze data, a process that manipulates tokens.
Syntax	Information is the measurable relationship among tokens that reduces entropy. The tokens in this study are mental states; the effectiveness measure of information quantifies the change in mental states.
Representation	Information is meaning. Meaning emerges from a sign that stands for an object to a particular observer. Personal information (sign) about an individual (object) gives meaning to an unknown third party (observer).
Adaptation	The adaptation view introduces subjectivist assumptions to explain how information is created by a system (e.g., person, organization). Information is created when a system perceives differences in its environment which alter that system.

Source: McKinney and Yoos (2010)

The information sciences literature presents very broad or very specific definitions, usually elaborated to answer a context or a research problem. Belkin (1978) makes a distinction between definition and concept, where definition represents what the phenomenon is, while a concept represents a way of looking at or interpreting a phenomenon. The definition of information, however, is unnecessary to study the phenomenon, while useful concepts have great importance to interpret the phenomenon in question adequately. In analyzing the different concepts proposed and their discrepancies, he states that “in order to fairly judge the value of any information concept, one needs access to the reasoning behind the proposal and some indications of its possible consequences” (BELKIN, 1978, p. 55). The starting point is Shannon (1949) for its acceptance and grounding in several disciplines. However, after the 1970s, the researchers recognized that Shannon conceptualization is insufficient for information science due to its limitations in considering human behavior from a technological view, ignoring the present cognitive aspects in communication between people, such as knowledge, learning, and reasoning (BELKIN, 1978). The concept of information presents properties such as utility, representativeness, intentionality, and veracity, which allows the reduction of the uncertainty on individuals while accessing and using the information. Belkin proposes requirements to validate the concept of

information divided into three groups. The first group is methodological, which analyzes the usefulness of the concept; the second group is behavioral, which considers the phenomenon with which the concept must deal with; and the third is definitional, which deals with the context of the concept. Without formulating a concept of information, the author analyzes different proposals elaborated by previous studies of the information science using these requirements. The conclusion indicates that useful information concepts should employ these three proposed requirements, whereas concepts that deviate from these requirements only address specific contexts in the research proposed by their authors, but without a significant contribution to information science literature.

Bateson (1972) discusses information definition using Shannon's theory as the starting point to elaborate his own definition. Bateson states that "the 'laws' of probability cannot be stated so as to be understood and not be believed, but it is not easy to decide whether they are empirical or tautological; and this is also true of Shannon's theorems in Information Theory" (p. 5). He redefines the concept:

> The technical term "information" may be succinctly defined *as any difference which makes a difference in some later event*. This definition is fundamental for all analysis of cybernetic systems and organization. The definition links such analysis to the rest of science, where the causes of events are commonly not differences but forces, impacts, and the like. The link is classically exemplified by the heat engine, where available energy (i.e., negative entropy) is a function of a *difference* between two temperatures. In this classical instance, "information" and "negative entropy" overlap (BATESON, 1972 p. 386).

Bateson expands the conceptualization to the use of information to manipulate human behavior. Some parts or alternatives of the information are excluded to manipulate the behavior. Information systems, from this perspective, act as activated elements to apply corrective actions whenever there is a difference between the present state and the desired state by its controller or organization. The discussion follows in a cause-and-effect context applied to humans on the implication of the loss of pieces of information and the problem of reduplication, which seeks to guarantee the desired state in a situation of loss of pieces of information. A perceived difference is treated as units of the human mind, where these units complete the pieces of lost

information. This discussion originated due to the inadequacy of the application of mathematical concepts in human behavior field. Bateson brings two important points important for reflection. First, he deals with the human aspect of information and how mathematical elements are insufficient to explain the human behavior even in cause-effect relationships, a behaviorist paradigm that was challenged in the late 1960s. Second, he presents the information system as an element that aims to give stability to the way information is presented to individuals, acting correctively whenever the current state is different from the preferable state. Lack of control of organizations on the type of information consumed by users can interfere with this desirable state of behavior and bring positive and negative consequences the organization outcomes, such as productivity and performance.

The various typologies that define information have material and conceptual conflicts. Case (2007) discusses aspects of the materiality of information in dealing with processes, knowledge and subject matter. Information represents a process when the act of informing and communicating occurs, an internal and immaterial construction involving two agents (transmitter and receiver). Knowledge is formed through cognitive processing and represents an internal and immaterial cognitive construction that can be presented through physical artifacts such as books, articles, documents, and others. In this dimension, the cognitive map of the individual plays a fundamental role in the production of meaning from the artifacts. The artifacts are characterized by physical, informational objects that may involve documents and data, and which have a monetary value as a resource or a commodity. In this case, information can be produced, acquired, replicated, communicated, distributed, traded, manipulated, and controlled (RUBEN, 1992) in its fully material form and its production necessarily depends on the cognitive aspects of the authors. The immaterial representation of information exists through human cognition and involves all the activities of internalization and interpretation of information according to cognitive maps. The processes of information production, such as writing a theoretical essay, is the physical representation of human cognition that is being transferred from human memory to a physical artifact. Communication occurs in learning activities such as delivering classes to a group of students, or a user using an information system to perform a work, where the materiality is in the resource used (e.g., computer system), while the

process of internalization and construction of meaning about information happens in the cognitive level.

Many information concepts were formulated addressing the physical artifact in which the transmission of information happened rather than the human cognitive aspects, which brought several problems and limitations to these concepts (BELKIN, 1978). Shannon (1949) related information with uncertainty once the message could be incomplete and without a guarantee that the transmitted signals were received by the receiver. The uncertainty led to entropy concept, defined as “a measure of the degree of disorganization in a system which reflected a tendency for any state of affairs to lose order and become more random” (CASE, 2007, p. 46). The tendency of randomness brings greater uncertainty about the transmitted message, which requires a larger volume of data to guarantee the integrity of the signals transmitted. This aspect of uncertainty is questioned by other studies in the human sciences, arguing that associating information with uncertainty is counterintuitive, since having access to information is a process of building certainty (MILLER, 1983). The system theory itself presents the concept of negative entropy that brings the idea of stability by the replacement of energy lost during processing and reorganization, reducing randomness (PRESTES MOTTA, 2001). The use of an information system aims to increase the performance of the organization, standardizing processes and reducing uncertainties due to the use of information as inputs for the processes. Additionally, the information systems allow the implementation of corrective actions when deviations were detected using the feedback information. The reduction of uncertainty is a fundamental property for increase the usefulness of information.

In summary, the information has distinct conceptualization and definitions, where authors like Belkin (1978), Dervin (1983), Bateson (1972), McKinney and Yoos (2010), Case (2007), Miller (1951), and others developed the conceptualization and taxonomies according to the requirements of their studies. The conceptualization used in this dissertation considers the influence of information on the cognitive aspects of the individuals. The information, therefore, is conceptualized following Dervin (1983) and Belkin (1978) and the representation taxonomy of McKinney and Yoos (2010), which consider information as an element for the creation of meaning to individuals when they internalize the information stimuli from the external environment through the cognitive maps (schemata). The problem on the use of multiple digital technologies

and, consequently, the information provided by these technologies is the uncertainty about their influence on the individual behavior and the organizational outcomes. Once the information creates meaning and realities, it is important to understand the elements that influence the information behavior. This dissertation is developed to investigate the individual behavior aspects, and the influence on organizational outcomes is an opportunity for future research. The proposed concept meets Belkin's requirements for having methodological, behavioral and definitional aspects, and is also supported by Dervin who discusses information regarding external, internal, and sense-making aspects.

Finally, the concept of information represents the basis for constructing other related concepts, such as information need, seeking, and use, based on the elements of the information concept (CASE, 2007). The information conceptualization is the starting point in which every research on Information Sciences or MIS should take to clarify the methodological, behavioral, and definitional aspects of the research (BELKIN, 1978). The following sections discuss the HIB conceptualization and the influence of information on human behavior.

2.3.2 Human Information Behavior

The Human Information Behavior (HIB) is defined as “the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use” (WILSON, 2000, p. 50). The study of human behavior requires the understanding that people are complex and have characteristics that cannot always be reproduced in experiments or laboratory, and that human behavior results from a range of conditions (i.e., cultural, social, political, and material conditions) that makes it unpredictable in several situations (FIDEL, 2012). Studies on HIB deal with processes of information need, seeking, and use, and any human behavior while interacting with information. The HIB is widely used to address a variety of information-related phenomena, including active and passive information seeking, information use, and other behaviors motivated by the recognition of lack of information (CASE, 2007). The HIB research includes all types of information phenomena, like “face-to-face communication with others, as well as the passive reception of information as in, for example, watching TV advertisements, without any

intention to act on the information given" (WILSON, 2000, p. 50). The HIB aims to identify the way in which individuals interact with information, where the information needs and practices to obtain and avoid information are sub-concepts of HIB (HIRVONEN et al., 2012). During the 1980s and 1990s, the HIB area debated on how to refer to the HIB research once many studies referred to the "information seeking behavior," "information seeking and use", and "human information behavior" interchangeably. The debate was motivated for the conceptual problems about the presence or the lack of the "human" word on the literature, given that the paradigm shifted from the system-centered to the user-centered studies (PETTIGREW et al., 2001). The argument to use the HIB nomenclature was "because information does not behave; only people do" (PETTIGREW et al., 2001, p. 44). However, the use of the term HIB as a way of generalizing the behaviors resulting from the human relationship with information prevailed in the literature, extending the concept to all forms of interaction of people with information (BATES, 2010). The HIB includes different types of relationships between people and information, and studies on how people need, seek, and use information in different contexts, both in the personal and in the professional environment (PETTIGREW et al., 2001). The assumption is that behaviors can be studied and understood, as well as the elements and conditions that influence the manifestation of behaviors, but a certain level of unpredictability on the HIB is always present as the individuals react differently when facing the information. The HIB studies aim to understand how information influences the daily life of the individuals and the behaviors related to it.

The HIB can be used to investigate different units of analysis, such as individual, groups, organization, and society (BAWDEN and ROBINSON, 2013). The group behavior can influence individual behavior in the environment, and, for this reason, it is important to determine exactly the unit of analysis during the design of the research. Social and cultural factors also influence the HIB studies on groups, organization, and society, although the individual factor is a central element for the HIB. Thus, it is important to know the possible impact of the social and cultural factors on the HIB research for the generalization of the conclusions of the research for groups, organization, and society (BAWDEN and ROBINSON, 2013). The majority of the studies in HIB area summarize their conclusions regarding social groups, that is, inform if the groups analyzed were professionals, students, teachers, patients, and so on,

knowing that the sample collected to represent the social group. A quick analysis of recent research in HIB (table 4) shows how the conclusions are applied and summarized to social groups.

Table 4 – Social Group Research in HIB

AUTHOR	SOCIAL GROUP	THEORY/CONCEPT	STUDY SUBJECT
Buck et al. (2014)	Mobile Application Consumers (apps)	Consumer Behavior	Information Source
Catalano (2013)	Masters and Doctoral Students	Human Information Behavior	Information Seeking Behavior
Hirvonen et al. (2012)	Sports Practitioners	Health Information Behavior	Health Information Behavior
Mullins e Sabherwal (2014)	Students in decision making in simulated business	Human Information Processing	Information Overload
Niu e Hemminger (2012)	Academic researchers in natural sciences, engineering, and medical sciences	General Model of Information Behavior	Information Seeking Behavior
Park et al. (2014)	Users of investment social networks	Information Sharing and Seeking	Information Seeking and Information Sharing
Pfeiffer et al. (2014)	Consumers in the supermarket	Human Information Behavior	Information Seeking
Zamani et al. (2013)	Tablets Users	Sensemaking	User Behavior
Zhang et al. (2014)	Compulsive users of smartphones	Flow Theory, Reinforcement Motives, Convenience	User Behavior

Source: Prepared by the author

Another critical element in HIB studies is the impact of digital technology on human behavior. The advances of the digital technologies changed the relationship between people and the daily formats of interaction in the personal, professional, and academic lives. On the academic side, for instance, the use of social media allows the interaction between teachers and students, and simplify the information sharing previously restricted to physical environments, which influences the learning process, creativity, and drive different attitudes that influence HIB (MILLS et al., 2013). During the 1970s, researchers emphasized the need to expand the studies on the resultant human behaviors of the use of information systems to understand mechanisms and structures that affect HIB (MOORE and NEWELL, 1973). The digital technology evolution has shifted the context of information science research to different areas of interest that previously did not exist once the interaction between people and

information changed and added new elements to the HIB research. Therefore, HIB research considers all the behaviors resulting from the relationship between the individuals and the information, where digital technology plays a fundamental role due to its role in structuring the information presented, interacting with processes such information need, seeking, and use, that influences human behavior in the organizations.

2.3.3 Information Need

The need definition refers to circumstances in which something is required or essential beyond desire, or even to express the lack of a basic need (CAMBRIDGE DICTIONARY, 2018). The management and business research use the Maslow's Human Motivation Theory (1943), popularly known as Maslow's Hierarchy of Needs or simply Maslow's Pyramid of Needs, to address the need definition and the circumstances that people perceived needs. The Maslow's Hierarchy of Needs proposes that people have five needs arranged hierarchically, presupposing an order of satisfaction before the need above manifest. The hierarchical arrangement has been challenged in the literature once the manifestation of a need in an individual does not depend on the satisfaction of another immediately below, but that it is a parallel process equally active in human beings (ALDERFER, 1969). Psychology addresses need through motivation, where being motivated means that the individual is energized and moves forward toward a particular goal or end (RYAN and DECI, 2000). The need can also be characterized as an inner motivational state that impacts the individual's thoughts and actions (GRUING, 1989). All these definitions are important to understand that the information need process satisfies a certain motivation and has an instrumental character, that is, it aims to meet a specific objective (GREEN, 1990). The need for information involves a process of perceiving the difference between an ideal state and the real state of knowledge (WIJNGAERT, 1999). Motivation manifests itself in order to fill this information gap recognized by the individual consciously or unconsciously. For instance, a medical study has investigated the information needs of cancer patients and shown that providing information that meets the individual's specific needs (for example, all details or minimal details of the progress of the patient’s medical condition) impacts how the patient deals with disease and treatment (ROOD

et al., 2015). The research showed that relevant factors associated with the information need are satisfied with the information and involvement in decision making. The individuals have differences in cognitive coping style about the disease, a variable that health professionals should be aware of when communicating with patients (ROOD et al., 2015). Thus, depending on the patient's cognitive coping style, more or less information about her/his health condition should be provided.

The concept of information need presents four characteristics (GREEN, 1990). The first is the instrumental character of need, which usually involves a desired goal. Second, the possibility of challenging the need, that is, individuals do not always need what they claim to be needed. At this point, returning to the initial definition of this section, need is often associated with the motivation to meet the need. If the individual fails to meet the need, it can influence the performance or goal of the individual. Third, the information need process has moral weight, that is, it can be considered a primary or secondary need (GREEN, 1990). The discussion finds differences between authors and research areas, such as medicine, psychology, MIS, information science, and others. In psychological terms, the need for cognition is considered a basic need and there is a direct association between the need for cognition and information need based on the information conceptualization once uncertainty can drive the information need (CASE, 2007). The fourth characteristic is that individuals are not always able to determine their real information needs. Individuals may overestimate or underestimate the need. There is a differentiation between need and desire, and the information does not always present a fundamental characteristic to carry out a task or influence motivation. In these situations, there is a variable associated with power, which means access to unnecessary information is a desire to demonstrate the power and becomes a demonstration of the power of the individual (GREEN, 1990).

In the HIB area, studies on this subject occurred intensively until the 1970s and did not present a unanimous concept (WILSON, 2000). Taylor (1968) proposed a typology to analyze how information needs are met in libraries. He categorized needs as visceral, conscious, formalized, and committed, differentiated by the individual's ability to express their information need. A visceral need, for example, exists in the individual's unconscious and brings a sense of dissatisfaction because she/he does not know how to verbalize the present cognitive gap in order to obtain the desired information, besides not being able to express the doubt, using broad questions

(COLE, 2011). The visceral need is the typical case where the individual asks the librarian where the social science books are without knowing what specific subject she/he needs to investigate in the book (TAYLOR, 1968). The conscious need brings more satisfactory results but requires a higher level of research by the individual to achieve the desired results. The formalized need allows for an advanced level of elaboration, but the uncertainty lies in the ability to obtain an appropriate response. The committed need is a higher level of consciousness in which the individual can objectively express what he needs to find the information. Taylor (1968) developed this typology to represent the stages as library users search for books, and routinely these stages can be observed according to the types of research or questions asked. He generalized these results by applying them to information systems. This typology represented the construction of awareness regarding the information need and was elaborated from the observations of everyday situations on the library users' behaviors. The findings were significant correspondent with other activities of information need and can be generalized consistently. It also shows the relevance of library science to elaborate generalizable concepts of information (CASE, 2007). Cole (2011) provided a stronger conceptualization to what he called the theory of information need, using the Taylor four levels of information need. The information need is "the starting position for all user information search, (…) intangible and visceral and thus unknowable and nonspecifiable in a query to an information system" (COLE, 2011, p. 1217).

The information need was also associated with uncertainty. In this approach, the information need arises initially from uncertainty, and the individual has the motivation to reduce the uncertainty. Human beings perceive the difference between what they know and what they want to know about a particular subject by comparing their current level of knowledge with the desired level of knowledge and acting with the information seeking process whenever there is a sense of uncertainty (ATKIN, 1973). There are several ways to reduce uncertainty, including social and personal interactions with individuals who can provide the information needed. The correct specification of the information need is important to satisfy the need. The anomalous state of knowledge of the individual is a way to specify the need in which the individual acknowledged that there is a need that requires action (BELKIN et al., 1982). The individual compares the anomalous state of knowledge to her/his perception of uncertainty, and the solution comes through the information seeking process that fulfills

the need. The theory reinforces that the information need arises from the uncertainty, gap or state of anomaly that moves from the present situation to the desired situation and initiates the information seeking process until the perception of satisfaction of this need occurs at a higher or lower level, according to the expectations and motivations of the individual (BELKIN et al., 1982). Situations of uncertainty may involve feelings of anxiety that act as motivators for cognitive behavior and result in actions as engagement reinforcement or quitting of the information seeking (KUHLTHAU, 1993). Dervin (1983) highlights the concept through sense-making by identifying the need in its early stage as a sense of information gap that leads the individual to seek ways to satisfy the gap. This approach is subject to side emotions like anxiety that act on the sentimental level.

The information need is a fundamental conceptualization of the HIB literature and seldom was measured since this is a cognitive activity that happens several times per day and is transparent to the individuals.

2.3.4 Information Seeking

The information seeking process starts from the perception that something is missing, whether an object, an answer or a reason, characterizing itself as an action in which the individual must be active and requires an initial motive or cause (CASE, 2007). The information seeking occurs when individuals intentionally seek information for some purpose such as decision making or solving some problem (FIDEL, 2012). The information seeking is the central phenomenon of interest in the HIB literature to understand human behaviors resultant from the information. Wilson (1999) has developed a model where the information seeking plays a central role, starting with the perception of the need, and the information seeking results in processes that generate demand in information systems and other information sources. This model is aligned with the definition of information seeking as “the purposive seeking for information as a consequence of a need to satisfy some goal. In the course of seeking, the individual may interact with manual information systems (such as a newspaper or a library), or with computer-based systems (such as the World Wide Web)” (WILSON, 2000, p.49). Case (2007) defined “information seeking is a conscious effort to acquire information in response to a need or gap in your knowledge” (p. 5). Effort, speed, and convenience

are elements that influence information seeking. The time needed to find the information may affect the depth of the research, the sources searched and the way the research is performed (CONNAWAY et al., 2011). The advances of the digital technologies provided several information sources that were restricted to physical environments until the end of the twentieth century, and the supply of information occurs in large quantity resulting, in some cases, in information overload due to the restrict information processing capacity or human attention (SIMON, 1971). The challenge of finding information, however, remains practically the same, that is, correctly identifying the needs and sources of information and seeking them appropriately to meet that need of the individual.

The motivation to start the information seeking are characterized as extrinsic and intrinsic (GOTTLIEB et al., 2013). Extrinsic motivation is an activity developed by the individual to achieve a larger goal or the means to achieve a particular goal such as making a decision. Intrinsic motivation is the goal itself and is associated with cognitive processes that provide a rewarding feeling when the individual achieves the goal. The uncertainty about a certain, the curiosity about a theme and the learning process can be the intrinsic motivators of the information seeking. Curiosity, defined as the “the burning desire to know and understand” (GOTTLIEB et al., 2013, page 585), is one of the most important cognitive aspects to activate the information seeking process without external motivation. The reward for satisfying the curiosity is a cognitive process that attributes value to information seek (GOTTLIEB et al., 2013). The cognitive processes are an integral part of the information seeking process since they involve an active level of consciousness of the human mind and determine actions with greater or lesser focus. Kuhlthau (1993) presents a model that relates feelings (affective), thoughts (cognition) and actions (physical) during the information seeking process. The initial task of the information seeking is the feeling of uncertainty and awareness about the lack of knowledge about a subject, which drives vague thoughts and exploitative actions to obtain the relevant information. The final task results in satisfaction or disappointment with the outcome of the information seeking and, eventually, iterate the process. At the cognitive level, the tasks of exploring, formulating and collecting information represent the activities of greater focus and interest of the individual, leading to actions that contribute to selecting and documenting the maximum information about a given subject (KUHLTHAU, 1993). The information

seeking process is continuous, and disappointment is the trigger that restarts the information seeking until the satisfaction of the needs. When the extrinsic motivation starts the information seeking process, this process is repeated several times to meet the needs of the main goal pursued. When the intrinsic motivation starts the information seeking process, however, the perception about the information value that motivated the curiosity or uncertainty determines the satisfaction of the information need that is the end of itself. Besides the feeling of satisfaction or disappointment, time is a factor that can determine the continuity of the information seeking process, triggering cognitive activities that aim at maximum efficiency with the least effort to obtain information (CHOO, 2006). This phenomenon of higher efficiency with less effort is known as the Principle of Least Effort (CASE, 2007). The information seeking will always occur in easier information sources available and with the least time of dedication possible, such as friends, relatives, co-workers, teachers, media of entertainment, and less in books, scientific articles, information systems, or other sources that require more time and effort (DERVIN, 1983). The exception to the principle of least effort is the individuals known as the information elite, a small group that has developed a habit and discipline of information seeking and performs advanced seeking processes. The demand for information is elastic, and it depends on the individual to determine when to start and when to stop the search (DERVIN, 1983).

The application of information seeking processes in studies in other areas is evident mainly in healthcare research due to the proliferation of medical content in electronic media such as websites and social media. The goal is usually to understand the motivators and blockers for the information seeking process, analyzing the keywords used, the credibility attributed to the information retrieved and the trust on the results obtained with the research (JEAN et al., 2015). For instance, Carpenter et al. (2015) investigated the patient's information seeking in online sources about medications and how that information is shared with patients. The conclusion was that it was important to establish a relationship between the patient's physician, patient, and relatives to increase treatment engagement and obtain better results (CARPENTER et al., 2015). There is a concern to understand patient's behavior in the information seeking online for the post-consultation diagnosis, examining the reasons and background of the information seeking, and helping physicians to guide their

patients about which sources to indicate and how to use such complementary information. The information need is manifested by the lack of satisfaction with the treatment, low trust in the physician, questions unanswered during the consultation and insufficient emotional support (LI et al., 2014). The health information seeking on the Internet has the potential to influence behaviors and outcomes of healthcare, where people seek information for themselves or others as relatives and friends. Understanding the differences between the type of information researched for oneself or a relative can improve the mechanisms developed to provide support to patients, their families and friends (SADASIVAM et al., 2013).

Other applied researches are aimed at understanding how information seeking occurs during conferences for consensus building and publication of results, usually deliberative meetings that should produce a final document with the result of the discussions (ANDERSON et al., 2012). The participants conducted researches in the external sources of information other than those provided by conference organizers. The research identified a positive influence on the consensus building since there is real information on the issues discussed (ANDERSON et al., 2012). The HIB research also aims to understand how information published in the media tends to influence people in different ways and their intention to seek information about risk situations (HO et al., 2014). The analysis of the literature allows concluding that information seeking process occurs beyond the HIB area and presents significant contributions to understanding the human behavior, improving the relationship between individuals and developing information systems, such as apps and websites, that meet human needs. The development of interfaces that facilitate information seeking is one of the main research objectives in the HIB area.

2.3.5 Information Use

The information use is closely linked to the information seeking process discussed in section 2.4. The information seeking and use continuously feedback each other until the satisfaction of the information need or disappointment that generated the iteration (CHOO, 2006). The information use is one of the most important processes for the success of a task or objective, since the sources of information are increasingly available to people, whether in physical or electronic media, and the way

these sources are used determine the result (CASE, 2007). A large number of information sources result in information overload and questions about the relevance of the content available (BAWDEN and ROBINSON, 2009). For instance, the development of an academic paper may generate information overload and questioning when the researcher chooses to rely on questionable sources (i.e., low-ranking journals) or reliable sources (i.e., high-ranking journals).

The information use process is related to the construction of meanings, build knowledge, decision-making, solve problems, store for future use, and exchange information with others (TAYLOR, 1996; CHOO, 2006). The organizations create, transform and use the information to manage and integrate their processes, resources and digital technologies (CHOO, 2006). A parallel is traced on an individual level, where cognitive processes create, transform and use the information obtained for the performance of the task. The complexity of the task assigned to the individual affects the information use process, especially the type, channel and source of information used to perform tasks with different levels of complexity (BYSTROM and JARVELIN, 1995). The type of task assigned to the individual determines the information use and modifies the knowledge structures of the individual. The cognitive maps representing the structures of the human brain organize the information used and can interfere in the structuring of knowledge (BYSTROM and JARVELIN, 1995). For instance, the reading of scientific articles and development of interpretations (information use process) influences how the knowledge will be structured in the memory of the researcher, a process that occurs through individual cognitive maps or schemata. The way the researcher organizes his activities also determines the structure of the knowledge. Wilson (2000) reinforces this view with the information use process definition as:

> The physical and mental acts involved in incorporating the information found into the person's existing knowledge base. It may involve, therefore, physical acts such as marking sections in a text to note their importance or significance, as well as mental acts that involve, for example, comparison of new information with existing knowledge (p.50).

Wilson complements the definition by pointing out that there are processes of comparing new information with existing knowledge and that this process occurs at the

mental level. Finally, a study explores the information use process in subject matter experts, questioning the amount of information used by people considered specialists in their areas of practice (SHANTEAU, 1992). The main result of the research is to show that subject matter experts use more their previous knowledge developed on a specific subject and less information sources than the beginner professionals, but the type of information used by specialists is more relevant to address the problem or complete the task. The way the individual performs the information use process determines the success and the level of expertise of individuals. Shanteau (1992) concluded that knowing the cognitive processes of information use could help in the development and training of junior professionals.

2.3.6 Information Source

Information source is an additional and important topic included in the general literature review that is related to the digital technologies used on a daily basis. The information sources allow individuals to perform their tasks during the information need, seeking and use processes. There are formal and informal information sources that are used for these purposes (CHOO, 2006). The formal sources represent books, official documents, structured information systems, newspapers, periodicals and all kinds of informational mechanisms formally recognized by specialists in the subject. Formalizing a source of information depends on the credibility legitimacy built and attributed to individuals and organizations. Informal sources of information are friends, family, co-workers, television programs, radio songs, networks, and social media, Internet mailing lists, the opinions of friends and other sources that interfere with the HIB but are not official sources (CASE, 2007). The type of source used depends on the search strategy and the information need, using sources that can adequately satisfy the information need requirements. Generally, there is a combination of different formal and informal sources used in everyday life, but when it comes to the production of knowledge or learning process, the formal information sources are preferred (CHOO, 2006). Although, there is a recognition that the digital technology evolution, such as web 2.0, has created a subtle differentiation of these types of information sources.

The legitimacy and credibility of information sources have been the subject of discussion in the literature. Cosenza et al. (2015) explained that the web 2.0 had introduced a number of interactive capabilities to the digital technologies, such as social networking, as well as new content delivery tools, such as blogs, collaborative digital encyclopedias, and tools known as eWOM (Electronic Word-of-Mouth). The power of the digital content about a particular topic is greater than the power of the traditional content because the content is available online for research every time and for everyone (COSENZA et al., 2015). The social network users use informal channels as a primary source for information seeking rather than for formal sources to establish direct contact with the author of the information, or people close to the author, allowing the interaction and discussion (LAMPE et al., 2012). Using a social network as a primary information source seems to be a backlash and even an exaggeration, but it is a movement that has advanced in recent years. Some scientific works use encyclopedias such as Wikipedia, an online and collaborative encyclopedia, which allows anyone to access, create, review, edit and include topics, but has lack of trustworthiness due to the dependence on the information provided by the community, free of charge. On the other side, Wikipedia database presents consistency because of the continual update, the community collaboration, and the openness to every user, what creates legitimacy as an information source. The legitimacy of the information source also depends on the type of content made available. Liu et al. (2011) investigated the level of credibility of the content and concluded that in crises, such as natural disasters or catastrophes, the information source influences the credibility of the information. The traditional information sources of transmission (i.e., newspaper, television channel) present greater credibility than new sources of information (i.e., social networks, blogs, WoM) (LIU et al., 2011). The effectiveness of communication and ability to express policy also depends on the information source used. Traditional media (i.e., newspaper, television channel) are associated with the effectiveness of political communication, while capacity for expression is related with the social media (ZHOU and PINKLETON, 2012). On the other side, the recent studies suggest that the social networks are the information sources for teenagers in Western Countries for social activity, but not the first took for the information seeking (AILLERIE and MCNICOL, 2018). The information sources (i.e., social networking) also influence the selective political information exposure when the digital technology allows the

customization of the information source and has a stronger effect on ideologically moderate individuals (DYLKO et al., 2017). The empirical evidence also indicates that the use of social networking as information source influences the people political preferences and voting behavior, but the evidence still need further investigation (i.e., EL PAIS, 2018).

3 MODEL DEVELOPMENT OVERVIEW

The conceptual model development is explained in the three articles presented in this research (chapter 3, 4, and 5). This section aims to provide an overview of the models developed, including the title, research questions, objective, methodology, hypotheses, and research model for each article for clarity. Table 5 summarizes the model structure, the dimensions used in the research, and the base literature for the conceptualization of the model and the dimensions that are further explored in each article.

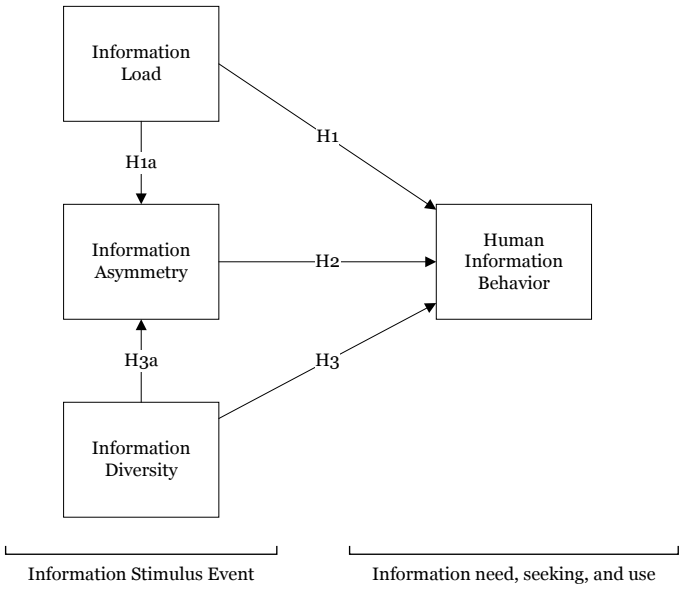
Table 5 – Summary of Model Structure and Dimensions

Information Stimulus	Information Diversity	• Number of information sources • Level of independence of the sources	Iselin (1988; 1989) Duncan (1972) Hwang and Lin (1999)
	Information Load	• Perception of quantity • Perception of complexity	Jackson and Farzaneh (2012) Hwang and Lin (1999) Bawden and Robison (2009)
Human Information Behavior	Information Need	• Visceral Information Need • Level of Uncertainty • Knowledge Gap • Level of consciousness	Cole (2011) Taylor (1968) Choo (2006)
	Information Seeking	• Satisficing • Information Source Availability • Information Search Tools	Kuhlthau (1993) Choo (2006) Cole (2011)
	Information Use	• Know-How • Motivation • Personal fulfillment • Problem-solving • Learning • Information stored • Decision Making • Information Exchange	Cole (2011) Barki et al. (2007) Taylor (1996) Choo (2006)

Source: Prepared by the author

The article 1 details are presented in table 6. The first article is a literature review, following the Webster and Watson (2002) approach to build the literature review. The article was the first paper elaborated with the initial conceptualization and model designed for this research. It presents the Information Asymmetry as an dimension influencing the HIB. However, during the qualitative and quantitative development, the Information Asymmetry was removed from the model to simplify the

Table 6 – Article 01 Title, Research Questions, Objective, Methodology, Hypotheses, and Research Model

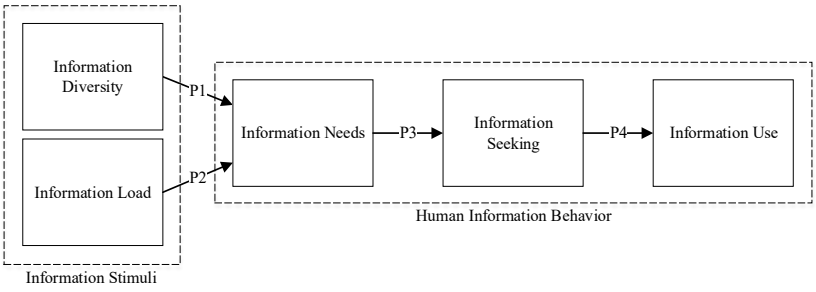
Title	The Influence of Information Stimulus Event on Human Information Behavior
Research Questions	1. How does information stimulus event influence human information behavior? 2. How does information stimulus event influence IS adoption?
Objective	The objective of this research is to investigate information stimulus event, which influences human information behavior in the context of a large number of information sources, introduced to the individual's life by digital technologies.
Methodology	Literature Review, following Webster and Watson (2002). Data analysis with NVivo 12 for Mac.
Hypotheses	• H1: Information load in the context of digital technologies impacts human information behavior. • H1a: Information load in the context of digital technologies impacts information asymmetry. • H2: Information asymmetry in the context of digital technologies impacts human information behavior. • H3: Information diversity in the context of digital technologies impacts human information behavior. • H3a: Information diversity in the context of digital technologies impacts human information behavior.
Research Model	

Source: Prepared by the author

research development. The length of the qualitative protocol and the number of items on the quantitative survey also influence the decision to remove the Information Asymmetry. Additionally, the changes on the research and the conceptual model were discussed with the member of the examination board that accepted the proposal for a

simplified model. This article was developed using the literature identified in the MIS basket of eight most important journals (AIS, 2016), in addition to the MIS Quarterly Executive, Harvard Business Review, and MIT Sloan Management Review. The keywords used for the research were “human information behavior,” “information behavior,” “information event,” “IT event,” “IS event,” “digital technologies,” and “digital transformation.” After the results review, the backward and forward literature analysis, 88 articles were selected for the research and model building. Next, table 7 presents the summary for the article 2.

Table 7 – Article 02 Title, Research Questions, Objective, Methodology, Hypotheses, and Research Model

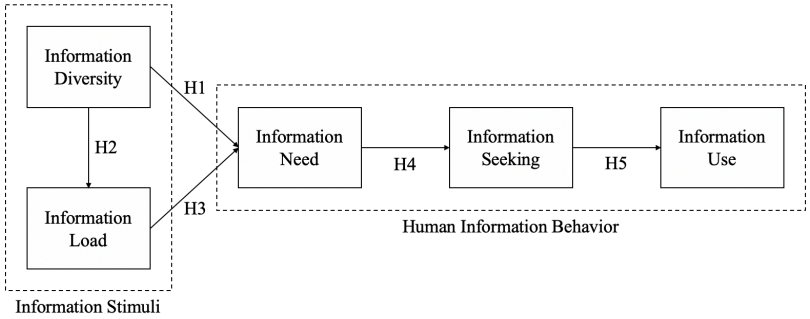
Title	The Influence of Information Stimulus on Human Information Behavior: A Qualitative Approach
Research Questions	1. How does information stimulus influence human information behavior?
Objective	The objective is to investigate the influence of information stimulus on human information behavior during the use of multiple digital technologies, precisely the individual behavior in the organizational setting.
Methodology	Qualitative, semi-structured interviews with 23 information workers. Data analysis with NVivo 12 for Mac.
Propositions	• P1: The information diversity influences the information need. • P2: The information load influences the information need. • P3: The information need is related with the information seeking. • P4: The information seeking is related with the information use.
Research Model	

Source: Prepared by the author

Article 02 was developed for the qualitative phase of the research. The HIB theory was used to guide the model specification and the development of the propositions. The interview protocol was elaborated to validate the propositions among the constructs on the research model. The data collection was performed with semi-structured interviews, which were taken with 23 information workers of a multinational

technology company. The data analysis was performed with a combination of inductive and deductive processes to critically evaluate the views of the information workers about the influence of information stimulus generated by the use of multiple digital technologies on the HIB (GRAEBNER et al., 2012). The coding procedure was combined the theoretical-based codes previously developed with the codes that emerged during the data analysis. Myers and Newman (2007), Venkatesh et al. (2016), Graebner et al. (2012), Campbell et al. (2013), and Orlikowski and Baroudi (1991) were employed to guide the data analysis presented on the research.

Table 8 – Article 03 Title, Research Question, Object, Methodology and Research Model

Title	When We Need to Know Everything: The Impact of Information Stimuli on the Human Information Behavior
Research Questions	What is the impact of the use of multiple digital technologies on human information behavior?
Objective	The objective is to investigate the impact of information stimuli generated by the digital technologies on the HIB.
Methodology	Quantitative research with 565 information workers of multiple companies and countries. Data analysis with SPSS and SmartPLS.
Hypotheses	• H1: The Information Diversity negatively impacts the Information Need. • H2: The Information Diversity positively impacts the Information Load. • H3: The Information Load positively impacts the Information Need. • H4: The Information Need positively impacts the Information Seeking. • H5: The Information Seeking positively impacts the Information Use.
Research Model	

Source: Prepared by the author

Finally, table 8 presents the summary for article 3 developed using a quantitative approach. The conceptualization was developed to introduce five hypotheses tested on the research model. The data collection was performed with a survey containing 34

items related with the five constructs, 07 control question, and 22 device and app usage questions. The items were adapted based on the current literature or developed based on qualitative data analysis and the literature. The survey was sent to 3,959 emails to information workers of multiple companies, and 1,982 emails to the information workers of a specific multinational technology company. The email for the general information workers of multiple companies contained the invitation letter in English and Portuguese, describing the purpose of the survey and links to access the survey in the Qualtrics platform. For the information workers of the multinational technology company, the invitation letter was sent only in English with the link to the survey. The total of 971 people accessed the survey and 565 completed the questions. The response-items ratio was 16:1. The data analysis was performed with SPSS and SmartPLS (RINGLE et al., 2015), following the quantitative research approach to validate the measurement model and the structural model (HAIR et al., 2017; HENSELER et al., 2015; KOUFTEROS, 1999; MACKENZIE et al., 2011). The results are further discussed in the articles.

The next three chapters reproduce the articles exactly as submitted to their respective conferences. The additional detail and complements for the articles are provided in the Appendices. Appendix B presents the research protocol for the qualitative research, and the survey for the quantitative study is available in Appendix C and D.

4 ARTICLE 1: THE INFLUENCE OF INFORMATION STIMULUS EVENT ON HUMAN INFORMATION BEHAVIOR

Abstract[1]

People use information systems to seek information. Digital technologies have increased the number of information sources and amount of time people consume interacting with them. However, life is overloaded with unpredictable and uncontrolled information sources, generating anxiety, stress, and uncertainty. While the Management Information Systems field is concerned with understanding how to increase adoption of information systems that represent formal information sources, digital technologies are selected by users and used to perform work tasks. Given this scenario, we present a new approach to investigate user behavior in this information context. The objective of this research is to investigate information stimulus event, which influences human information behavior in the context of the large number of information sources. We hope to provide a new model to assist the academic community, practitioners, and society to understand this phenomenon, as well as to improve IS design and help individuals to advance their experience and interaction with IS.

Key words: Information Stimulus Event, Human Information Behavior, Information Load.

4.1 INTRODUCTION

People use information systems to seek information. Digital technologies are social media, mobile, analytics, and embedded devices (IGI-GLOBAL, 2019) that generate information stimulus event. The digital technologies have increased the number of information sources and the amount of time people consume interacting with them. However, life is overloaded with unpredictable and uncontrolled information sources, where the volume and complexity of information overwhelms the user, leading to lower decision speed and quality (LAKER et al., 2017). The amount of information

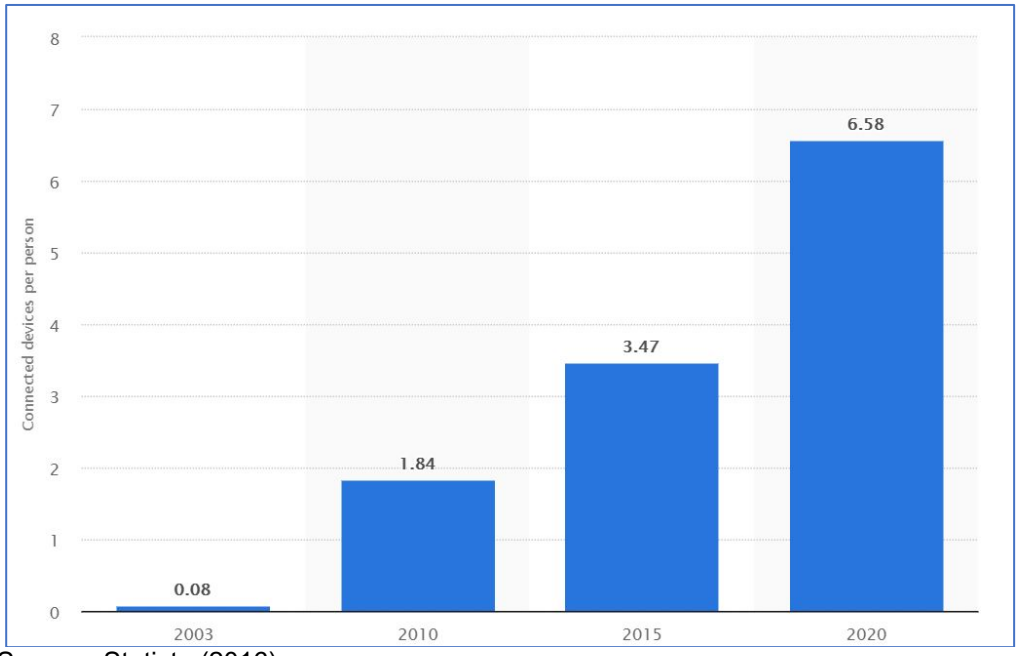
[1] A version of this paper was published in DIGIT 2016. This is an updated version.

that the individual seeks to make a decision is related with the psychological distance from the decision (HALAMISH and LIBERMAN, 2017). This situation is affected by the volume of information produced and consumed. For instance, adults in the United States are exposed to approximately 74Gb (gigabytes) of data per day, including information sources such as newspapers, apps, magazines, television, books, and websites (SHORT, 2015). Information load increases life complexity due to distractions that affect attention and concentration on the task to be performed (GOLEMAN, 2013). Meanwhile, the Management Information Systems (MIS) field is concerned with understanding how to increase the adoption of IS that represent formal information sources given the scenario in which digital technologies are brought by users to the organization.

The advances in digital technologies occurred in an unprecedented speed on the last years. The development of new devices and apps that allow the access of several information sources changed the way that people communicate and interact. The human being is essentially an information seeker creature that consumes every piece of information received (GAZZALEY and ROSEN, 2016). The digital technologies allow the access to a large number of information sources, which people adopt and use for personal and professional activities. However, the use of more information sources may affect the human cognitive system once it has limits on information processing capacity.

Simon (1971) discussed the problem to allocate the cognitive attention, stating that “information consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention” (p. 40). The fact is that the amount of information produced every day reached 2.5 quintillion bytes of data, and the pace is accelerating with the growth of the connected devices that produces data (FORBES, 2018). The number of connected devices continues to increase along the years. In 2003, there were 0.08 connected devices per person; in 2010, the number increased to 1.84; in 2015, the number reached 3.47 devices per person. The forecast for 2020 is 6.58 devices connected per person (Figure 5). The users rely on multiple digital technologies (i.e., laptops, tablets, smartphones, and apps) to support a wide range of tasks (KARLSON et al., 2009). People have an innate information seeking behavior (GAZZALEY and ROSEN, 2016), thus the users consume information from multiple digital technologies wittingly or unwittingly (CASE, 2007).

Figure 5 – Forecast on connected devices per person



Source: Statista (2016)

Stein et al. (2015) investigate IT use patterns based on IT stimulus events that elicit emotions, resulting in adaptation behavior strategies in response to the different types of stimuli. Information stimuli is defined as suggestions, clues, signs, indicators, messages, and events that convey information to the human cognitive system (GIBSON, 1960). Stimuli carry environmental information about objects, places, events, people, and human actions that stimulate perception and human sense. We believe that the evolution of technology has generated different classes of information stimuli events enabled by digital technologies that elicit information behavior. We argue that information stimulus event is observed in terms of information load, and information diversity and their influence on human information behavior regarding IS adoption.

The study of Human Information Behavior (HIB) emerged in the early twentieth century, addressing the information sources used to meet the need for information, information seeking, and information use behavior (CASE, 2007). Research in the MIS field has seldom employed HIB concepts to its studies as little attention is given to the study of information phenomena itself (MCKINNEY and YOOS, 2010; DETLOR, 2003). The concept of information has great importance as a dependent variable in evaluating the effectiveness of IS used in firms (CARTER et al, 2015). As the number of digital

technologies increased inside the organization, the same happened with the number of information sources that influence human behavior, impacting the quality of strategic decision making (KAPLAN, 2008).

Given this scenario, the objective of this research is to investigate information stimulus event, which influences human information behavior in the context of the large number of information sources, introduced to the individual's life by digital technologies. We believe this research will increase the understanding of the information stimulus event that influences influence technology usage, as well as that of IS adoption phenomena. Few studies have investigated IS adoption by analyzing the influence of information behavior. Our study applies HIB concepts to understand the need for information, information seeking, and use of information that drive behavior. The HIB field aims to improve IS design to enhance user experience in relation to information use (CASE, 2007). We believe our model can benefit organizations when taking design decisions, driving IS adoption, and improving user task performance. Two research questions guide this research:

How does information stimulus event influence human information behavior?

How does information stimulus event influence IS adoption?

We began our investigation on previous literature and developed the research model based on the literature review. We present the planned research method and expected results in the final remarks.

4.2 THEORETICAL DEVELOPMENT

Theoretical development encompassed three phases following Webster and Watson's (2002) methodology from the literature review. First, we identified the main contributions for digital technologies, information stimulus event, and HIB in top IS journals referenced as the MIS basket of eight journals (AIS, 2016), in addition to the MIS Quarterly Executive, Harvard Business Review, and MIT Sloan Management Review. Second, we revised the references used in preparing the articles identified in the first phase (go backward). Finally, we analyzed later articles that cited works identified in the first phase (go forward), selecting those with consistent contributions for this research.

4.2.1 Digital Technologies

Digital technologies are the engine of digital transformation and represent the context of this research. Organizations driving digital transformation develop new digital products and services that impact human beings with different forms of information ubiquitously present in everyday life.

The digital technologies such as social media, mobile devices, analytics, and embedded devices (internet of things - IoT) are present on every activity performed by the individuals, influencing digital transformation (IGI-GLOBAL, 2019). The digital transformation is defined as the use of new technologies to enable major business improvements, such as enhancing customer experience, streamlining operations, and creating new business models (HEAVIN and POWER, 2018). The speed with which digital technology appears on the market requires processes to establish a different level of relationship with customers, employees, and stakeholders in order to increase firm performance, since everything is becoming connected in the digital environment. In this scenario, it is crucial to the organization's survival to respond quickly to significant changes in the business. Digital transformation allows for improvement of the customer experience and direct engagement with stakeholders, enhancing operations and developing new lines of business. However, few organizations have the managerial and technological capacity to make significant gains with digital technologies due to organizational behaviors that need to be changed so as to be successful, starting at the executive and strategic level. The main organizational barriers are workers' attitudes, legacy technology, innovation fatigue, and politics. These barriers need to be broken to enable the organization to perform digital transformation in an environment where information overload; limitations in human capacity for technological implementation; and the need to balance convenience, speed, and superficiality of digital tools with the rational processes of the human mind represent the main challenges to overcome (FITZGERALD et al., 2013).

This scenario represents a major challenge to organizations as digital technologies are present inside them, generating spurious information with random correlation among work priorities and personal life, which make work more complex (THE ECONOMIST, 2015). Users need to deal with the variability and ambiguity of information generated by the digital technology they are bringing to or adopting at the

company, which generates signals and stimuli hard to control. Information overload leads to anxiety, stress, and uncertainty (KEITH et al., 2014) and can impact strategic decision making (KAPLAN, 2008) in a way that a deeper understanding of information stimulus event is required.

4.2.2 Information Stimulus Event

Information stimulus event is addressed in different ways in MIS and social psychology literature. Kimbrough and Moore (1992) describe information event as a series of processes performed to allow information flow for work execution. The authors describe information event activities as retrieving documents, making decisions, and sending notifications. Miller (1956) evaluates human information transmission capacity using different stimuli. A stimulus has an amount of information sent to a person who then provides a response with another amount of information. The correlation between stimulus-response is the amount of information transmitted. This amount varies asymptotically according to the dimensions and directions related to the stimulus, in addition to the variation according to memory use strategy (MILLER, 1956). Gibson (1960) defines information stimulus as suggestions, clues, signs, indicators, messages, and events that convey information to the human cognitive system. He sustains that stimuli carry environmental information about objects, places, events, people, and human actions that stimulate perception and human sense. Gianni et al. (2015) consider that the stimulus model consists of information flow enabled by signals, states, and events induced by environmental stimuli and rules for detecting these signals.

Zhang (2013) discusses IT stimulus as an affective antecedent triggered by psychological elements. The author defines affective antecedent stimulus as an event in which a person reacts or responds, characterized by elements that contain affective information and may originate in their own IT or environmental context, as the ecosystem of IT use. He categorizes types of stimuli as the object itself and the use of the object, for example, computer as object and computer use as behavior. These categories emerge from the finding that affective concepts tend to be associated with an object (the object-based stimulus) or behavior (stimulus based on behavior). Beaudry and Pinsonneault (2010) address users' responses to IT events through the

coping model of user adaptation, which proposes that users respond with an adaptation strategy after appraisal of the disruptive IT event that occurs in their environment. The authors define adaptation as "cognitive and behavioral efforts exerted by users to manage specific consequences associated with a significant IT event that occurs in their work environment" (p. 496). The IT event refers to both new IT implementations and the changes made to existing IT, perceived as significant enough to stimulate an individual's responses. User adaptation behavior occurs at different times after awareness of the IT event, acting before, during, and after implementation of the technology disruption. The authors report that there is information asymmetry that leads the individual to adopt adaptive strategies at different times and use different strategies. Users first assess whether the IT event is an opportunity, threat, or a combination of opportunity/threat, and then determine their level of control over the situation, reacting with an adaptation process centered either on emotions when they realize low-level control or on the problem when they realize high-level control over the IT event (BEAUDRY and PINSONNEAULT, 2010).

Stein et al. (2015) aim to understand how IT events and emotional factors influence IT use behavior. They analyze which IT stimuli events provoke emotions and the influence of these emotions on IT use patterns. The authors propose a model to appraise affective responses, adaptation strategies, and IT use patterns to IT events. A stimulus event is an event in which the person performs an assessment, responding with different emotions according to the evaluation. The emotional response can be provided according to four classes of emotions: 1) loss, anger, dissatisfaction (initiated by appraisals of threat and low control); 2) deterrence, anxiety, fear (activated by appraisals of threat and high control); 3) achievement, satisfaction, pleasure (triggered by appraisals of opportunity and low control); and 4) challenge, excitement, hope (sparked by appraisals of opportunity and high control) (STEIN et al., 2015).

Following the definitions identified in the extant literature, we define information stimulus event as information generated by digital technology that elicits the human cognitive system and influences human behavior. The human cognitive system perceives and conceives information, and emotions may bring uncertainty mainly through high information load, diversity, and asymmetry, resulting in different human information behavior.

4.2.3 Human Information Behavior

HIB studies were initially developed in library and information science (Case, 2007). Wilson (1999) conceptualizes HIB as the totality of human behavior in relation to information sources and channels, including both active and passive information seeking and use. HIB is the activities that a social actor performs to identify their information needs, the ways they seek information, and use information, involving the transfer, exchange, and processing of information. Information need is a psychological, cognitive, and affective state influenced by the context, the environment, and the individual's situation, which occurs from the social actor's perceived need. This situation requires the use of formal and informal sources that result in the success or failure of satisfaction of the perceived need. Success leads to sharing information and exchanging behaviors with other people, while failure triggers new iteration of information need, seeking, and use (WILSON, 1999). Courtright (2007) uses the terminology information need, seeking, and use for broad behavior, which can start either intentionally and directly or passively and indirectly, triggered by internal or external stimuli. Context and situation have distinct characteristics in HIB literature. The author describes context as a framework for information practices where the individual interacts with information resources and influences information behavior. Situation is part of the context and represents a dynamic interaction in which interpretative processes are deployed, ratified, changed, and solidified, where a particular set of circumstances leads to HIB (COURTRIGHT, 2007). Situations of certainty and uncertainty may occur in the same context of interaction with information resources.

HIB represents an iterative cycle of information need, information seeking, and information use. The iterative cycle begins with the perception of a problem by the individual and occurs in three stages (CHOO, 2006). The first stage is the information need in which individuals realize discrete issues within an environment. The size of the discrete issue determines the gap of knowledge and the type of information that the individual should seek to solve the problem. Information seeking is the second stage in which the person uses IS to get information to solve the issue. IS produce an information product that determines the effectiveness of the system, depending on its utility to solve the issue. IS are useful if they produce valuable information. The third

stage encompasses information use, where the individual uses the information obtained from the sources consulted, changing the problem status. A new iteration of need, seeking, and use begins if the problem is not solved or if an adequate level of knowledge in the individual's mind that satisfies the information need is not reached, which depends on their internal cognitive structure and emotional disposition. These two components influence the iterative cycle and how the social actors perceive problems and react to the information presented (DETLOR, 2003). Context is another variable that influences the cycle of information need-seeking-use. While identifying information need, environmental variables can influence perception of information gap by social or workgroups in which the individual participates. Information seeking can be impacted by these groups' social characteristics, and information use is subject to the influence of social norms.

4.3 NOMOLOGICAL NETWORK AND RELATIONSHIPS

Figure 6 presents the proposed nomological network and hypotheses among the variables. We will analyze information use behavior in the organizational context, involving formal information sources and digital technologies, which represent informal information sources. This setting leads to a high number of information stimuli events represented by information load, information asymmetry, and information diversity and impacts HIB.

Fitzgerald et al. (2013) describe information overload as a challenge organizations need to handle to promote digital transformation. Miller (1956) demonstrates that people can process a limited amount of information before losing the capacity to transmit information they are receiving from information sources. Campbell (1988) also identifies information load as a characteristic of task complexity that impacts user behavior toward work. Information load represents a problem when it overcomes human cognitive capacity by increasing the number of stimuli the individual can handle (MILLER, 1956; CAMPBELL, 1988). In this scenario, we postulate that:

H1: Information load in the context of digital technologies impacts human information behavior.

Stein et al. (2015) relate IT stimuli events with emotional responses, resulting in adaptation behavior that can vary according to the level of control the individual perceives in the specific situation. Beaudry and Pinsonneault (2010) report that information asymmetry occurs among users during IT events as each user takes individual behavior, leading to information asymmetry. Both emotions and information asymmetry happen in contexts of uncertainty, affecting user behavior. We hypothesize that:

H1a: Information load in the context of digital technologies impacts information asymmetry.

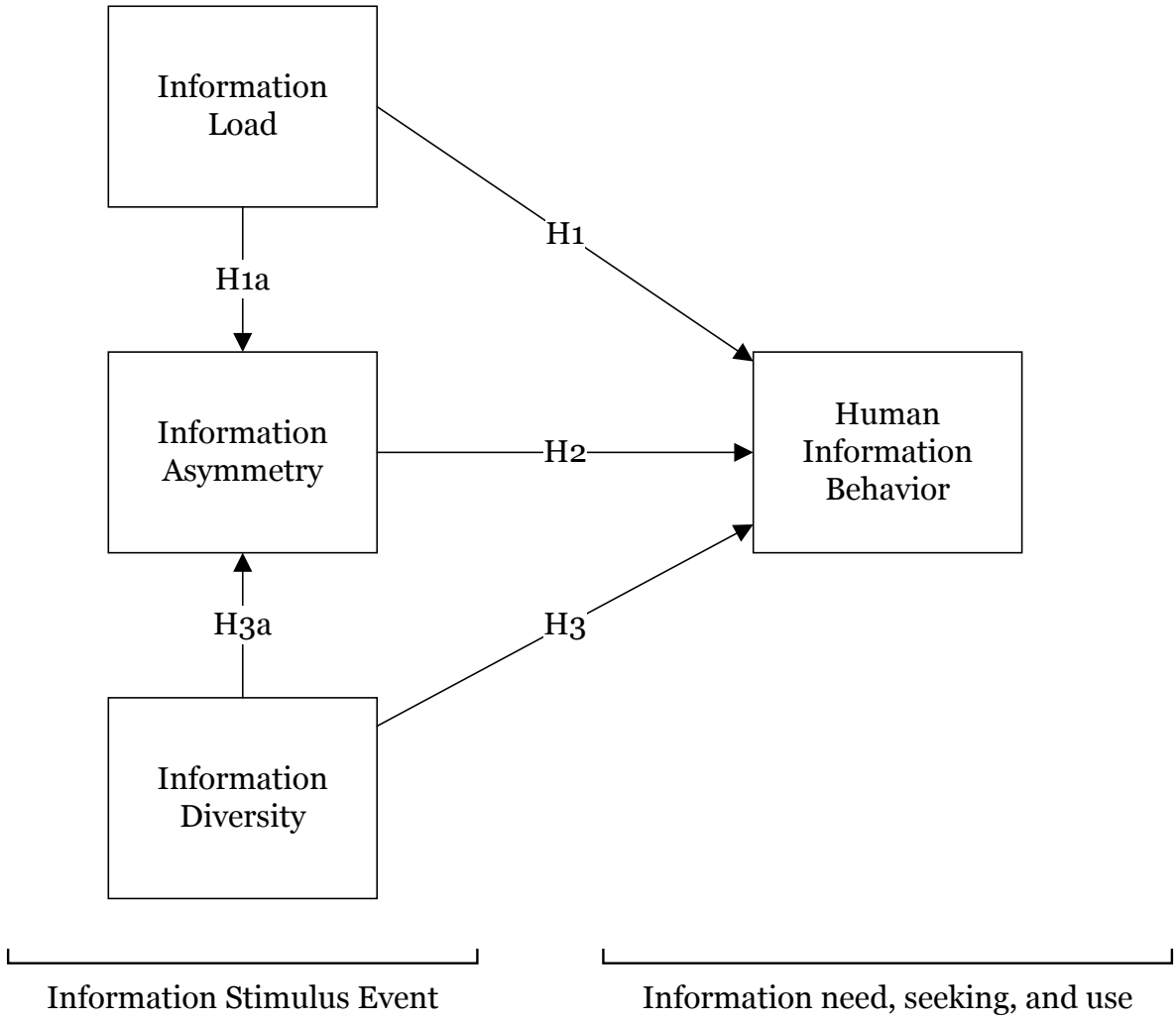
Information asymmetry is the difference of information between the principal and agent that puts principal in a disadvantaged position due to hidden information (AKERLOF, 1970). Information asymmetry is linked to perceived uncertainty that affects user behavior toward decision making (PAVLOU et al., 2007). It is also the difference of awareness of an IT event during a certain time (BEAUDRY and PINSONNEAULT, 2010). When a new information stimulus happens, user adaptation behavior starts with user awareness of the consequences of the information stimulus event. Users adopt digital technologies without complete knowledge of the intentions and resultant behavior fostered by them and with a low level of awareness of the impact an information stimulus event has on information behavior. We hypothesize that:

H2: Information asymmetry in the context of digital technologies impacts human information behavior.

Information diversity represents the number of alternative information options users may or may not process in a given context (CAMPBELL, 1988). It is defined as the number of dimensions of unrelated variables in the information set. As the number of cues increases, typically beyond approximately 10 items of information, decision-making performance starts to fall (ISELIN, 1989). HIB is triggered when the individual becomes aware of an information gap related to a problem, driving the information behavior cycle. Given this context, we posit that:

H3: Information diversity in the context of digital technologies impacts human information behavior.

Figure 6 – Nomological Network



Source: Prepared by the author

The last hypothesis proposes the relationship between information diversity and information asymmetry. As the individual faces many stimuli, more cognitive processes elicit uncertainty (ISELIN, 1989; BEAUDRY and PINSONNEAULT, 2010). A rich information context is characterized by a large number of information sources provided by different technologies. Since information diversity changes user behavior with the increase of unrelated variables, we propose that:

H3a: Information diversity in the context of digital technologies impacts human information behavior.

4.4 METHODOLOGY

This study will combine mixed methods of qualitative and quantitative research methodology (VENKATESH et al., 2013). We plan to conduct a field study to investigate the influence of information stimulus event on HIB. Field study requires unrestricted access to various stakeholders inside organizations (STEIN et al., 2015). For the initial approach, we plan to select companies with intensive information use and that allow users to bring their own devices (i.e., digital technologies) to the organizational environment. After collecting and analyzing the necessary evidence to support the model relationship, a survey will be performed using a quantitative approach to verify the consistence and reliability of the present model.

4.5 CONCLUSION

The initial research aims to investigate the influence of information stimulus event on HIB and its impact on IS adoption. We will develop new concepts to study user behavior and provide elements to understand the impact of digital technologies on organizational settings. The preliminary research model was developed based on the literature review with three antecedents (information load, information asymmetry, and information diversity) and the hypotheses were proposed to link the variables to the model.

The traditional theories may not support the investigation of current IS phenomena due to various contexts of technology use in everyday life (CONSTANTIOU et al., 2014). We will develop a new approach to research such phenomena using information and behavioral elements in hopes of providing a better explanation for technology use and adoption, investigating human information behavior in the context of the large number of information sources. We expect to provide a new model to the literature and a practice to help the academic community,

the organization, and society to understand such phenomena, as well as to improve IS design and help individuals to advance their experience and interaction with IS.

This paper was the first step in the development of this research since it limited the theoretical perspectives and the unit of analyses to conduct the next phases of the research. The information stimulus was conceptualized with three dimensions, and the HIB was included as the dependent variable, which was important in terms of representation since the complete model developed on the other two papers expanded the HIB dimension into its three processes. The HIB was the dependent variable since the selection of this theme for the doctoral research, but the study of this dimension as a "black box" was not possible due to the multipurpose dynamics and different behaviors and outcomes of HIB. This article was important to provide clarity on the research and, additionally, determine the main variables operationalized later on the other two papers.

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5 ARTICLE 2: THE INFLUENCE OF INFORMATION STIMULUS ON HUMAN INFORMATION BEHAVIOR: A QUALITATIVE APPROACH

Abstract

The use of multiple digital technologies to perform tasks or solve problems become a regular practice in the corporate environment while the amount of information available to people grows at an impressive pace. However, scant studies dedicated to understanding the influence of the actual use of multiple digital technologies and the influence of information stimulus on the behavior. Recent literature on the information system positions the study of the human information behavior as a critical research area. For this reason, this research focuses on the influence of information stimulus on the human information behavior during the use of multiple digital technologies, precisely the individual behavior in the organizational setting. This paper developed a cognitive model and conceptualized the information stimuli to understand the impact of the use of multiple systems. The total of 20 information workers of a large technology corporate were interviewed to evaluate the influence of information stimuli on the human information behavior. The findings showed that influence of information load and information diversity on the information workers to determine their information need, their ability to seek for specific information, and the use of information while performing a task.

Keywords: Information Stimulus, Human Information Behavior, Cognitive Model

5.1 Introduction

The use of multiple digital technologies to perform tasks or solve problems become a regular practice in the corporate environment. Digital technologies are the technologies the users adopt and use to perform their working and personal activities, as devices like laptops and smartphones, and apps like email, mobile communication tools, social media, and internet-based applications (BENSELIN and RAGSDELL, 2016). Similarly, the amount of information available to people grows at an impressive pace. Bohn and Short (2012) estimated that the Americans consumed an average of 34GB of data per person in 2008; Short (2015) updated the number to 74GB per person on an average day stimulating the human brain. However, scant studies were designed to investigate the influence of multiple digital technologies on the human behavior (HEMMER and HEINZL, 2011). There is a lack of research on the influence of information stimuli generated by digital technologies on the individual's cognitive system. Recent literature on the information system (IS) positions the study of the human information behavior (HIB) as a critical research area. Hemmer and Heinlz (2011) explain that "HIB can be understood as an overarching research trajectory trying to offer generalizable predictions about and explanations of behavioral phenomena observable when humans acquire and process information" (p. 223). Thus, HIB can act as a frame of reference to investigate the influence of information phenomena on behavioral and cognitive aspects.

This research focuses on the influence of information stimuli on the HIB during the use of multiple digital technologies, precisely the individual behavior in the organizational setting. The technology evolution allowed people to interact with various sources of information, resulting in a significant increase in the information stimuli. The contextual information represents the source of meaning for human behavior and is the unit of analysis that makes possible the understanding of such behavior (DERVIN, 2003). As a source of meaning, the contextual information can influence the user's habits and behavior during the use of a technology (POLITES and KARAHANNA, 2013). The use of digital technologies allows the access of data from multiple contexts and the interaction with the distinct situation at the same time. Due to the proliferation of digital technologies, the number of stimuli increased the level of complexity and exceeded the individual's cognitive capacity to process information (BAWDEN and

ROBINSON, 2009). In this scenario, the following research question guides this research: How does information stimulus influence human information behavior? To answer the question, five dimensions were investigated in a qualitative research, including information load, information diversity, information need, information seeking and information use (ISELIN, 1989; HWANG and LIN, 1999; WILSON, 2000; HEMMER and HEINZL, 2011).

The HIB model allows the investigation of how individuals, groups, organizations, and society relate to the information that they need, seek, receive, share, and use (WESSEL et al., 2017). In that sense, the HIB is part of broader human and social activity that depends on user's context of information use, including the individual's action, and the subjective construction created in the individual's cognitive system (CHOO, 2006). The HIB is a process with distinct stages that involve cognitive and affective components influencing the human behavior (WILSON, 1999). The three primary processes are information need, information seeking, and information use, operationalized in this research. While the affective component influences the IS use (STEIN et al., 2015), our research focuses on the cognitive processes of the HIB. The information phenomena open venues to expand the research on system use. Extant studies on systems use present and discuss the role of adaptation, learning, intentions, cognitive effort and behavior on ex-ante and post-adoption (e.g., BARKI et al., 2007; BURTON-JONES and STRAUB, 2006). Our study employs the HIB approach and the recent system use literature (e.g., BURTON-JONES and GRANGE, 2013; BAGAYOGO et al., 2014). Precisely, the criteria to select the recent system use literature was the employment of the three fundamental variables: the user, the system, and the task. These variables are common for both conceptual approaches.

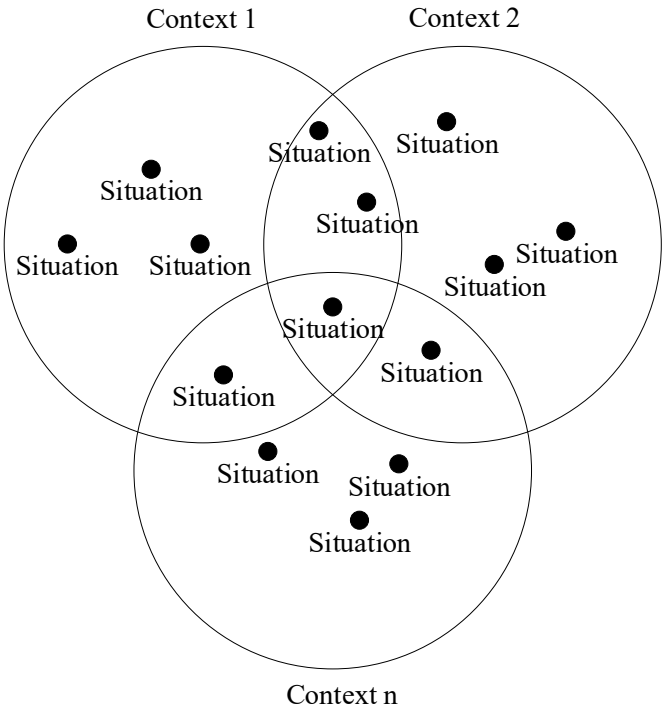
To unveil the user's behavior resultant from the information stimuli, we conducted qualitative interviews with 20 information workers in a large technology corporation. The semi-structured protocol was based on theory and guided the data collection. We analyze the data using qualitative approach to evaluate the model and the propositions. The paper is organized in sections, starting with the theoretical review. Next, the research model and propositions are presented. The procedures employed in this research are presented in the methodology section. The findings of the qualitative research are showcased in the results section. Finally, the discussion, theoretical contribution, and conclusion close the paper.

5.2 Theoretical Development

5.2.1 Information Stimuli

Information stimuli are the environmental stimuli such as alerts and notification that create a cognitive activity. The three main components of the human memory are the sensory store, the working memory, and the long-term store (SWELLER, 1988; ATKINSON and SHIFFRIN, 1968). The information is acquired on the sensory store using various sense organs, and this unit holds a significant amount of information that stay only a few seconds in this area (WYER and SRULL, 1986). The stimulus elicits the information flow composed of signals, states, and events induced by environmental stimuli and rules for detecting these signals (GIANNI et al., 2015). Hundreds of stimuli arrive at the sensory store every second. The multiple contexts and situations that user faces every day are the source of the stimuli, represented in figure 7.

Figure 7 – Multiple contexts and situations



Source: Prepared by the author

As suggested in figure 7, when the users use digital technologies, they get access to information flowing from different contexts and interact with multiple situations that may influence more than one context. The context represents the unit of analysis that makes possible the understanding of the HIB (DERVIN, 2003). The context stability allows the habits formation, leveraging the work routine variables to influence the individual behavior (POLITES and KARAHANNA, 2013). However, with the use of multiple digital technologies, the individuals are exposed to diverse information stimuli from multiple information sources. The human cognitive system is exposed to constant information flow in the physical and virtual environments, creating distraction and cognitive load (POLITES and KARAHANNA, 2013). Therefore, to evaluate the cognitive load, two dimensions were investigated to observe the information stimuli: the information diversity and the information load. Information diversity has been conceptualized in the literature as the diverse, unrelated, or distinct types of information available for a person or a population (ISELIN, 1989). The information load is related to the information processing capacity of an individual (JACKSON and FARZANEH, 2012; HWANG and LIN, 1999; SIMON, 1971). We propose the both information diversity and information load allow the analysis of the influence of information stimuli generated by multiple digital technologies and the interaction with multiple contexts and situations on the human cognition.

5.2.2 Human Information Behavior

Human information behavior represents the process performed to acquire and use of information. The three main components are information need, information seeking, and information use (WILSON, 2000). The information need is the fundamental behavior and the profound motivation of the others two processes. Cole (2011) positions information need as the starting point for adaptation behavior. The motivation of the information need is the stimuli present in the contexts and situation, which contain the problems and the tasks that motivate the individuals (VAKKARI, 2016; Belkin, 1980). The output of the information need is the information seeking to find the necessary information that motivated the need and the information use to perform the task or solve the problem. The information seeking is the purposive, indirect, and semi-direct seeking of information as the outcome of a need to satisfy an

objective (WILSON, 1999; COURTRIGHT, 2007; KUHLTHAU, 1993; TAYLOR, 1968). During the information seeking, the user interacts with the digital technology to search for the information necessary to accomplish her/his goals (COLE, 2011). Information use is the interaction and, eventually, the incorporation of new information into the person's existing knowledge (WILSON, 1999).

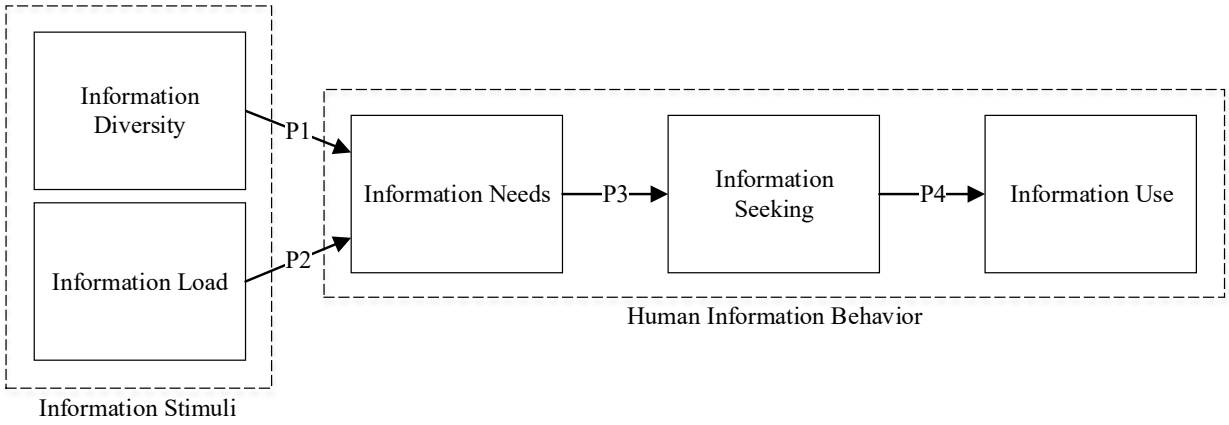
The environmental stimuli interact with the existing knowledge to create, modify or elaborate new structures, schemata, frames, or mental models (COLE, 2011). Stimuli encoded as text, images, animations, or videos influence the user behavior with context-driven messages and suggestions to induce decision making (TAM and HO, 2006). The stimulus provokes in adaptation behavior, defined in Beaudry and Pinsonneault (2005) as "acts that users perform in order to cope with the perceived consequences of technology event" (p. 494). The working memory is the information processing area that coordinates the reception of stimuli and retrieval of schemata on the long-term memory (ATKINSON and SHIFFRIN, 1968). The cognitive load theory establishes that the tasks may exceed the working memory capacity, hampering the information processing capability (JONG, 2010). Wyer and Srull (1986) describe the working memory with the limited capacity to retain information, which depends on the relevance of the current processing objective. The information need, seeking and use processes leverage the working memory capacity to process information, creating and modifying mental models based on the stimuli.

During the information use process, the users gather data in the environment to adapt their behavior (SPINK and COLE, 2006). The adaptation behavior is responsible to react to environmental information stimuli, creating knowledge frames to organize the stimuli into meaningful schemes (DUBROVSKY, 2002). The formal and informal systems generate distinct types of stimuli and have different consequences on the adaptation behavior. The formal systems are the official organizational systems, such as information retrieval systems and enterprise resource system, while informal systems are unexpected sources of information, such as interpersonal communication with colleagues and personal collections of information (HANSEN and JARVELIN, 2005). The users prefer the informal systems due to the emotional and psychological reasons manifested in the use of their personal systems in the organization setting (COLE, 2011). Therefore, the HIB processes should be analyzed considering all sources of information in which the users interact.

5.3 Research Model and Proposition

This section presents the development of research model and propositions that emerged during the literature review. Figure 8 presents the proposed research model and relationship between the dimensions. The observation of the HIB occurs at the individual level in the organizational setting, involving the use of formal and informal information sources (GOODHUE and THOMPSON, 1995).

Figure 8 – Research Model



Source: Prepared by the author

The concept of information stimuli developed in this paper establish the relationship between the information diversity and information load with the cognitive aspects of the HIB. Thereby, the concept of information stimuli proposed on this research are the stimuli generated by the digital technologies that arrives at the human cognitive system and influences the human behavior. The conceptualization to build the relationship between the dimensions are discussed below.

5.3.1 Information Diversity

Information diversity has been conceptualized in the literature as the diverse, unrelated, or distinct types of information available for a person. Information diversity represents the number of alternative information options that the users may or may not process in a given context (CAMPBELL, 1988). Complex systems are characterized

by heterogeneous environments the increase the complexity of the decision making (DUNCAN, 1972). The information diversity may negatively influence the information need and consequent user behavior when it provides a large number of information sources, which allow the arrival of unrelated information in the working memory. The study developed by Iselin (1988) demonstrated that with the increase on the number of unrelated information sources, the decision-making performance falls. The information diversity is influenced by the use multiple digital technology and may affect the working memory that is responsible for the information processing capacity (JONG, 2009). Given this scenario, we propose:

Proposition 1 (P1): The information diversity influences the information need.

5.3.2 Information Load

The information load is an essential concept due to the rapidly increasing quantity of environmental information (BENSELIN and RAGSDELL, 2016). The amount of information stimulus in people's context increase the complexity of tasks and require adaptation strategies to assimilate the information. Technology is the principal driver of information load, including the devices such smartphones, and applications, like email, mobile communication tools, social media, and internet-based apps (BENSELIN and RAGSDELL, 2016). The push systems that actively send new data to the user without request are responsible for increase the number of information stimuli on the environment. This is an evidence of the influence of digital technology in the information load (BAWDEN and ROBINSON, 2009). Simon (1971) discussed that the information load that arrive the individual’s cognitive system may increase if the information processing systems (i.e., computers) deliver more information in the environment than absorbs it. The factors associated with information load are the volume of information, information processing capacity, available time, characteristics of information, task parameters, personal factors, and sources of information (formal and informal, push and pull systems) (JACKSON and FARZANEH, 2012). The underlying assumption is the human information processing capacity has a finite limit to assimilate and process information in a given period of time (MALHOTRA et al.,

1982). Hence, the information load may affect the HIB process, influencing directly the information need. In this sense, we propose:

Proposition 2 (P2): The information load influences the information need.

5.3.3 Information Need

The information need is the central concept of the HIB research as it motivates the other behaviors. Cole (2011) proposed a theory to explain the information need paradox that, differently of other primary human needs, such as food, water, or shelter, characterized on the distinct levels of needs that vary from visceral, unconscious need to command-driven expression of the need. Cole conceptualized the information need as a black box, with the context motivating the query for the IS, using the problem and task as input, and the HIB as the output that motivates the information search, information seeking, and information use. The information need motivates the adaptation mechanism with survival imperative and existential imperative, seeking for meaning to support both imperatives (COLE, 2011). Taylor (1968) proposed a theory to explain the information need and conceived that it starts at the deepest level of human cognition, the unconscious level of visceral information need. In the first level, the inquirer has superficial knowledge about the need, and the translation of the need to search expression represents the most complex activity. Next, in the second level the user gets conscious about the information need, but in an ill-defined area of ambiguity and uncertainty. The third level allows the inquirer to describe the need in concrete terms and qualify the question in rational statements, and the IS use is the primary constraint, exploring the necessary resources to fill the knowledge gap. In the fourth and last level, the user commands the IS using well-defined terms to get the specific data (TALOR, 1968). The recognition of gaps in the state of knowledge stimulates the search for information to fills the gap (CHOO, 2006). The user goals and values combined with problems and tasks drive the gap filling process. The uncertainty and confusion states generated by the information stimuli are the critical point for the information need process, in which the user does not know the information she or he needs to search (KUHLTHAU, 1993; TAYLOR, 1968). For context characterized by high information stimulus, the user may take more time to move from confusion and

frustration to sense of direction toward the information seeking and use, but she/he will eventually seek for the information once the need to know is a cognitive need (SIMON, 1971; CASE et al., 2005). Therefore, we propose:

Proposition 4 (P4): The information need is related with the information seeking.

5.3.4 Information Seeking

Information seeking is the process of purposively seek for information due to the stimulus to perform a task, solve a problem, or react to some environmental disturb. The information need drives the information seeking as described in the previous session. The information stimulus creates cognitive engagement when it arrives at the working memory and stays accessing long-term memory schemata, creating and/or modifying the knowledge structure. Kuhlthau (1993) proposed the most accepted model of information seeking, which she initially called information search process, describing six stages to seek information and the impact on cognitive, affective and physical actions. The described processes were an initiation, selection, exploration, formulation, collection, and presentation in which the user feel, think, and act in different ways, depending on the initial stimulus that enacted the seeking behavior. During these processes, the user determines the type of information retrieval system she/he will employ to seek the information. The user chooses the information source and selects the best result based on the level of anxiety and satisficing (BAWDEN and ROBINSON, 2009). The satisficing is defined as a process “through which an individual decides when an alternative approach or solution is sufficient to meet the individuals’ desired goals rather than pursue the perfect approach” (Simon, 1971 p. 71). Satisficing is a heuristic way of coping with the elevated information stimuli environment to determine the sufficient amount of information necessary to complete a task or solve the problem (BAWDEN and ROBINSON, 2009). The satisficing feeling is manifested when the user has enough information to achieve her/his goal. The information seeking is the initial step for the knowledge formation that takes place during the information use process, storing new information in the long-term memory and creating or updating the schemata or mental models (COLE, 2011). Therefore, we propose:

Proposition 5 (P5): The information seeking is related with the information use.

5.3.5 Information Use

The information use performs a complex cognitive activity to retrieve preexisting knowledge about a topic and interact with the stimuli from the environment (COLE, 2011). The cognitive activity modifies the individual's knowledge structure to create new frames or schemata or modify the current one present in the memory. The environmental stimuli interact with preexisting knowledge about a subject and modify the structure, schemata, frames, or mental models. The information use activities encompasses acts of reading, thinking, note-taking and other actions (physical and mental) the users perform to work with information (Wilson, 1999; Todd, 1999). The elements that influence the human cognitive system during the information use are the information resources, computational resources, interfaces, query characteristics, user knowledge, situation, and environment (SARACEVIC, 1996). The elements enact adaptation behavior, where the user issue commands and interact with the output at the cognitive level to assess the utility of the response of the query. Therefore, the user, the system, and the task are essential elements of the information processing (BARKI et al., 2007). On the user level, the cognitive styles influence the information processing in distinct manners and depend on the person's personality to act and react to information stimuli (CHOO, 2006). The system conceptualization "includes social structures, practices, and communities that exist for sharing and disseminating information" (CHOO, 2006, p. 31) and the states of real-world systems (the faithful representation) perceived by the user (BURTON-JONES and GRANGE, 2013). Conway (1968) explains that "organizations which design systems (…) are constrained to produce designs which are copies of the communication structures of these organizations" (p. 31). In this sense, systems design is fundamental on the map the real-world representation of the company structure on the virtual world to map the reality with the cognitive representation. Finally, the task or problem motivates the information use in which the human information processing leads to change of the individual's knowledge (CHOO, 2006).

5.4 Methodology

The methodology to support this research was based in qualitative interviews to investigate relationship between the dimensions and the propositions. We employed a qualitative research approach thru an inductive process to discover new information about the phenomenon (MYERS and NEWMAN, 2007; VENKATESH et al., 2016). The characteristics of the information workers interviewed are presented in table 9. The next sections describe the procedures.

5.4.1 Data Collection

We adopted a semi-structured interview approach for the data collection. The target population of the research was corporate information workers that use multiple digital technologies, such as laptops, smartphones, tablets, social media, analytics systems, CRM, email, and other applications that generate information stimuli, and work inside and outside of the organization premises. During the pretest, the researchers interviewed three Ph.D. candidates for face and content validity and wording check. The researchers interviewed 20 information workers at a large technology corporation subsidiary. The interviewees worked at different divisions in the company: sales, marketing, and technology services. Most interviews were face-to-face in meeting rooms inside the organization premises, while two participants responded questions by phone. The interviews were recorded and transcribed for data analysis. The semi-structured protocol is available in Appendix A.

Table 9 – Interviewee's Characteristics

AGE		GENDER		LEVEL OF EDUCATION		DIVISION		JOB TENURE	
21-30	40%	Female	45%	Bachelor's degree	55%	Sales	65%	01-10	50%
31-40	35%					Marketing	25%	11-20	20%
41-50	20%	Male	55%	Post-graduate degree	45%	Technology Services	10%	21-30	20%
51-60	5%							31-40	10%

Source: Prepared by the author

5.4.2 Data Analysis and Code Development

The qualitative data was analyzed with NVivo 12 that helped to organize the coding structure and data reduction process (BAZELEY and JACKSON, 2013). The researchers used previous literature to formulate the semi-structured protocol (Appendix A). The elements that guided the first level of data coding is presented in table 49.

Table 10 – Protocol Structure

THEORETICAL STRUCTURE	CONSTRUCT	VARIABLE	AUTHOR(S)
Information Stimulus	Information Diversity	Number of factors	Iselin (1989); Duncan (1972)
		Number of components	
	Information Load	Volume of information stimulus	Jackson and Farzaneh (2012)
		Information volume	
Information Behavior	Information Need	Visceral information need	Cole (2011); Taylor (1968)
		Uncertainty	Choo (2006)
		Knowledge gap	Dervin (2003)
	Information Seeking	Information source	Wilson (1999)
		Information search	Cole (2011)
		Satisficing	Simon (1971); Bawden and Robinson (2009)
		Stimuli influence on *satisficing*	
	Information Use	Knowledge level	Cole (2011)
		Affective characteristics	Choo (2006); Stein et al. (2015)
		Cognitive factors	Choo (2006); Cole (2011)

Source: Prepared by the author

The coding process started with the elements identified in the literature and presented in table 49. Employing a blend of inductive and deductive approaches (GRAEBNER et al., 2012), the views of the information workers were critically evaluated about the influence of the information stimulus on HIB. The semi-structured interviews were analyzed with the initial coding based on the literature to provide insights for the additional code development based on interview data. In this sense, the coding was based on literature-driven and data-driven approaches (FEREDAY and MUIR-COCHRANE, 2006; DECUIR-GUNBY et al. 2011). The approaches require separate procedures for create codes. Decuir-Gunby et al. 2011 recommended a three-steps procedure: (1) generate the code; (2) review and revise the code in context of the data; and (3) determine the reliability of coders and the code. The authors also

suggested five steps to inductively create codes: (1) reduce raw information; (2) identify subsample themes; (3) compare themes across subsamples; (4) create codes; and (5) determine reliability of codes. These approaches were employed during the coding process, that is, the literature-driven first was used to organize the data in different dimensions identified during the literature review, next review, revise, and determine the reliability of the data collected. Next, the data-driven approach was analyzed using the five steps described previously. The coded generated from data analysis were compared and discussed. An iterative coding process was adopted until all coding structure were formulated. The complete coding generated is available on table 11.

Table 11 – Codebook Exported (continue)

NAME	REFERENCES
Information Stimulus	0
Information Diversity	0
Number of Apps	52
Number of Devices	20
Information Load	0
Information Volume	37
Complex reasoning	1
Dynamic reading	2
Focus	18
Information Avoidance	5
Information Orgainzation	10
Information Summarization	1
Information value	1
Multitasking	7
Task Priority	7
Tools to organize information	9
Volume of Information Stimulus	25
Attention Protection (Stimuli control)	11
Benefical Stimuli	7
Continuous Information	3
Disturbing stimuli	5
Loss of Productivity	4
Multitasking	4
Stimuli accustom (Get used to the stimuli)	4
Stimuli avoidance (Information avoidance)	11
Stimuli generate productivity	5
Task priority	7

Source: Prepared by the author

Table 11 – Codebook Exported (continue)

NAME	REFERENCES
Information Behavior	0
Information Need	0
Viceral Information Need	27
Annoyance	7
Anxiety	13
Curiosity	1
Maturity	2
Self-Control	7
Uncertainty	21
Anxiety	1
Communication Velocity	1
Curiosity	2
Difficult to focus	1
Fear of unknown	1
Insecurity	2
Need of to prioritize	5
Unconfortable feeling	4
Knowledge gap	20
Begin information seeking	12
Focus	1
Helpful information	1
Information Literacy	2
Information Seeking	0
Information source	20
People	14
Reliability of the information source	5
Technology	23
Information search	20
Avoidance	3
Indiference	5
Information usefulness	2
Learning	5
Loss of focus	6
Satisficing	20
Capacity to teach the information	6
Consult other sources	3
Enough information	6
Perception	12
Script to search information	3
Standard of perfection	2
Time available	1
Validate the knowledge	1
Stimuli influence on satisficing	22
Arouse of information need	3
Confusion	2
Disturbance	5
Help	5
Incapacity to complete the task	2
Indiference	5
Interrupt task	1
New iteration	2
Reduce external stimuli	1

Source: Prepared by the author

Table 11 – Codebook Exported (final)

NAME	REFERENCES
Information Use	0
Knowledge level	26
Change knowledge	6
Increase knowledge	18
Narrow Knowledge	2
Practical knowledge	5
Useless information	1
Affective engagement	39
Anxiety	5
Change priority	10
Hedonic feeling	1
Level of fatigue	2
Negative feeling	8
Sense of security	6
Type of stimulus	7
Cognitive aspects	40
Content	5
Happiness	2
Help	3
Keep focus	6
Lose focus	9
Negative perception of evolution	3
Positive perception of evolution	13
Purposive information use	1

Source: Prepared by the author

5.5 Results

5.5.1Information Stimulus

The first two questions of the protocol asked the number of devices and the number and type of apps used during the working hours. We estimated the level of the information diversity using the index of complexity developed by Duncan (1972). It is a simple equation computing the number of decision factors and the number of components. Duncan defined the number of decision factors (F) as physical factors internal or external to the organization. The number of components (C) are the distinct information sources inside the decision factors. The complexity factor is calculated by the number of factors (apps) times the squared number of components (devices): (F) x (C)2. Using the data of the first two questions (average of 8.8 apps per user; 2.6 devices per user), this generated a complexity index of 59.49, which is an extraordinarily complex environment due to the dissimilar nature of factors. The

information diversity reported by the users prejudice the ability to use information adequately and perform tasks continuously. Once we identified the high level of information diversity and stimuli, we analyzed the information load.

The volume of information stimulus was investigated to determine the impact of information load on cognitive system. The information load relates with individual's information processing capacity in an inverted-U curve in which information underload happens on the left side of the inverted-U curve and represents information processing below the cognitive capacity, and overload happens on the right side of the curve and is the cognitive overcapacity (HWANG and LIN, 1999). We questioned the interviewees about the amount of information stimuli they get in the workplace. Stimuli avoidance behavior emerged strongly along to the response of interviewees, explaining the strategies employed to avoid the stimuli. The interviewee 18 said he disabled the notifications, including new emails to focus on daily tasks:

> I deactivated everything including email [notification]. I receive the more instant message, Skype mainly. The WhatsApp has some limiters as to the groups; I blocked everything in working hours, I set the [notification to] do not disturb. (Interviewee 18)

The interviewee 11 reported that he realized a productivity decline due to the number of alerts and resolved by "turning off everything," keeping only the warnings of the relevant apps that required immediate action. The stimulus avoidance closely relates to the attention protection and the need to control the stimuli received. For instance, the interviewee 04 explained she/he disabled all notifications due to the distraction and the time consumption, changing the behavior to look at the app only when she/he wanted. On the other side, many interviewees mentioned the stimulus negatively influenced their ability to prioritize the task. The interviewee 01 described the confusion of having new emails with tasks while performing another task and the difficult to choose which one to prioritize. In the same sense, interviewees 13 and 15 mentioned the notification helped to remember some essential tasks to deliver on time but, sometimes, the information stimuli changed the priority of tasks they defined at the beginning of the day.

The information workers were asked about the strategies to process massive quantities of information. Several interviewees reported they need focus to handle

large information volume. The interviewee 06 told that “if I need to interact with data and create from them, I try to work in a focused model, that is, I [am talking] about the airplane mode or offline to focus only on those data and try to extract information from them”. Another strategy employed was to organize the information using tools and technology. For instance, interviewee 05 explained that she/he uses filters and some technology to divide and learn from the information received. The tools to organize the information played a significant role to work with the data. The interviewee 09 said, “I invest much time in transform the noise, the disconnected information, in something simple to use with modern tools”. This report finds relevance on Bawden and Robinson (2009), which explain the importance of critical thinking to control the anxiety generated by too much information. The information pathologies influence the HIB, which results in “information that is distorted, manipulated, or not shared, used, or read” (WESSEL et al. 2017, p. 24). The phenomena were evident when interviewees reported the disturbance stimuli and complex reasoning necessary to organize the information use.

An important characteristic present on interviews were the need to control the information stimuli to maintain focus. This is an evidence on the influence of information stimuli on the information need. The interviewees reported the need to control the level of stimuli to avoid more need for information. The reports of the interviewees about the complex environment, the need to turn off the devices, apps and change the place, and the high Duncan’s index of complexity are evidences of the high level of information stimuli reported by the information workers. In a technology company where the labor nature involves the processing of information, the level of information stimuli seems to influence the capacity to prioritize tasks, maintain the attention and keep a level of control, and generated confusion and stress, employing multitasking to handle the daily activities. These reports suggest the support for P1 and P2.

5.5.2 Human Information Behavior

The visceral information need, uncertainty, and knowledge gap represents the information need. The visceral information need is the unconscious information need in which the user cannot specify the need for information retrieval system (COLE, 2011). Anxiety, annoyance, self-control, curiosity, and maturity were the five subcategories emerged. Most of the users reported anxiety as the dominant feeling

during the information need process. The interviewee 17 said “the first feeling is, if I do not answer or look at this now, something terrible can happen. I think we are more and more in an immediate business; everybody is literally within our reach and in the palm of the hand. […] Anxiety is a good word”. The interviewee 03 reported the uncomfortable feeling of stop the current task due to some stimulus, but the influence of curiosity and anxiety: “it is a mixture of what you want to do with that discomfort of getting out of what you are doing, it bothers me, but curiosity and anxiety is greater”. Both situations emphasize the role of visceral information need as the deepest level of motivation to change the current task. Uncertainty dimension analysis generated eight new subcategories, including need to prioritize, uncomfortable feeling, insecurity, curiosity, anxiety, difficult to focus, communication velocity, and fear of unknown. As an example of the need to prioritize due to the uncertainty, the interviewee 08 said: “I stop and try to reanalyze what is more priority and try to reprioritize from there, but I stop”. The interviewee 06 made a similar report but using the alternative to write on paper the tasks that need to be done to reduce the uncertainty: “you get stuck, so the moment I decide to do [the task], when I have a lot to do, a lot going on, I write down”. Every time a new stimulus arrives, the uncertainty interrupts the current task due to uncomfortable feeling, anxiety, and curiosity. For instance, interviewee 14 explained the anger for do not check the new stimulus: “I have things being developed with clients that I need to close and then I do not know if that number that is calling me can be about a negotiation that I need answers and not answering makes me angry”. Four new subcategories were created to represent the knowledge gap: begin information seeking, information literacy, focus, and helpful information. The largest exampled category is the begin information seeking. The interviewee 17 explained that “if something comes up that is a new subject or something that I was not prepared or was not mapped to, it gives me some discomfort because I have to go back and see what it was before I answer”. The interviewee 05 explained the “ah-ha moment” to start seeking the information: “you get some news that you say: ‘stop’; or whatever you hear there, you think: ‘I do not understand anything of this, I need to research, I need to understand’”, confirming that the knowledge gap enacted new processes of information seeking. The observation of the behaviors reported by the information workers, like discomfort, anger, the need to stop something to seek something new, strongly suggest that the information need generates the new information seeking behavior.

The high level of information stimuli, in fact, influence the information need and affects information seeking or enact new seeking processes, suggesting the support for P4.

Four dimensions comprise the information seeking process: information source, information search, satisficing, and stimuli influence on satisficing. The interviewees related the information source with three material subcategories, such as technology, people, and reliability of the information source. Many interviewees informed the first information source was the technology, followed by peers, coworkers, and people that know the information, and some demonstrated concerns about the reliability of the information. Interviewee 09 said that “the most important source of information for my business, as a salesperson, are the people”. The interviewee 07 reported the need to use company generated data to act:

> We use a lot in the profession the company indicators. For example, we have a tool that indicates how much the company or our client is active in social media. Then it speaks how many times [the company] was mentioned in the social media because it was mentioned that has to do with the news of that company. So, to meet the customer today, I am opening the [tool] (Interviewee 07).

It was common for many interviewees to report the influence of both technology and people to information search. Wilson (1999) emphasizes the difference between information seeking and search: search comprises the information seeking and represents the interaction with the system. Analyzing the information search behavior, it resulted in five new subcategories, including loss of focus, learning, indifference, avoidance, and information usefulness. Loss of focus was the most cited situation in which the users explained that if they receive a stimulus during the information seeking, it influences the process. The interviewee 17 reported the influence of the stimuli on the information search, saying: “I think they might end up delaying. So maybe if you can focus on a thing, the search for information without being stimulated, not to say embarrassed, by these external factors, I think you could get even faster or even a collection of knowledge that was more fixed”. Interviewee 15 explained negative impact of the stimuli by summarizing that “the more stimuli I receive, the more I will want to seek information”. Satisficing represents the feeling of the user to meet the individuals’ desired goals regarding information seeking (SIMON, 1971). Eight new subcategories emerged, including perception, capacity to teach others, enough information, script to

search information, the standard of perfection, consulting other sources, time available, and validate the knowledge. The interviewee 09 detailed that the satisficing “it is kind of instinctive, this does not have a methodology, for me it is kind of unconscious. I read it, and it satisfied me, and I already get an opinion about it”. Other interviewees related their capacity to teach or explain the subject to validate their knowledge and generate the satisficing. Interviewee 03 said that “if I feel comfortable explaining it to you is because I have enough knowledge with me”. However, when asked about the influence of stimuli on the satisficing, the interviewees reported confusion, disturbance, interruption of the task, the arouse of information need, and the need to perform new information seeking. For instance, interviewee 15 summarized the feeling, saying:

> “I think it messes up. I already had several situations that the customer, in the case, asked one thing and I asked internally. It turned me a huge text, then [this answer] will generate more doubt, it will generate other questions that is not what the customer wants to know. I think that many times less is more, so I go in the line of less, but always attending what the person asked without generating more things in the head of the person that can generate doubts” (Interviewee 15).

Interviewee 05 complained about the influence of external stimuli during the execution of the task, explaining “it will mess up because you get lost and cannot give depth to what you wanted”. The interviewee 06 demonstrated anger when asked about the influence of the stimuli, explaining that “the stimuli tend to remove your deliverable, you do not deliver. […] You never deliver what you need to do, so the stimulus normally prevents the conclusion”. These findings strengthen the support for P5 by confirming that if information workers face constant information seeking, they are unable to use the information in a state of flow and conclude the task, an adverse effect on the information use.

The information use dimension was analyzed regarding knowledge level, affective characteristics, and cognitive aspects. When asked about their perception of the knowledge level during the information use, the information workers reported situations they felt their knowledge increased, changed, limited and had the opportunity to learn from practice. The perception of increasing knowledge while using the information was consensus around the interviewees. The interviewee 02 reported that

“if there is something recurrent that I know I already worked, it gets easy”. Interviewee 04 explained the need to increase the knowledge to talk to customers about some industry trend, stating that “it aggregates value, I had to learn to be able to talk [to the customer] at least at a basic level. Any level above this I request a specialist”. Commenting the situation that changed her or his knowledge, interviewee 05 explained: “the guy was with me in the room and he said: ‘man, this speech is perfect’. I was presenting to him and he, unintentionally, said three things that I thought it was cool, so this is something that people like to hear or will find different. So now I use that on my speech, I incorporate it”. Some interviewees reported the practice helped them to increase their knowledge, like interviewee 12, reporting that “I think that you learn if you search and execute. It has no use just to search and not execute. I think the practice will lead you to learn”. Some interviewees reported the anxiety feeling about the stimuli, like the interviewee 06 explained the lack of stimuli generates anxiety: “if it takes much time getting nothing on WhatsApp, you think it is strange. It is a struggle between the conscious and unconscious. It is very difficult to focus on the final [objective]”. The cognitive aspects asked about the perception of task evolution for the information workers, and the majority of interviewees reported the positive perception of evolution but warned the threat of the information stimuli. Interviewee 09 said, “the notion of progress can be compromised, not always when the external stimulus exists”. Interviewee 06 explained that “I realized [progress] when I do not have stimuli because I can focus, and it is difficult you get out of the inertia and there is a lot going on”. Many information workers explained they lose focus during the execution of an activity. As explained the interviewee 04: “if I have an interruption, I will lose [my line of] reasoning. […] By the time I get back, I will have to take two steps back and revisit what I have already taken from knowledge”. The reports strengthen the support of knowledge level, affective characteristics, and cognitive factors on information use.

5.6 Discussion

Our research aims to investigate the influence of information stimulus on the HIB during the use of multiple systems. First, we identified the cognitive processes of HIB, which were information need, information seeking, and information use. We also described the factors that encompass these processes and analyzed how they

influence the individual behavior in the organizational setting. Second, we conceptualized the information stimuli, the context and the situation in which the individuals interact while using their devices and apps. We found in the extant literature the influence of information load on HIB processes, and we conceptualized information diversity and cognitive absorption as factors that influence the HIB. We evaluated the proposed conceptualization by interviewing information workers in a large technology corporation subsidiary, obtaining the confirmation of identified factors. The interviews analysis confirmed the support of the propositions evaluated, presenting consistency to identify the HIB during the use of multiple systems. Precisely, we found that the high information load and information diversity influences the capacity of the information workers to determine their information need, their ability to seek for specific information, and the usage of information while performing a task. The individuals receive too many diverse information that influenced their cognitive capacity and HIB.

The use of multiple systems to perform personal and working tasks is a regular practice among the information workers in the organizational settings. The recognition of the negative influence of these systems on the HIB was expressed in behaviors such as the need to focus, the strategies to prioritize tasks, the development of self-control, and the level of anxiety. Many information workers adopted unexpected behaviors to cope with information density found in the corporate environment, like changing the workplace or reducing the level of stimulus during execution of the complex task. At the same time, the information workers recognize their responsibility for bringing and using multiple devices and consciously turned off the notifications to reduce the level of stimulus. The limited cognitive capacity prevents the individuals to process all information they receive, resulting in decreasing job performance and decision quality. For example, many information workers reported multitasking as a strategy to cope with the volume of information but complained about the difficult to complete a task. The human memory can process a limited amount of information, and the tentative to work with the diverse and high volume of information, with reduced cognitive absorption, influence negatively information use.

We introduced a novice approach to investigate the actual use behavior during the consumption of information. The IS research area seldom evaluated the resultant behavior during the use of information as a dependent variable. Thus, we highlight the importance to develop studies with HIB concepts when studying system use, adoption,

and post-adoption. For example, analyzing how the use of information influence the post-adoption of an IS can provide a better explanation that motivates the system use. One can hypothesize that the presence of information in an IS motivates the user to adopt utilitarian and hedonic systems. On the system use side, it can be conceptualize the use of social network due to the presence of information about family, friends, and celebrities, motivating the information seeking.

This research provides four theoretical contributions. First, our research makes significant contributions to the development and evaluation of an exhaustive conceptualization of the HIB processes applied to IS research. Second, we analyzed the influence of information stimulus using two dimensions during the use of multiple systems. Therefore, we provided a stronger model when evaluating the influence of the cognitive load on the individuals. Third, our research contributes to a novice approach to evaluate information as a dependent variable. The investigation of information artifact is a critical research area once the information is the product of the systems. Forth, we provided a research model and the validation of the propositions for the IS literature, highlighting and confirming the dimensions employed in an exploratory study using HIB concepts.

For practitioners, the findings highlight the importance of design in two ways. First, the system design of the user interface should consider visual elements to protect the individuals' cognitive capabilities. Precisely, the amount of information presented during activities that require elevated cognitive load should privilege the individual focus and the task objective. For instance, apps designed for reading and studying in tablets or smartphones may advise the user to turn off the system notifications to do not interrupt the state of flow. Second, organizations should consider the elements to design workplaces. This includes the workplace planning with focus areas to allow the development of activities that require a high cognitive activity. The holistic experience provided by the cognitive absorption depends on a reduced level of information stimuli. Consequently, organizations that depend on the information capacity of their workers should invest in appropriate spaces to allow both the development of collaborative work, such as open workplaces, and individual focused work, like focus rooms. In doing so, the organizations provide the environments for the development of immersive activities, positively impacting the individual performance.

5.7 Limitations and Future Research

This research analyzed the influence of information stimulus on the HIB processes. The results emphasize the need for additional research evaluating the influence of high information load and diversity and the negative cognitive absorption on the individual's performance. With a better comprehension of these factors, future research may expand the current model and evaluate additional variables such as individual performance. Precisely, future research can analyze the influence of information stimuli on the performance and quality of the decision making. Additionally, there are opportunities to explore other information views of the taxonomy developed by McKinney and Yoos (2010). There are opportunities to explore information characteristics views, such as token, syntax, representation, and adaptation, with the consequent implication on IS factors. Finally, the current paper developed a cognitive model of HIB. Our data demonstrated some affective traits during the interviewees, what open opportunity to explore affective characteristics on future research.

Notwithstanding, this research presents some limitations. First, the research was performed in a technology corporation subsidiary with information workers. The generalization of the results is limited to this population, and further studies should explore the influence of information stimulus on a larger population. Second, our research interviewed information workers about their practices with information, limiting the results by the interviewee's memory and bias. Precisely, we investigated the user behavior in an organization, what could make the user report behaviors better than the practiced. Third, additional empirical validation can strengthen the results observed in this study. Finally, this is the starting point for the HIB research using an exploratory approach in IS field.

5.8 Conclusion

This research advances our comprehension about the influence of information stimulus on the HIB during the use of multiple devices. We conceptualized the information stimuli and HIB processes, operationalizing the cognitive model to analyze the user behavior. By developing such model, this paper provides a fundamental for the emerging study of information in the IS literature. We provide a new model to the

IS literature, contributing to the academic community. Additionally, practitioners can leverage this model to improve systems design and create a productive environment.

Appendix A: Interview Protocol

1. How many digital devices do you use daily between computers and mobile devices?
2. When you start your work activities, what software or applications do you use?
3. During your work tasks, do you get many notifications or stimuli from digital devices? How do you influence your work?
4. While performing work tasks using digital devices, can you block distracting stimuli? How you do it?
5. When you use an application or system at work that generates a lot of information, how do you handle the volume of information?
6. During your work activities, can you be completely immersed in the task you are doing?
7. During your work activities using technology, do you lose your attention easily?
8. Imagine that you are performing a task and receive notification that you need to look at what it is. What are your thoughts and feelings?
9. How does the volume or quantity of stimuli of their devices influence the level of uncertainty during the execution of a task? Do you realize that this uncertainty generates a need for information?
10. When you receive a stimulus or notification, do you feel a knowledge gap? Do you consciously realize the need for information?
11. When you need to perform a task, what sources of information do you use to get information?
12. Do information stimuli influence information-seeking actions?
13. How do you realize you have searched for enough information to accomplish a task?
14. Do informational stimuli influence the limit of information search?
15. While using information to accomplish a task, do you notice a change in your level of knowledge? Can you give an example?
16. When you receive a stimulus, do you see a change in your intentions, motivations, feelings, or urgency while using information to solve a task? Can you give an example?

17. While using information to accomplish a task, do you realize that you are evolving with the task or solving a problem? How do the stimuli influence your perception?

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6 ARTICLE 3: WHEN WE NEED TO KNOW EVERYTHING: THE IMPACT OF INFORMATION STIMULI ON THE HUMAN INFORMATION BEHAVIOR

Abstract

The innovation in digital technologies, such as social media, apps, and mobile devices, has created new information sources that overwhelm the human cognition with stimuli. These stimuli sent through technology (i.e., notifications, alerts, messages) occur when the users receive alerts on their devices (i.e., smartphones, laptops) from various apps that generate information and may divert their attention. The need to know effect is manifested on the human obsession to read every piece of information received despite its utility. The stimulus that contains information evokes cognitive process and may affect the human information behavior (HIB). However, the current cognitive research in information systems is limited to the isolated consideration of the specific types of behaviors in the computer-mediated context. Thus, the objective of this research is to investigate the impact of information stimuli generated by the digital technologies on the HIB. The information stimuli and HIB were conceptualized, and a new scale was developed. The paper presents results from a quantitative survey performed with 565 information workers that use multiple digital technologies. The results were analyzed with PLS-based Structural Equations Modeling. The results indicate an elevated impact of information stimuli on the HIB and provide insights for researchers and practitioners.

Keywords: Human Information Behavior, Information Stimuli, Cognitive Aspects, Digital Technology.

6.1 Introduction

The innovation in digital technologies, such as social media, apps, and mobile devices, has created new information sources that overwhelm the human cognition with stimuli. These stimuli sent through technology (i.e., notifications, alerts, and messages) occur when the users receive alerts on their devices (i.e., smartphones and laptops) from various apps that generate information and may divert their attention. The stimulus that contains information evokes cognitive process portrayed as the need to know effect that captures the user attention during a given period of time (MASLOW, 1963). Simon (1971) described the need to know effect as deciding what information to know, store, and learn. The need to know effect is manifested on the human obsession to read every piece of information received despite its utility (SIMON, 1971). The low information processing cost resulted in an explosive volume of data processed, increasing dramatically the information stimulus presented to the users. Hence, the use of multiple digital technologies, represented by mobile devices and apps, causes the information stimulus that may divert the user attention and activate cognitive processes that affect the user behavior, leading to the consumption of the content to know, learn, and store the information.

The behavioral studies in the Management Information Systems (MIS) field have been exploring cognitive theories to explain the effects of information systems (IS) artifacts on human behavior. Davern et al. (2012) postulate that “cognitive research in IS explores the interactions between cognition and context that influence behaviors and outcomes in the development and use of IS” (p. 274). Some researchers investigated the effect of the stimuli on the user behavior, employing cognitive and psychological models (i.e., TAM and HO, 2006; ZHANG, 2000; LEE at al., 2012; DENG and POOLE, 2010; ADDAS and PINSONNEAULT, 2018). However, the current cognitive research is limited to the isolated consideration of the specific types of behaviors in the computer-mediated context (HEMMER and HEINZL, 2011). The influence of the information and the cognitive processes has received little attention from the extant literature (MCKINNEY and YOOS, 2010). To expand the current research and understand the impact of information stimuli, we employed Human Information Behavior (HIB) as a frame of reference to predict and explain the behavioral phenomena. The HIB literature was developed in the Information Science

field and is defined as “the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use” (WILSON, 2000, p. 49). The HIB has provided major and important contributions to the study of human behavior while interacting with information, describing the conceptual processes and stages that influence the acquisition and processing of information (HEMMER and HEINZL, 2011). However, besides its importance, the HIB model seldom was measured with quantitative research.

The investigation of the information effect is important once the use of information seems to imply cognitive activities of some nature (DAVERN et al., 2012). The use of information allows the sharing of meaning during the use of an IS, representing an objective reality about internal and external objects to the user (MCKINNEY and YOOS, 2010). The information use is related with the cognitive processes tied to the knowledge formation, which interact with long-term and working memories, and with the sensorial register that receives the stimuli responsible for starting the cognitive information retrieval process (ATKINSON and SHIFFRIN, 1968; JONG, 2009). Therefore, this research focused on the development of a cognitive model to explain the relationship between cognitive processes and user behavior.

We propose the investigation of the impact of information stimuli in the HIB. To contribute to the development cognitive IS research, the question that guides this paper is: What is the impact of the use of multiple digital technologies on the human information behavior? Specifically, our objective is to investigate the impact of information stimuli generated by the digital technologies on the HIB. Furthermore, we aim to analyze the new HIB scenario where the information is widely available to every user due to the ubiquity of digital technologies in everyday life (SPINK and COLE, 2006). To achieve this objective and answer the research question, we developed a quantitative model, operationalizing five latent variables that allowed the observation of the phenomena.

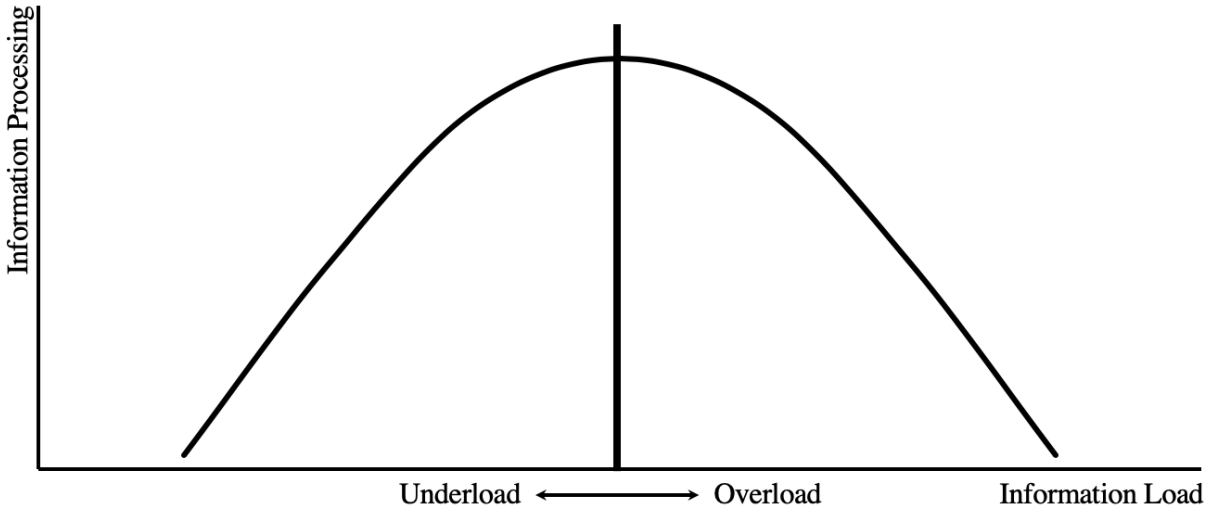
The research draws on the literature field of MIS, social psychology, and Information Science, relating management and cognitive processes. The paper presents results from a quantitative survey performed with 565 information workers that use multiple digital technologies, analyzed with PLS-based Structural Equations Modeling (SEM). The results indicate an elevated impact of information stimuli on the human information behavior and provide insights for researchers and practitioners.

6.2 Theoretical Background

6.2.1 Information Stimuli

The information stimuli are a phenomenon that resulted from the use of digital technologies (mobile devices and apps executed on these devices). The digital technologies are a source of information stimulus, while the user is the agent receiving the stimuli. The difference between the information stimuli and the simple sensorial stimuli is its content. In both types of stimuli, they are received in the human brain by the sensorial register in which the five human senses are stimulated, but the information stimuli interact mainly with three senses (sight, hearing, and touch). Once an information stimulus arrives at the sensorial register, its content facilitates the recall of schemata from long-term and working memory due to the need to know effect (ATKINSON and SHIFFRIN, 1968; MASLOW, 1963; SIMON, 1971; CASE et al., 2005). Since most of the information is processed on the working memory, the expected consequence of a large amount of information stimuli is the cognitive load. The cognitive load model postulates that cognitive activities, such as learning, are hampered when the learning task exceed the working memory capacity (JONG, 2009). Simon (1971) discussed the impact of information overload due to the scarce attention available, explaining that an information processing system (i.e., computer) can reduce the demand for attention as long as it absorbs (or process) more information than it produces. However, the stimuli complexity is the major factor that influences user behavior (DUNCAN, 1972). For instance, in the case of web stimuli complexity, the number of links, number of graphics, homepage length, and animation influence the information complexity perception (GEISSLER et al., 2001). This result is in line with previous psychological research developed by Miller (1956) that asserts that the human information processing capacity is limited by seven, plus or minus two chunks of information at the time. Duncan (1972) also demonstrated that the number of factor and components (i.e., the source of information and number of sources) determine the level of complexity analyzing the information. The cognitive processing capacity can be summarized in an inverted U-curve, that is, the information processing capacity is optimal by a certain point, and suboptimal after this point (HWANG and LIN, 1999), as illustrated in figure 9.

Figure 9 – Relationship Between Information Processing and Information Load



Source: Hwang and Lin (1999)

Hence, we argue that the use of multiple digital technologies exposes the users to information stimuli that generate the elevated cognitive load. We propose to measure the effect of information stimuli on the cognitive load with two latent variables: information diversity and information load (figure 9). The information diversity represents the number of distinct or unrelated types of information received in a given time (ISELIN, 1989). For instance, when the information worker is using his smartphone, she/he can receive notifications from different apps, such as instant messages from family and friends, financial data about the use of her/his credit card from the mobile banking app, emails from the company, and so on. Duncan (1972) relates the large numbers of unrelated information sources used with the higher complexity for decision making. The empirical studies sustain that the information overload effect occurs when the individual receives approximately ten items of information, and the higher the information diversity, the larger the information overload (ISELIN, 1988). Thus, the information diversity may represent an effect of information stimuli on the human cognitive system.

The information load is related to the information processing capacity of an individual (JACKSON and FARZANEH, 2012; HWANG and LIN, 1999; SIMON, 1971). The human information processing capacity decreases after a certain amount of information load, represented in the central inflection point on the inverted U-curve

(figure 9) (Hwang and Lin, 1999). The overload on information processing is caused by the quantity of information available for consumption of individuals and is responsible for many problems that affect the effectiveness, and even the health, of information workers (BAWDEN and ROBINSON, 2009). Therefore, we postulate that information load is a latent variable that allows the measurement of the effect of information stimuli on the cognitive system.

6.2.2 Human Information Behavior

The human information behavior model presents three cognitive processes that self-define it: information need, information seeking, and information use (CASE, 2007; CHOO, 2006; WILSON, 2000). The information need is the fundamental behavior and the motivation of the information seeking and use. The ex-ante information need is a perception motivated by different levels of consciousness that range from an unconscious expression of the need to a level of conscious expression of the need (HEMMER and HEINZL, 2011). Cole (2011) positions information need as the starting point that affects the user behavior in a continuous learning process about that need, so in next iterations of the similar need, the individual can formally express the information need. The information stimuli influence the information need once the need to know the effect is motivated by a constant necessity to know, learn, and store information (SIMON, 1971; MASLOW, 1963; CASE et al., 2005).

The output of the information need is the information seeking to find the necessary information that motivated the need. The information seeking is the purposive, indirect, and semi-direct seek of information as the outcome of a need to satisfy a goal (WILSON, 2000; COURTRIGHT, 2007; KUHLTHAU, 1993; TAYLOR, 1968). During the information seeking process, the user interacts with the IS to search for the information necessary to accomplish an objective (COLE, 2011). Some authors argue that information seeking, as the entire HIB model, changed due to the availability of information in everyday life. Spink and Cole (2006) explain that “the information seeking approach has been challenged by the everyday life information seeking approach that includes more consideration of human sense-making behaviors and more nonacademic and less-formal information seeking behaviors” (p. 27). In the context analyzed in this research, the information seeking occurs in response to an

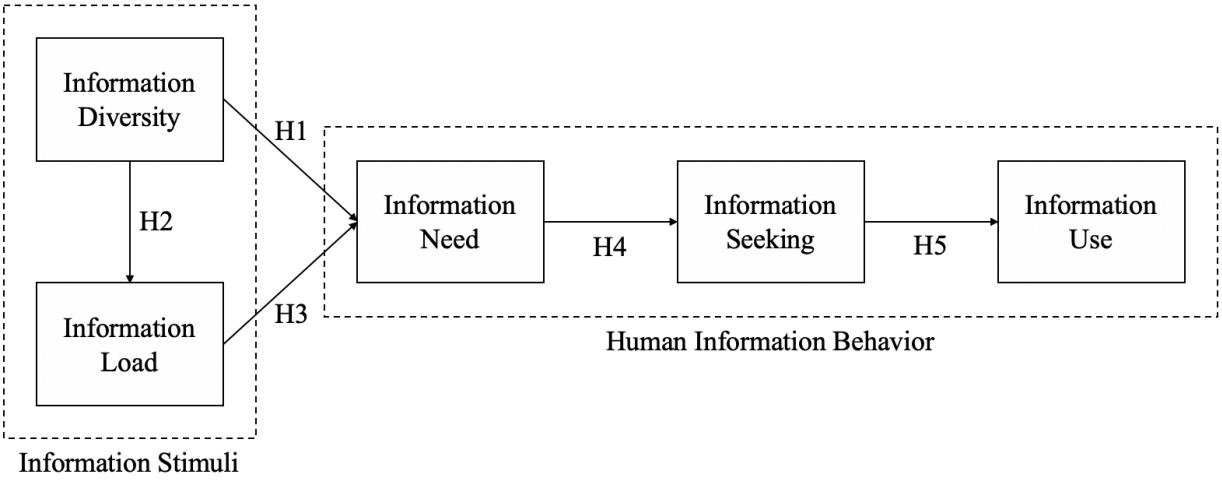
information stimulus and the individual uses the digital technology to retrieve the information. The user may continue the information seeking process until she/he achieve the satisficing feeling, which is a heuristic way of coping, just taking enough information to meet a need (BAWDEN and ROBINSON, 2009).

The information use process happens during the execution of an action to incorporate that information (COLE, 2011). The interaction and, eventually, the incorporation of new information into the person's existing knowledge base happens during the information use process (WILSON, 1999). That is, the knowing, learning, and storing phase of the need to know effect takes place in the information use process (SPINK and COLE, 2006; SIMON, 1971). In the context of the present research, the information use occurs seamless to the person perception, as the other cognitive processes – that is, these are discrete cognitive processes that people perform automatically and do not think about it unless questioned. The information use is the most important process though once it is associated with the learning and storing of such information (CHOO, 2006; COLE, 2011).

6.3 Research Model and Hypotheses

The research and empirical model with the proposed hypotheses is illustrated in figure 10. The model was formulated to represent the relationship of the latent variables conceptualized on the previous section. The objective of this research is to investigate the impact of information stimuli generated by the digital technologies on the HIB. The conceptualization of information stimuli was developed considering the cognitive load generated on individuals, being observed by the information diversity and information load constructs.

Figure 10 – Research and Empirical Model



Source: Prepared by the author

The HIB is observed with the information need, information seeking, and information use processes that take place discreetly on the human memory and control process systems (ATKINSON and SHIFFRIN, 1968). Therefore, the main hypotheses of the relationship between information stimuli and HIB are established in section 5.2. To measure the effect of the constructs, the following hypotheses were developed:

Hypothesis 1 (H1): The Information Diversity negatively impacts the Information Need.
Hypothesis 2 (H2): The Information Diversity positively impacts the Information Load.
Hypothesis 3 (H3): The Information Load positively impacts the Information Need.
Hypothesis 4 (H4): The Information Need positively impacts the Information Seeking.
Hypothesis 5 (H5): The Information Seeking positively impacts the Information Use.

While H1, H2, and H3 were developed in previous research (i.e., ISELIN, 1989; BAWDEN and ROBINSON, 2009; HWANG and LIN, 1999), none of them were measured with HIB model. Likewise, the H4 and H5 relationships have theoretical and qualitative research but do not present tradition with quantitative research approach. Due to the limitation on previous research, the positive and negative paths were hypothesized following the literature. The only hypothesized negative relationship was H1 between information diversity and information need for two reasons. First, Iselin (1988; 1989) found the negative relationship of information diversity on decision making and influence on the information perception overload. Duncan (1972)

conceptualized that a large number of information sources increase the decision-making complexity. Considering that information need is the first and an ex-ante process of the HIB model, we hypothesized that a large number of unrelated sources of information would disturb the individual to determine the information need. Therefore, the negative path was posited in the model.

The H2 path is evident in the few studies that investigated information diversity. Iselin (1989) states that “the higher the information diversity, the larger was the information overload diversity effect” (p. 163). However, the H3 positive path deserves some analysis. The information load represents the quantity of information processed in a given time (JACKSON and FARZANEH, 2012). The individuals will seek information until they face the satisficing feeling, that is, take enough information to meet the need (BAWDEN and ROBINSON, 2009). Hence, we posit that H2 will result in a positive relationship.

Finally, the H4 and H5 are the internal paths among the HIB constructs. While their relationships are discussed in the previous section and in the Information Science field, it is important to highlight the positive path hypothesized. Once HIB is a continuous process, the need to know effect reinforce the iteration, that is, information need lead to information seeking, and information seeking to information use (COURTRIGHT, 2007). Thus, we hypothesized a positive relationship between H4 and H5.

6.4 Method

The research was developed following a pragmatic-positivist paradigm to measure the relationship among the constructs (ORLIKOWSKI and BAROUDI, 1991). The survey items were developed using the literature and previous research to formulate the survey. Hence, we developed an exploratory study that aims to search for patterns in the data collected to understand the relationship among variables (HAIR et al. 2017).

The questionnaire contained 34 indicators divided into five constructs. The items were developed specifically for this research. Table 12 presents the constructs and the concise definition that guided the item development (complete questionnaire is on Appendix A). We followed partially the scale development procedures of MacKenzie et

Table 12 – Theoretical Structure, Constructs, and Elements

Theoretical Structure	Construct	Concise Definition	Source
Information Stimuli	Information Diversity	Information diversity is the number of independent or unrelated variables in an information set provided to the user in a given period of time.	Iselin (1989), Hwang and Lin (1999), Duncan (1972)
	Information Load	Information load is the amount of information stored in the persons working memory that may influence the information processing capacity.	Bawden and Robison (2009), Jackson and Farzaneh (2012)
Information Behavior	Information Need	The information need is the perception of knowledge gap by the user about a subject that creates a cognitive need.	Cole (2011), Taylor (1968), Choo (2006)
	Information Seeking	Information seeking represents the acts that the user employs to seek for the information as a consequence of a cognitive need.	Wilson (1999), Cole (2011), Bawden and Robinson (2009)
	Information Use	The information use encompasses the acts of reading, thinking, note-taking, and other actions (physical and mental) that the users take to work with information toward knowledge formation.	Cole (2011), Choo (2006), Spink and Cole (2006)

Source: Prepared by the author

al. (2011) and the instrument validation procedures of Koufteros (1999), as well as Hair et al. (2017) for the measurement mode validation and path analysis. Four constructs were measured with reflective indicators and one construct (information seeking) with formative indicators.

During the conceptualization, it is important to analyze the relationship between the item and the construct. The constructs can be designed with formative or reflective indicators, representing the conceptual definition of the construct (MACKENZIE et al., 2011). Reflective and formative indicators have different measurement philosophies (HAIR et al. 2017). The causal indicators cause the latent variable and can be fully measured using a set of reflective, interchangeable, and highly correlated indicators. The causality flows from the latent variable to the indicators, and each indicator is viewed as an imperfect reflection of the latent variable (MACKENZIE et al. 2011). The composite indicators form the latent variable using the most important elements that explain a specific aspect of the construct domain, determining the meaning of the construct (HAIR et al. 2017). The indicator content and construct conceptualization determine the way that the construct and indicators are linked. To develop the scale, reflective and formative indicators were used to define the latent variables.

The Information Seeking construct was specified as formative once it describes five independents causes of the construct with low correlation among the indicators. The information seeking is the most evident process in the HIB framework once the information workers perform visible actions to seek for information (CASE, 2007). Information seeking is defined as the acts that the user employs to seek for the information as a consequence of a cognitive need (WILSON, 1999; COLE, 2011; BAWDEN and ROBINSON, 2009). The literature of Information Seeking has content and conceptualization that form the construct, which suggests this construct may be a candidate for the use of sub-dimensions of the formative specification (CHOO, 2005). To validate the formative construct, the content validity must be established, capturing the major facets of the construct (HAIR et al., 2017). This step was performed during the scale development phase (Appendix A), and due to the different facets identified (five), this construct was specified as formative (table 13).

Table 13 – Information Seeking Subdimensions

ITEM	QUESTION	DIMENSION AND AUTHOR(S)
Seek01	When I seek for information to complete a task and receive information stimuli, I seek for more information than necessary.	Satisficing (Bawden and Robinson 2009; Simon 1971)
Seek02	When I seek for information to complete a task and receive information stimuli, I seek enough information.	Satisficing (Bawden and Robinson 2009; Simon 1971)
Seek03	When I seek for information to complete a task and receive information stimuli, I seek good enough information.	Satisficing (Bawden and Robinson 2009; Simon 1971)
Seek04	When I seek for information to complete a task and receive information stimuli, I find enough information.	Satisficing (Bawden and Robinson 2009; Simon 1971)
Seek05	When I seek for information to complete a task and receive information stimuli, I receive too much information.	Passive information load (Bawden and Robinson 2009)
Seek06	When I seek for information to complete a task and receive information stimuli, I use my apps to seek for information.	App usage (developed)
Seek07	When I seek for information to complete a task and receive information stimuli, I keep my focus when I seek for information.	Loss of focus (developed)
Seek08	When I seek for information to complete a task and receive information stimuli, I reduce my anxiety when I seek for information.	Information Search - Anxiety (developed)
Seek09	When I seek for information to complete a task and receive information stimuli, I increase my happiness when I seek for information.	Information Search – Happiness (developed)

Source: Prepared by the author

In formative constructs, the number of indicators limits the maximum outer weights in $1/\sqrt{x}$ ratio, where x is the number of indicators (HAIR et al., 2017). In this scenario, the maximum outer weight with eight indicators is 0.354 (some indicators have higher values because indicators with some degree of correlation share the outer weight as explained by Hair et al. (2017). The construct was elaborated considering five different dimensions divided in eight indicators to represent the general actions that the information workers perform to seek for information while receive information stimuli. As such, one challenge is to develop a scale that represent this process. This challenge justifies its specification of the construct as a formative where each indicator captures specific aspects of the domain with little overlap among indicators (HAIR et al., 2017).

The survey was applied to information workers in multiple companies. The researchers sent 5941 emails to information workers of multiple companies. The email contained the invitation letter, describing the purpose of the survey and link to access the survey in the Qualtrics platform. The total of 971 people accessed the survey in the platform and 565 completely answered the questions. The response rate was 9,5%, and the response-item ratio was 16:1. The female participation was 23,7%, and the male response was 76,3% (0,8% reported as non-binary or did not want to inform). The larger average age was between 35 and 44 years old that represented 45% of the respondents, and 91% of the respondents are in the labor market for 11 years or more. The employment status was 86,5% as a full-time employee, while 48,8% of the respondents reported having completed the master's degree, 40,9% reported as bachelor's degree, and 3,7% asserted to have completed the doctoral degree.

The scale was developed during three phases, following the recommendations of MacKenzie et al. (2011). First, the literature review was used to guide the development of a large database with items based on each construct. This first scale had 99 items in total. Second, the scale was reviewed with three academics and three senior information workers for content validity, and they helped to reduce the scale to 55 indicators. The third phase was the pretest in which two pretests were conducted. The first pretest was applied using an online tool to under graduation students, collecting 56 complete questionnaires. We analyzed the data with Factor Exploratory Analysis, KMO, Bartlett, and Cronbach's Alpha (KOUFTEROS, 1999). We examined the psychometric properties of the scale, evaluating its convergent, discriminant and

nomological validity (MACKENZIE et al., 2011) using two statistical packages: SPSS version 24 and SmartPLS 3 (RINGLE et al., 2015). The first pretest provided several insights for refinement of the instrument, and the number of indicators was reduced to 34 items due to the identification of overlaps and inconsistencies. The second pretest was conducted with information workers using the Qualtrics platforms and validated with the same procedures. A sample of 91 respondents was used to validate the scale. Finally, the survey was distributed to 5941 information workers, obtaining 565 complete questionnaires. In addition to the 34 indicators, 07 demographic control questions were included in the survey to gather information about gender, age range, time in the labor market, education, employment status, industry, and job position. The data were examined for missing data, suspicious response patterns (straight lining or inconsistent answers), and outliers (HAIR et al., 2017). The analysis helped to identify 71 cases that represented extreme situations and were removed from the sample. The final sample analyzed contained 491 cases.

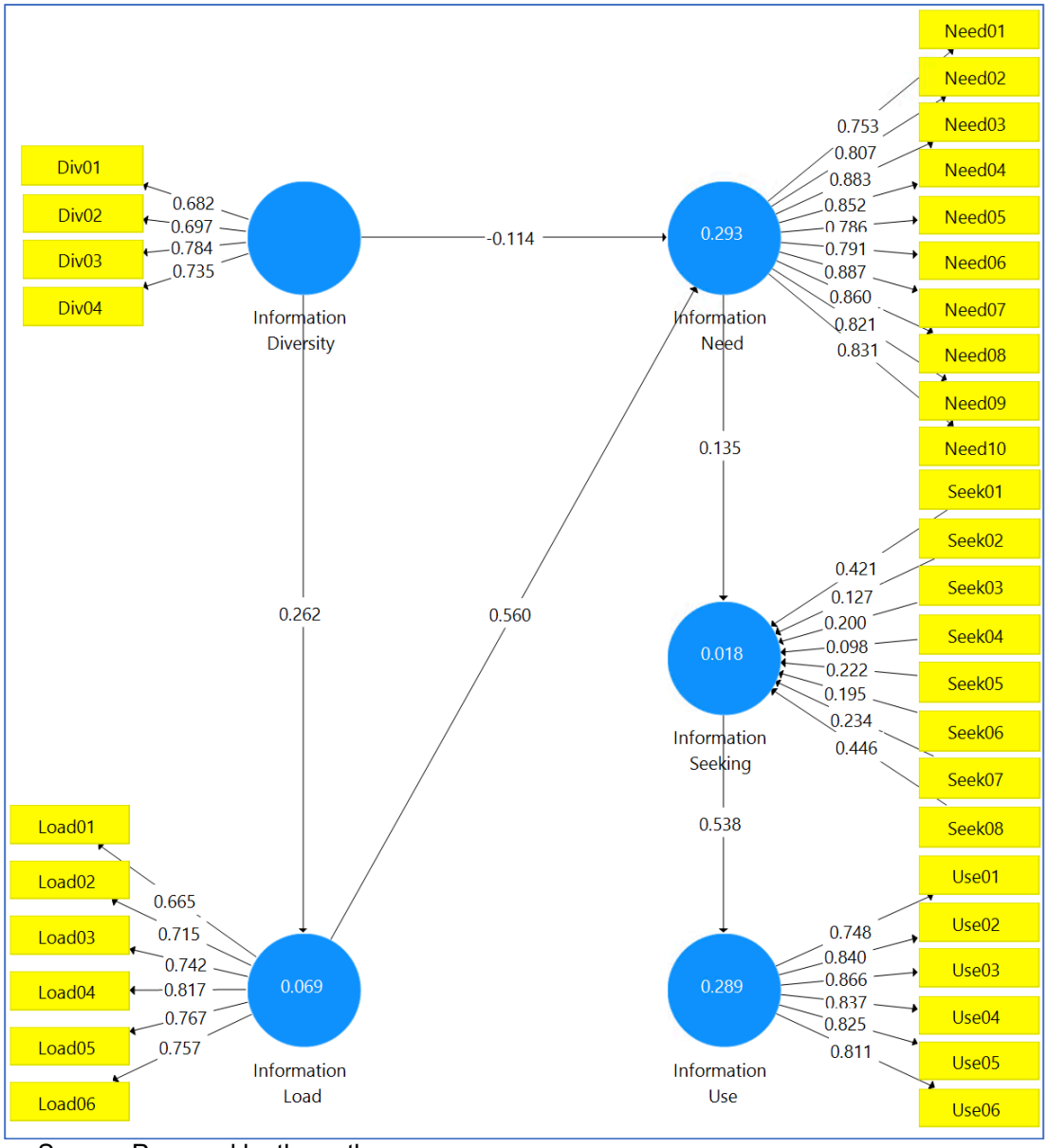
6.5 Data Analyses

The data analyses were divided into two steps following the Hair et al. (2017) protocol. First, the measurement model was evaluated to test the relationship between constructs and their correspondent items variables. Second, the structural model was specified to describe the relationship between constructs.

6.5.1 Measurement Model

The measure model validation aims to explain the relationship between the indicator's variables and the latent variables (HAIR et al., 2017). The empirical model is composed of five latent variables and 34 indicators. Four latent variables were specified with the reflective construct and one with the formative construct. Figure 11 presents the measurement model.

Figure 11 – Measurement Model



Source: Prepared by the author

The convergent validity for reflective constructs was validated thru indicator reliability, Cronbach's Alpha, average variance extracted, and composite reliability. The discriminant validated was established thru three methods: cross-loadings examination, Fornell-Larcker criterion, and heterotrait-monotrait ratio (HTMT) assessment. For the formative construct, the collinearity issues were assessed.

The first assessment on convergent validity was the indicator reliability by examining the outer loadings for reflexive indicators. The outer loadings should be higher than 0.708 for consistency. Three reflective indicators presented values below

the threshold: DIV04 (0.699), LOAD01 (0.644), and LOAD02 (0.700). In the three cases, there was no compromise on other indices (AVE and CR), and the indicators were retained. Hair et al. (2017) explain that in social sciences studies and development of new scales, moderate outer loadings are expected and acceptable. The Cronbach's Alpha (CA), average variance extracted (AVE), and composite reliability (CR) for the measurement model were evaluated (table 14).

Table 14 – Measurement Model Evaluation for Reflective Constructs

Construct	CA	CR	AVE	ID	IL	IN	IS	IU
Information Diversity (ID)	0.703	0.816	0.526	**0.726**				
Information Load (IL)	0.839	0.882	0.555	0.262	**0.745**			
Information Need (IN)	0.949	0.956	0.686	0.033	0.530	**0.828**		
Information Seeking (IS)	--	--	--	0.268	0.273	0.137	**--**	
Information Use (IU)	0.903	0.926	0.675	0.255	0.159	-0.038	0.603	**0.822**

Source: Prepared by the author

The AVE must be above 0.500, which was achieved for all the reflective constructs. The CA and CR are indices for the model reliability, and both should be above 0.700 for the reflective model. The results were satisfactory as can be observed in table 14. Next, the discriminant validity was evaluated using the cross-loadings method, which consists in analyzing if an indicator has higher outer loading in other constructs than their own. The cross-loading test established the discriminant validity once each indicator presented the higher loading on its own construct. The next test was the Fornell-Larcker criterion, which compares the root square of AVE and with the correlations of the constructs (table 14). This criterion also established the discriminant validity. Finally, the HTMT assessment is used as an additional test for PLS-SEM. The test consists in to examine the values closer to 1.000 of the HTMT table, which could indicate a lack of discriminant validity. As indicated in table 15, no values were close to 1.000.

Table 15 – Heterotrait-Monotrait Ratio (HTMT) Assessment

Construct	ID	IL	IN	IU
Information Diversity (ID)	**1.000**			
Information Load (IL)	0.344	**1.000**		
Information Need (IN)	0.066	0.584	**1.000**	
Information Use (IS)	0.321	0.192	0.054	**1.000**

Source: Prepared by the author

The Information Seeking construct was specified as formative once it describes five independents causes of the construct with low correlation among the indicators. To validate the formative construct, the content validity must be established, capturing the major facets of the construct (HAIR et al., 2017). This step was performed during the scale development phase, and due to the different facets identified (five), this construct was specified as formative. The collinearity was assessed to identify redundant indicators, which can compromise the weight estimation and statistical significance of the indicators. The variance inflation factor (VIF) was investigated for values above 4.000, but there are no values over the threshold, reporting value below than 2.000.

6.5.2 Structural Model and Hypotheses Testing

The structural model was evaluated regarding its predictive capabilities and relationship among constructs for hypotheses testing (HAIR et al., 2017). The predictive capabilities were tested with the coefficient of determination R^2, the effect size f^2, and the predictive relevance Q^2 thru the blindfolding procedure. The results are presented in table 16.

The coefficient of determination R^2 is a measure that represents in-sample predictive power. While there is no threshold for evaluation, for behavioral studies 0.20 can be considered high (HAIR et al., 2017). The index on the endogenous variable (Information Use) was satisfactory, explaining 36,3% of the variance. The effect size f^2 represents the change in the R^2 when an endogenous variable is omitted from the model. Guidelines for evaluating f^2 are that values of 0.02, 0.15, and 0.35 represent small, medium, and large effects of the exogenous construct, respectively. The index for the endogenous variable was satisfactory (0.570). Finally, the Stone-Geisser's Q^2

Table 16 – Coefficient of Determination R2, Effect Size f 2, and Predictive Relevance Q2

Construct	Pearson R^2	Cohen (f^2)	Stone-Geisser (Q^2)
Information Load	0.069	0.074	0.036
Information Need	0.293	0.430	0.185
Information Seeking	0.019	0.019	0.002
Information Use	0.363	0.570	0.225

Source: Prepared by the author

measure is an indicator of the model's out-of-sample predictive power or predictive relevance (HAIR et al. 2017). Q^2 values larger than 0 suggest that the model has predictive relevance for the endogenous construct, which is the case besides Information Seeking that present value slight above than 0.

Once the measurement model and predictive capabilities presented positive results regarding the model quality, the Bootstrapping procedure was performed to test the structural model relationships (table 17).

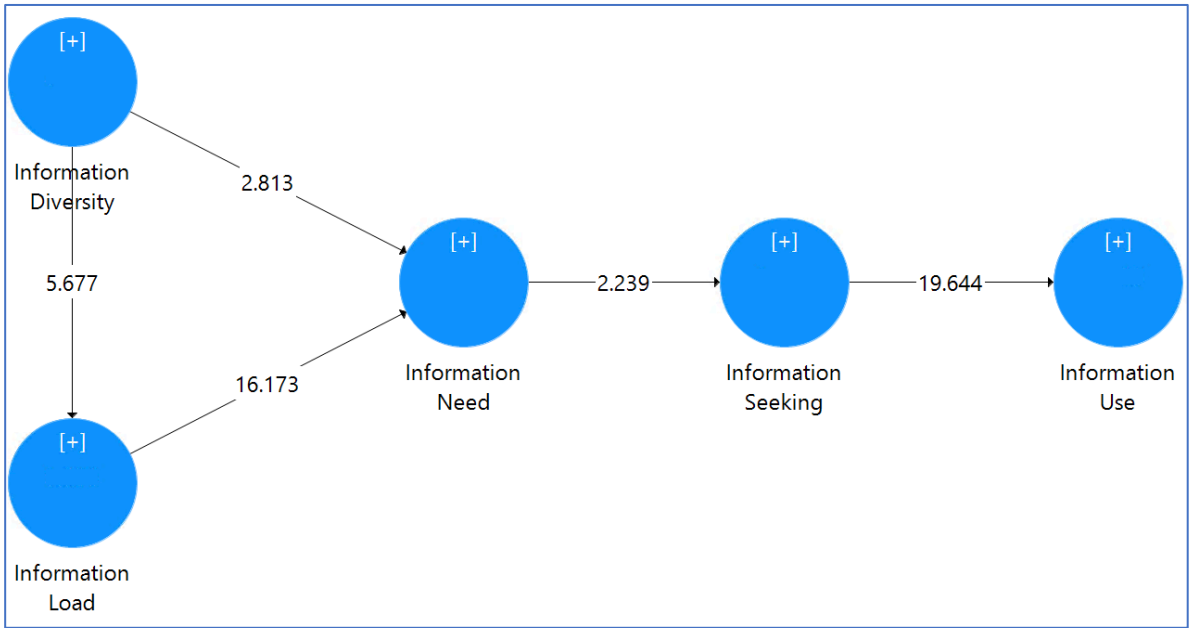
Table 17 – Evaluation of Significance and Relevance of the Structural Model Relationships

Relationship Direction	Original Sample	Standard Deviation	T Statistics
Information Diversity -> Information Load	0.262	0.046	5.677
Information Diversity -> Information Need	-0.113	0.040	2.813
Information Load -> Information Need	0.560	0.035	16.173
Information Need -> Information Seeking	0.137	0.061	2.239
Information Seeking -> Information Use	0.603	0.031	19.644

Source: Prepared by the author

The structural paths coefficients represent the hypothesized relationships between constructs. The minimum T-value for empirical support is 1.96 with the significance level of 0.05. The tests demonstrated support for the relationship between the constructs. Figure 12 presents the hypothesized paths.

Figure 12 – Structural Model



Source: Prepared by the author

The analysis in table 18 demonstrate the support for all hypotheses developed on the model. Next to the result, the significance level was reported. The implications of the results are discussed in section 5.6.

Table 18 – Hypotheses Evaluation

#	Hypothesis	Result
H1	The Information Diversity negatively impacts the Information Need.	Supported ($p < 0.005$)
H2	The Information Diversity positively impacts the Information Load.	Supported ($p < 0.000$)
H3	The Information Load positively impacts the Information Need.	Supported ($p < 0.000$)
H4	The Information Need positively impacts the Information Seeking.	Supported ($p < 0.025$)
H5	The Information Seeking positively impacts the Information Use.	Supported ($p < 0.000$)

Source: Prepared by the author

6.6 Discussion

The objective of this research was to investigate the impact of information stimuli generated by the digital technologies on the HIB and analyze the new HIB scenario where the information is widely available to the user due to the ubiquity of digital

technologies. The conceptualization of information stimuli and HIB was developed to support the model design. The model was validated with a survey responded by 565 information workers to test the hypotheses and observe the phenomena. The five hypotheses were supported, and the consequences of this study are discussed in this section.

The information diversity and information load were conceptualized to represent the information stimuli effect on the human cognitive system. The cognitive load results from the consumption of information widely available thru digital technologies and the limited human information processing capacity (JONG, 2009). The information stimuli easily activate the memory system due to the need to know effect and the schemata (mental model) retrieval that happens at the cognitive level (ATKINSON and SHIFFRIN, 1968; MASLOW, 1963; SIMON, 1971; CASE et al., 2005). The results suggested that information diversity negatively impacted the information need (total effect of -0.113) and positively impacted the information load (total effect of 0.262). An important finding was the strong positive impact of information load on the information need (total effect of 0.560), which suggest that the information load effectively generate the need to know effect and starts the processes to seek and use the information. The information need is an ambiguous, unconscious, and complex process that was captured with perception and feeling questions (survey available in Appendix A), resulting in a strong and unidimensional construct. The negative path between information diversity and information need suggests that number and the level of independence of the information source increase the difficulty to determine the information need. In real life, the information workers that use multiple digital technologies (i.e., mobile devices and apps) face a higher diversity in the information sources and may increase the complexity to define their priorities, complete tasks, and create a consistent routine as they are vulnerated to all sort of information stimuli. The secondary outcome of the information diversity is the increase of information load that bring more information to sensorial register and increase the cognitive load. The test of this relationship contributes to previous research of Iselin (1988), which performed experimental research between information diversity and overload. The three hypotheses (H1, H2, and H3) demonstrated that an information worker might face a strong impact on her/his daily life due to the amount of information stimuli absorbed.

The relationships between information need and information seeking (H4), and information seeking and information use (H5) were also supported. The effect size of the information need on the information seeking (total effect of 0.137) was moderate and suggests that not all the information need result in the information seeking actions. The measurement the information seeking required the use of formative scale and presented interesting results, with various outer weights and outer loadings reporting moderate effect (figure 12 portraits the outer weights). In formative constructs, the number of indicators limits the maximum outer weights in $1/\sqrt{x}$ ratio, where x is the number of indicators (HAIR et al., 2017). In this scenario, the maximum outer weight with eight indicators is 0.354 (some indicators have higher values because indicators with some degree of correlation share the outer weight as explained by Hair et al. (2017). The construct was elaborated considering five different dimensions divided in eight indicators to represent the general actions that the information workers perform to seek for information while receive information stimuli. The information seeking is the most evident process in the HIB framework once the information workers perform visible actions to seek for information (CASE, 2007). As such, one challenge is to develop a scale that represent this process. This challenge justifies its specification of the construct as a formative where each indicator captures specific aspects of the domain with little overlap among indicators (HAIR et al., 2017). Therefore, the support of H4 represent an important finding of this research linking subjective (information need) and objective (information seeking) constructs in the empirical model. The relationship between information seeking and information use (H5) was also supported, resulting in the higher load of the model (total effect of 0.603). The information use represents the processing of information in the working memory and the incorporation of knowledge in the long-term memory (COLE, 2011; CHOO, 2006). During the use of multiple digital technologies, the information workers may face a large usage of information, which does not reflect specifically in the storage of that information in the long-term memory. Nevertheless, the technology also provides mechanisms to help the users on the management of information consumed, such as features on web browsers to read some documents later, option to follow up an email later, star an instant message with important information, and so forth. SIMON (1971) explained the trouble that people face to throw away the physical media with information and the need to change the attitudes and culture toward information

storage. In some level, the need to know effect results from the obsession to save the information to read later and is tied to cognitive aspects of people's culture and attitudes. Hence, digital technologies might help on the organization and curation of information based on criteria defined by the information workers using advanced algorithms to select information to present to the individuals. Another important result is the coefficient of determination of information use construct (R^2) that resulted in a variance explained of 36.3%. For new scales and behavioral studies, this result is considered high and provide a level of confidence on the model's predictive power. The strong link between information seeking and information use, therefore, is an important finding of this research once, connecting objective and subjective aspects.

6.6.1 Contributions to Research and Practice

The contributions to research are the development of a new cognitive model, validation of a new scale, and the empirical research on the cognitive aspects of HIB. The new cognitive model was conceptualized with information stimuli and HIB, hypothesizing the impact of information stimuli thru digital technologies on human behavior. The new scale allowed to measure both cognitive aspects and the impact of information stimuli on the everyday life of the information workers. Finally, empirical research with quantitative methods is important to establish a relationship between constructs employing the HIB model.

For practice, two main contributions were to showcase the impact of information stimuli generated by digital technology on the human cognitive system and the importance of the technology's design. The use of digital technologies impacted the people's cognitive system, which opens opportunities for companies to invest in awareness programs about such issue to alert the consequences of constant use of technology. At the same time, the hardware and software industries may incentivize the conscious use of technology, designing systems that help on the focus of tasks and activities.

6.6.2 Limitations and Future Research

The research is subject of some limitations. First, this research was developed with information workers, a specific population that may bias the study while limiting its generalization. Second, the respondents self-reported their behavior on the questionnaire and reported their perception after the fact. While the impact of information stimuli resulted in the use of multiple digital technologies is a daily (or constant) situation, the self-report may limit the generalization of the research.

The future research may explore additional dimensions of information stimuli to capture other cognitive aspects. It can also explore other aspects of information seeking, exploring new dimensions or applying the research to a specific situation. Finally, the model was validated as a first-order model, grouping different subdimension in the constructs. The second-order model can be conceptualized to investigate new constructs and represent specific behavior during HIB.

6.7 Conclusion

With the ubiquity of digital technologies, it becomes critical to understand its impact on human behavior. Our research develops research and empirical model to assess the implications of information stimuli generated by digital technologies for cognitive and behavioral outcomes. We identified the impact of information diversity and information load on the HIB processes that exposes the effects of technology usage. This is an initial attempt to conceptualize the information stimuli, examining their impact on the HIB, and understanding their impact on information need, seeking, and use processes. We hope that new behavioral IS research is developed investigating this phenomenon and that this research stimulates new studies adopting the HIB model.

Appendix A: Survey Items

Instructions: Read the question and select the option that best represents your answer. There is no correct or incorrect answer. Avoid selecting all answer with the same value. Information stimulus represents all stimuli you receive from technology during a typical working day.

Definition: Informational stimuli are the stimuli received through technology (notifications, alerts, messages) with information that demands cognitive attention. Informational stimuli occur when you receive alerts on your smartphone or messages on your laptop from various apps that contain information, generating cognitive activity.

#	QUESTION
Div01	When I am performing my tasks and using my devices, I use diverse information sources.
Div02	When I am performing my tasks and using my devices, I use distinct information sources.
Div03	When I am performing my tasks and using my devices, I use many information sources.
Div04	When I am performing my tasks and using my devices, I use alternative information sources.
Load01	When I am performing my tasks and using my devices, the information load becomes inappropriate due to the information stimuli.
Load02	When I am performing my tasks and using my devices, the information load becomes elevated due to the information stimuli.
Load03	When I am performing my tasks and using my devices, the information load becomes intense due to the information stimuli.
Load04	When I am performing my tasks and using my devices, the information becomes ambiguous due to the information stimuli.
Load05	When I am performing my tasks and using my devices, the information becomes complex due to the information stimuli.
Load06	When I am performing my tasks and using my devices, the information becomes uncertain due to the information stimuli.
Need01	When I need information to complete a task and receive information stimuli, I perceive difficulty to express my information need.
Need02	When I need information to complete a task and receive information stimuli, I perceive dissatisfaction to express my information need.
Need03	When I need information to complete a task and receive information stimuli, I perceive an inability to express my information need.
Need04	When I need information to complete a task and receive information stimuli, I perceive difficulty in determining the words to express my information need.
Need05	When I need information to complete a task and receive information stimuli, I feel lack of knowledge to express my information need.
Need06	When I need information to complete a task and receive information stimuli, I feel the anxiety to express my information need.
Need07	When I need information to complete a task and receive information stimuli, I feel confusion to express my information need.
Need08	When I need information to complete a task and receive information stimuli, I feel doubt to express my information need.

#	QUESTION
Need09	When I need information to complete a task and receive information stimuli, I face barriers to express my information need.
Need10	When I need information to complete a task and receive information stimuli, I face inability to express my information need.
Seek01	When I seek for information to complete a task and receive information stimuli, I seek for more information than necessary.
Seek02	When I seek for information to complete a task and receive information stimuli, I seek enough information.
Seek03	When I seek for information to complete a task and receive information stimuli, I seek good enough information.
Seek04	When I seek for information to complete a task and receive information stimuli, I receive too much information.
Seek05	When I seek for information to complete a task and receive information stimuli, I use my apps to seek for information.
Seek06	When I seek for information to complete a task and receive information stimuli, I keep my focus when I seek for information.
Seek07	When I seek for information to complete a task and receive information stimuli, I reduce my anxiety when I seek for information.
Seek08	When I seek for information to complete a task and receive information stimuli, I increase my happiness when I seek for information.
Use01	When I use the information to complete a task and receive information stimuli, I perceive a change in my level of knowledge.
Use02	When I use the information to complete a task and receive information stimuli, I perceive an increase in my level of knowledge.
Use03	When I use the information to complete a task and receive information stimuli, I perceive the development of practical knowledge.
Use04	When I use the information to complete a task and receive information stimuli, I perceive evolution of tasks while using my knowledge.
Use05	When I use the information to complete a task and receive information stimuli, I perceive focus while using my knowledge.
Use06	When I use the information to complete a task and receive information stimuli, I perceive positive feelings while using my knowledge.

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7 GENERAL CONCLUSION

The objective of the General Conclusion chapter is to provide a general discussion about the doctoral dissertation. The broad objective of this dissertation was to investigate the influence of the informational stimuli mediated by the use of multiple digital technologies on human behavior information. Three articles were developed addressing different aspects of the study (literature review, qualitative research, and quantitative research) and, in addition with the conceptualization developed in the chapter 2, provide a comprehensive overview of the HIB process, the influence of information stimulus on the human behavior mediated by the use of multiple digital technologies, and the new conceptualization, including instrument and research model, to conduct behavioral research on the MIS area.

Chapter 4 (article 1) presents the conceptual model and the literature review that supported the conceptualization of the model. This paper was the first step in the development of this research since it limited the theoretical perspectives and the unit of analyses to conduct the next phases of the research. The information stimulus was conceptualized with three dimensions, and the HIB was included as the dependent variable, which was important in terms of representation since the complete model developed on the other two papers expanded the HIB dimension into its three processes. The HIB was the dependent variable since the selection of this theme for the doctoral research, but the study of this dimension as a “black box” was not possible due to the multipurpose dynamics and different behaviors and outcomes of HIB. This article was important to provide clarity on the research and, additionally, determine the main variables operationalized later on the other two papers.

Article 2 (chapter 5) brings qualitative research developed to study the relationship between the information stimulus and the HIB process (information need, seeking, and use). The model was revised to remove the Information Asymmetry dimension. Also, the transformative technologies conceptualization was simply replaced by digital technologies, feedback provided by the anonymous reviewer on the paper 1. The qualitative research was not completely exploratory once the research model and the propositions were elaborated based on the extant literature. However, the conceptualization of information stimulus and the influence of these stimuli on the cognitive aspects of the information workers, as well as the influence on the HIB was

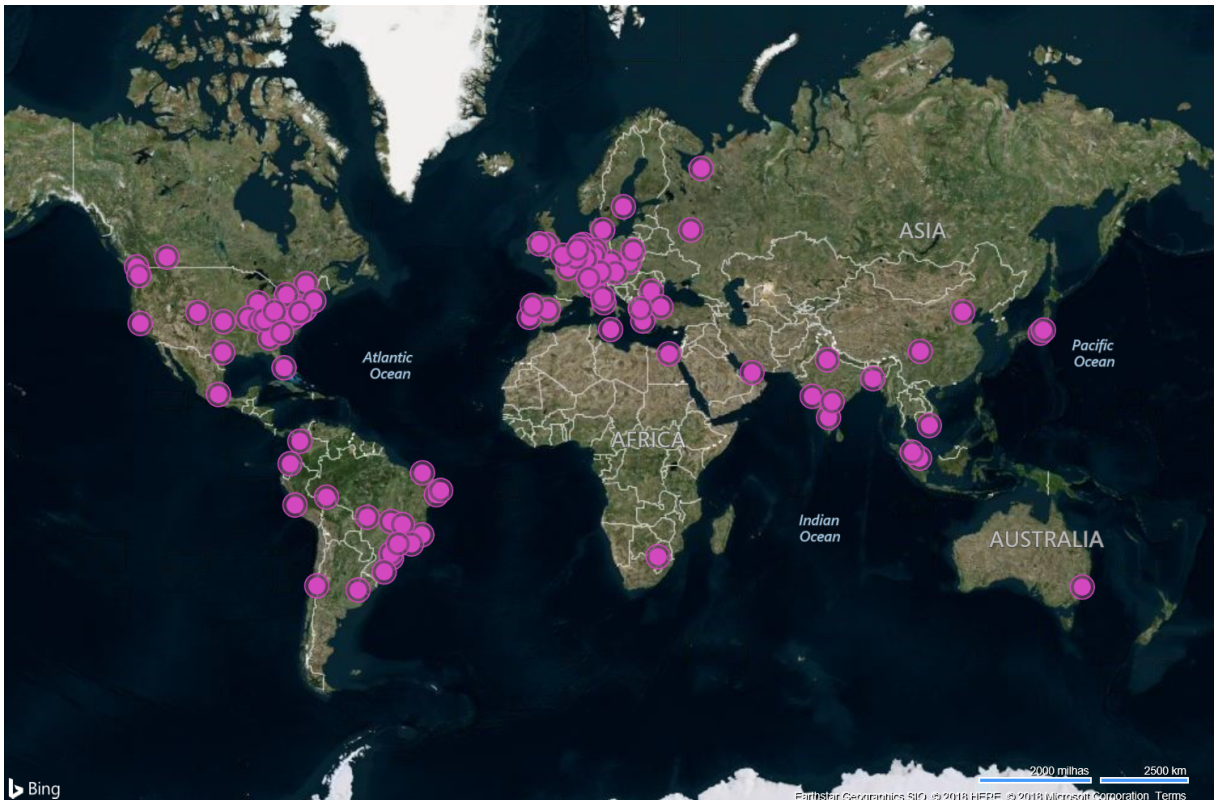
completely new on the HIB and MIS literature. The two major challenges to developing this research was the development of the semi-structured protocol to interview the information workers about their behavior when they received information stimulus. These interviews aimed to collect a self-reported behavior and the questions were about cognitive aspects that influenced the HIB. Nevertheless, a common trait was established after a certain number of interviews (around 10). Independent of the area in the multinational technology company that the information worker acted and the age range, it was possible to observe different strategies to handle the information stimulus, either if they did not think about the term information stimulus itself. The influence of information stimulus due to the use of multiple digital technologies was evident, and the information worker either avoided the stimulus or developed strategies to incorporate as part of their work activities. The information workers also reported the use of strategies for deep focus when the task demanded this level of focus. The information workers also evaluated the influence of information stimulus mediated by the use of multiple digital technologies on the information need, seeking, and use, reporting influence either if they do not mention the information need, seeking, and use itself. In this regards, the only apparent and observable process was the information seeking, which the user performed with the certain level on consciousness, while the other two are related to cognitive and discrete tasks. The information need and use were observed thru the actual behaviors described in table 5 on section 2.4 of the dissertation. Finally, the propositions were analyzed using inductive and deductive processes, and the data coding was based initially based on the literature and, additionally, on the data generated by the interview's analysis (GRAEBNER et al., 2012).

Paper 3 (chapter 6) was the last phase of the research elaborated on this dissertation. The paper 3 used the same conceptualization previously developed on paper 1 and 2, employing the quantitative approach to validate the research model and to test the hypotheses, that were similar to the others proposed on the first two articles. The article 3 brings the Need to Know effect conceptualization that is based on Simon (1971), Maslow (1963), and Case et al. (2005). While this conceptualization is adherent to the information stimulus and HIB previously developed, it helped to put in evidence the human behavior problem to need to consume every piece of information received and, consequently, the potential effect on the use of multiple digital technologies on

the information workers behavior. The HIB theory describes the different influences of information on human behavior in the situation in which the information is actively sought or passively received. The use of multiple digital technologies includes the use of apps that bring different types of information to the user while using one device. A common behavior reported during the qualitative phase was the deviation of original goal during the use of multiple digital technologies due to the interference of other information sources. The challenge on the quantitative phase was to validate a survey with a new scale to measure the impact of the information stimulus on the HIB. The scale was completely created from scratch, adapting and creating new items based on the literature and qualitative data. The challenge was to produce an instrument to observe the information worker behavior and the influence of the information stimulus. The instrument was created and validated in three iterations, the first with a large number of items (99) analyzed by the researcher, the second with 44 items evaluated with pretest, and the third with the final instrument with 34 items (the process for the scale development and data analysis is detailed in Appendix A). The dataset is composed of 565 answers of information workers from multiple companies and countries as observed in figure 13. The final sample used for the model estimation contained 491 answers that represented the phenomenon observed (the outlier's analysis and procedures used to remove the cases are described in Appendix A). The survey represented multiple subdimensions of information stimulus and HIB. The model presented consistent results, as described in article 3 and Appendix A, validating the model and scale.

The main academic contribution of this research is the development of a new conceptualization to investigate the impact of the information on human behavior. First, the research was designed to evaluate the influence of the information on the user behavior, different of previous research that analyzed the influence of an information system, represented by IT artifacts and technologies. While the analysis of the influence of the IT artifact is important, IT is a simple carrier of the information, that ultimately is responsible for the representation and creation of realities. The human brain, which includes the memory system, is an information processing mechanism that executes different behaviors based on the information received. The conceptualization using information as the core component is important to predict and explain the different sorts of human behavior.

Figure 13 –Respondents Geolocation



Source: Bing Maps (2018)

The contributions to the organizations and the practice are to highlight the problems generated by the consume of excessive information. The selection of digital technologies for use in different moments of the day is dilemma recognized during the qualitative research by the information workers. The use of alternatives information sources includes the use of new digital technologies to obtain information about tasks and business developed, as well as to communicate with other people. The problems on the information quality are evident in the last years with the creation social networks that allow the communication between people but may generate effects on the organization while the users are consuming the information during the business hours that, in many times, is unrelated with the professional activities. How to control the information sources and validate its contents? How to designed digital technologies to avoid the propagation of fake news and wrong information? There are many opportunities to evolve the information research to solve problems or side effects of the digital technologies on human behavior. The documentary Do you trust this computer? presents the challenges that are being imposed on societies with the

development of artificial intelligence and technologies such as deep learning. The digital technologies already influence decisively the human behavior for the facilities that they bring to the people's lives. The price the people pay for the use of the facilities of the digital technologies is to provide data which is constantly analyzed to learn about the human habits and behavior, and improve algorithms. In which of the sources of information should the user trust? The dilemma lies in relying on an advanced device or traditional information without knowing the reliability of the information source. This type of situation occurs more frequently as technology advances, and devices become accessible to the individuals, providing new sources of information and creating information overload situation and uncertainty on source reliability.

Daily, information is made available in social media and individuals do not have the concern or the conditions to know if the publication is correct or not. There is also a divergence of information, where two individuals believe that their sources are correct, generating conflicts and discussions about the same situation in which both may contain relevant data. The dilemma at the beginning of the twenty-first century is the vast amount of information available from different sources and the difficulty of legitimizing these sources. As more information is becomning available, more overload and difficulty to determine the criteria to validate these source and complexity for the decision making and judgments. Therefore, the research about the influence of information stimulus on HIB is more relevant with the evolution of digital technologies that may influence the people’s lives.

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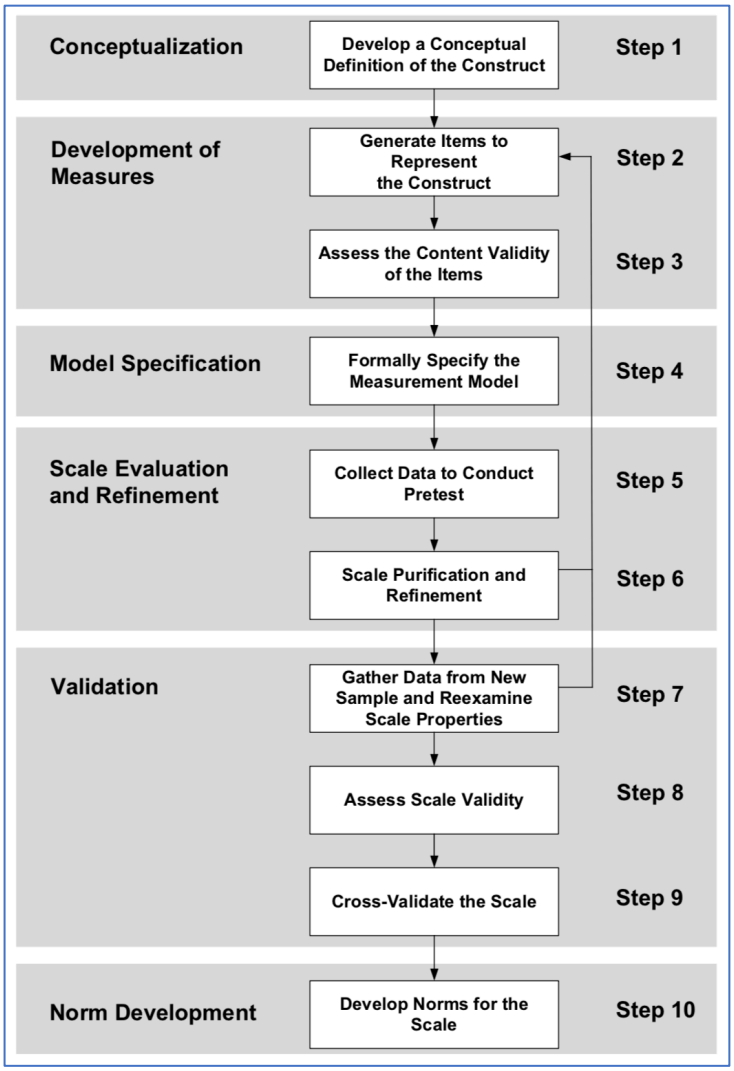
APPENDIX A – METHODOLOGY AND DATA ANALYSIS (ARTICLE 03)

SURVEY INSTRUMENT DESIGN

The survey instrument was designed following the scale development procedures of MacKenzie et al. (2011) and Koufteros (1999) for MIS and behavioral research. The steps are illustrated in figure 14.

Figure 14 – Scale development procedures



Source: MacKenzie et al. (2011)

Besides HIB has a long tradition in the academic research, the scale for the measurement of the core HIB constructs was not available on the literature (i.e.,

information need, seeking, and use), as well as the information load and information diversity. The survey was fully developed from scratch using the literature and qualitative interviews with 23 information workers that guided the scale design. This approach allowed the identification of several macro elements that compose the constructs. Table 19 presents the theoretical structure, the constructs, and the elements.

Table 19 – Theoretical Structure, Constructs, and Elements

THEORETICAL STRUCTURE	CONSTRUCT	DEFINING ELEMENTS	AUTHOR(S)
Information Stimulus	Information Diversity	Number of factors	Duncan (1972); Iselin (1988; 1989); Agarwal and Karahanna (2000)
		Number of components	
	Information Load	Volume of information stimulus	Jackson and Farzaneh (2012); Burton-Jones and Stroub (2006); Bawden and Robinson (2009)
		Information volume	
Information Behavior	Information Need	Visceral information need	Cole (2011); Taylor (1968)
		Uncertainty	Choo (2006)
		Knowledge gap	Dervin (2003)
	Information Seeking	Information source	Wilson (1999)
		Information search	Cole (2011)
		Satisficing	Simon (1971); Bawden and Robinson (2009)
		Stimuli influence on *satisficing*	
	Information Use	Knowledge level	Cole (2011)
		Affective characteristics	Choo (2006); Stein et al. (2015)
		Cognitive factors	Choo (2006); Cole (2011)

Source: Prepared by the author

The steps taken to the development of the scale are described in the next sections. The procedure was adapted to Partial Least Square (PLS)-based Structural Equations Modeling (SEM). Additionally, some steps were modified or skipped due to the limitations justified in each section.

Conceptualization

MacKenzie et al. (2011) recommended four aspects for the conceptualization of the construct, similar to the approaches suggested by Hair et al. (2010), Koufteros (1999) and Churchill (1979). The first is the examination of how the constructs have been used in prior research. The second element is the specification of the conceptual

domain of the construct to identify “the type of *property* the construct represents, and the *entity* to which it applies” (p. 299). The third is the specification of the concept of the construct, describing the necessary and sufficient attributes of the construct as narrowly as possible, combining common characteristics, unique characteristics, and breadth/inclusiveness. Additionally, the conceptualization must include the level of dimensionality (unidimensional or multidimensional) and stability (over time, across situations, across cases). Finally, the fourth element is the use of unambiguous terms to define the construct, providing a clear and concise conceptual definition of the construct to avoid multiple interpretations (MACKENZIE et al. 2011). These elements were considered during the scale design process using both the literature review and the qualitative data collected on the interviews with information workers around the six constructs conceptualized. Table 20 presents the summary of the literature review, using the four elements for the construct conceptualization.

Table 20 – Theoretical Structure, Constructs, and Elements (continue)

CONSTRUCT	NATURE
Information Diversity	**Concise definition** – Information diversity is the number of independent or unrelated variables in an information set provided to the user in a given period of time (Iselin 1989; Hwang and Lin 1999). **Nature** – Entity: user; General property: number of unrelated information variables. **Attributes** • Common attributes: user; information provided over time. • Unique attributes: unrelated variables in an information set. • Dimensionality: unidimensional. • Stability: vary over time, across situations, and across cases.
Information Load	**Concise definition** – Information load is the amount of information stored in the persons working memory that may influence the information processing capacity (Bawden and Robison 2009; Malhotra et al. 1982; Benselin and Ragsdell 2016). **Nature** – Entity: user; General property: the amount of information in the working memory. **Attributes** • Common attributes: user information processing capacity; influence. • Unique attributes: the amount of information stored. • Dimensionality: multidimensional. • Stability: vary over time, across situations, and across cases.

Source: Prepared by the author

Table 20 – Theoretical Structure, Constructs, and Elements (final)

CONSTRUCT	NATURE
Information Need	**Concise definition** – The information need is the perception of knowledge gap by the user about a subject that creates a cognitive need (Cole 2011; Choo 2004). **Nature** – Entity: user; General property: perception of the knowledge gap. **Attributes** • Common attributes: perception of the knowledge gap. • Unique attributes: cognitive need. • Dimensionality: multidimensional. • Stability: vary over time, across situations, and across cases.
Information Seeking	**Concise definition** – Information seeking represents the acts that the user employs to seek for the information as a consequence of a cognitive need (Wilson 2000; Choo 2004). **Nature** – Entity: user; General property: acts to seek for the information. **Attributes** • Common attributes: acts to seek information. • Unique attributes: cognitive need. • Dimensionality: multidimensional. • Stability: vary over time, across situations, and across cases.
Information Use	**Concise definition** – The information use encompasses the acts of reading, thinking, note-taking, and other actions (physical and mental) that the users take to work with information toward knowledge formation (Cole 2011; Barki et al. 2007; Choo 2006). **Nature** – Entity: user; General property: acts toward knowledge formation. **Attributes** • Common attributes: physical and mental acts. • Unique attributes: knowledge formation. • Dimensionality: multidimensional. • Stability: vary over time, across situations, and across cases.

Source: Prepared by the author

During the conceptualization, it is important to analyze the relationship between the item and the construct. The constructs can be designed with formative or reflective indicators, representing the conceptual definition of the construct (MACKENZIE et al., 2011). Reflective and formative indicators have different measurement philosophies (HAIR et al. 2017). The causal indicators cause the latent variable and can be fully measured using a set of reflective, interchangeable, and highly correlated indicators. The causality flows from the latent variable to the indicators, and each indicator is viewed as an imperfect reflection of the latent variable (MACKENZIE et al. 2011). The composite indicators form the latent variable using the most important elements that explain a specific aspect of the construct domain, determining the meaning of the construct (HAIR et al. 2017). The indicator content and construct conceptualization determine the way that the construct and indicators are linked. To develop the scale,

reflective and formative indicators were used to define the latent variables as described in the next sections.

Generation of the First Set of Items

The objective of item generation is “to produce a set of items that fully captures all of the essential aspects of the domain of the focal construct while minimizing the extent to which the items tap concepts outside of the domain of the focal construct” (MACKENZIE et al. 2011, p. 304). The items were designed using an iterative process. First, the researchers identified and adapted appropriate measures found in the literature for the current research or developed the items that were not present in previous studies. Following the MacKenzie et al. (2011) process, the theoretical definition of each construct was used to deduct the appropriated items in combination with qualitative data collected during interviews with information workers. The researchers initially identified 99 indicators that define the constructs. After analyzing each element, definition, and overlaps, the instrument was reduced to 44 indicators measuring 05 latent variables. The survey contained 07 demographic control data items, and 20 questions about the device and app usage. The first version of the survey was revised by three academic students and three information workers to analyze the wording and design validity. Some items were reworded and rearranged as a result of this activity. The indicators were written as simple and precise as possible, avoiding double-barreled items and ambiguous terms. The items were measured using a seven-point Likert scale ranging from strongly disagree to strongly agree. The first set of indicators was written in English and translated to Portuguese for sampling.

Content Validity

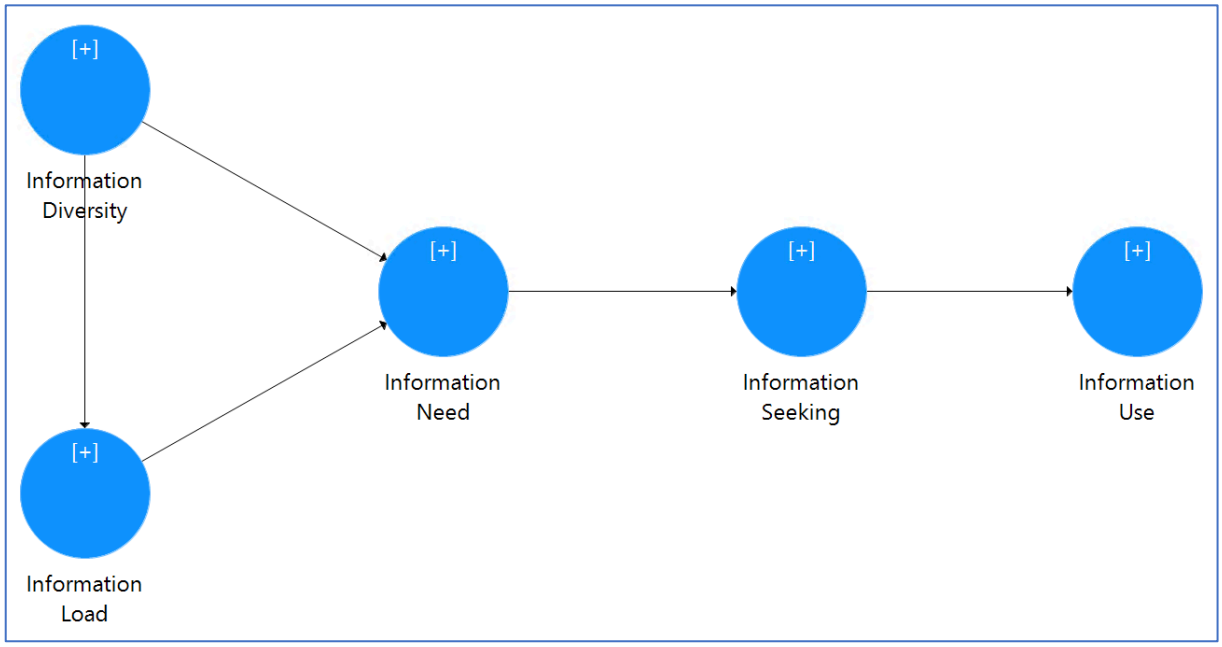
The assessment of the content validity aims to determine if the item represents an aspect of the content domain and if items collectively represent the entire domain of the construct. The technique recommended by MacKenzie et al. (2011) was not followed for content validity as it required additional steps for validation. The technique adopted was similar to Srivastava & Chandra (2018) by checking the consistency between the measurement items and the literature during the design of the

questionnaire. Once items were generated by deduction using the literature and qualitative data review, the items captured the domain of constructs and suggest content validity.

Formally Specify the Measurement Model

The goal of the formal specification of the measurement model is to determine the relationships between indicators and the constructs and sub-dimensions (MACKENZIE et al. 2011). This activity was initially developed during the literature review and model developing. MacKenzie et al. (2011) describe the procedure employing covariance-based structural equation modeling (CB-SEM), but this study employed partial least squares-based structural equation modeling (PLS-SEM). The PLS-SEM allows the simplification of the measurement model, without the need to combine reflective and formative items for identification of the model parameters. The measurement model is represented in figure 15.

Figure 15 – Formal Specification of Measurement Model



Source: Prepared by the author

Collect Data to Conduct Pretest

MacKenzie et al. 2011 advocated that the first data collection to conduct pretest should allow the examination of psychometric properties of the scale, evaluating its convergent, discriminant, and nomological validity. Koufteros (1999) recommended exploratory methods as the initial step during the pretest to assess unidimensional measurement, besides confirmatory analytic techniques should be used to test the measurement model for unidimensionality explicitly. Thus, the combination of both techniques was used to evaluate the pretest collection in the current study and is described in the next sections.

First Pretest Analysis

The pretest survey was applied to 56 undergraduate students of a public university in the south of Brazil. The pretest study was first validated following Churcill (1979), Koufteros (1999), and Hair et al. (2010) recommendations evaluating Cronbach Alpha, Corrected Item-Total Correlations (CITC), and Exploratory Factor Analysis on the complete scale and in the block. Table 21 presents the results.

Table 21 – First Pretest: CITC and Cronbach Alpha (N = 56)

CONSTRUCT	NUMBER OF INDICATORS	CITC	CRONBACH ALPHA
Information Diversity	3	0.409 to 0.652	0.729
Information Load	9	0.169 to 0.654	0.765
Information Need	12	-0.104 to 0.814	0.897
Information Seeking	10	0.345 to 0.644	0.827
Information Use	10	0.267 to 0.556	0.780
Complete Scale	44	-	0.918

Source: Prepared by the author

The complete scale and each construct presented Cronbach Alpha above 0.700, which indicates that the instrument has adequate reliability. However, the Item-Total Correlation had unsatisfactory results with correlation below 0.500 in the constructs, suggesting low correlation among the items (HAIR et al. 2010). To exanimate the correlations, the Exploratory Factor Analysis (EFA) was performed.

During the Exploratory Factor Analysis, the low correlation became apparent among indicators (table 22).

Table 22 – First Pretest: Exploratory Factor Analysis (N = 56)

CONSTRUCT	NUMBER OF INDICATORS	KMO	COMPONENTS EXTRACTED
Information Diversity	3	0.620	1
Information Load	9	0.638	3
Information Need	12	0.826	3
Information Seeking	10	0.707	3
Information Use	10	0.695	3
Complete Scale	44	0.074	14

Source: Prepared by the author

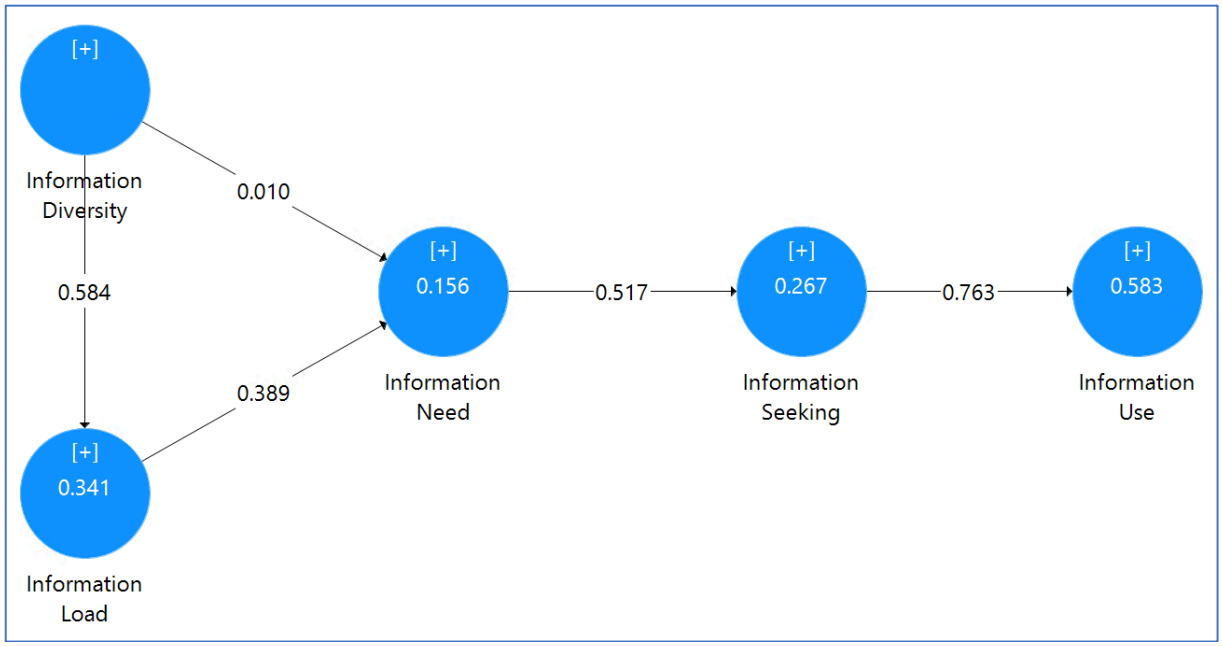
The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the number of extracted components were analyzed to determine the dimensionality of the indicators with their constructs. The acceptable KMO measure of sampling adequacy should be above 0.500, but to evaluate the factor adjustment adequacy, the KMO should be above 0.800 (HAIR et al. 2010). The complete scale is well below the recommended threshold (KMO = 0.074), and in block analysis presented values above 0.600, but only Information Need presented value above 0.800. The KMO measure suggests the sampling is not adequate to conclude about the EFA and infer about the psychometric properties of the model. The cause may be the sample size that is below the minimum 3:1 ratio of the sample size to the number of items. Additionally, the indicators may not adequately explain the constructs.

First Pretest Measurement Model

Besides the exploratory method results did not pass on quality criteria, the measurement model was evaluating following MacKenzie et al. (2011) procedure for the exploratory purpose, employed PLS-SEM instead of CB-SEM. The convergent, discriminant, and nomological validity were analyzed with SmartPLS (RINGLE et al. 2015). Figure 16 presents the initial model with values generated by the PLS Algorithm function. Table 21 brings the results of the convergent, discriminant, and nomological validity.

The results demonstrated the lower statistical validity of the current sample, presenting problems on Factor Loadings, Composite Reliability (CR) and Average Variance Extracted (AVE). In many constructs, items factors loadings presented values below the acceptable threshold of 0.500 (the recommendation is above 0.700) (Hair et al., 2011). This impacted the AVE of many constructs such Information Load (AVE = 0.288), Information Need (AVE = 0.493), Information Seeking (AVE = 0.398), and Information Use (AVE = 0.351).

Figure 16 – First Pretest: Initial Measurement Model (N = 56)



Source: Prepared by the author

The AVE represents the convergence of the items with the construct and values above 0.500 indicate adequate convergence. If the value is below 0.500, the variance explained contains more error than the phenomenon trait (Hair et al. 2010). The CR provides the degree that indicators describe the construct and should have values above 0.700 for reliability. The constructs presented values above the threshold, suggesting support for CR. Additionally, the discriminant validity was evaluated using the Fornell-Larcker criterion, cross-loadings, and Heterotrait-Monotrait Ratio (HTMT) criterion (HENSELER et al., 2015). The Fornell-Larcker criterion compares the square root of the AVE with the correlation of the latent constructs, and the AVE should be higher than the correlation. In the first analysis, there are two cases in which the

correlation of the latent construct is higher than the square root of the AVE between Information Diversity and Information Load, and between information Seeking and Information Use, not establishing the discriminant validity (marked in red on table 23).

Table 23 – First Pretest: CR, and AVE, and Correlations (N = 56)

CONSTRUCT	CR	AVE	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Information Diversity	0.845	0.650	**0.806**				
Information Load	0.771	0.288	0.583	**0.536**			
Information Need	0.914	0.493	0.237	0.394	**0.702**		
Information Seeking	0.864	0.398	0.287	0.397	0.517	**0.631**	
Information Use	0.819	0.351	0.154	0.442	0.500	0.763	**0.592**

Source: Prepared by the author

The second criterion was to evaluate the cross loading for items with loadings above 0.500 on the multiple constructs (table 25). Some items of Information Load, Information Need, Information Seeking, and Information Use presented high loadings in more than one construct, not establishing the discriminant validity using this criterion.

Table 24 – First Pretest: Heterotrait-Monotrait Ratio (HTMT) criterion (N = 56)

CONSTRUCT	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Information Diversity	1.000				
Information Load	0.673	1.000			
Information Need	0.258	0.547	1.000		
Information Seeking	0.416	0.485	0.556	1.000	
Information Use	0.328	0.506	0.674	0.871	1.000

Source: Prepared by the author (SmartPLS)

The HTMT criterion is the third evaluation method, in which values close to 1.000 indicates a lack of discriminant validity (HENSELER et al., 2015; RINGLE et al., 2015). Table 24 presents the results. The intersection between Information Seeking and Information Need got HTMT value 0.871, the higher result of the intersections. The result of the three tests suggests lack of discriminant validity on data collected and the

need of adjustments on the indicators to improve the model goodness of fit and allow inferences about the data evaluated, what is not possible with the current dataset.

Table 25 – First Pretest: Cross-Loadings (N = 56) (continues)

Item	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Div01	**0.637**	0.379	0.012	0.133	0.103
Div02	**0.863**	0.467	0.121	0.246	0.098
Div03	**0.895**	0.546	0.352	0.287	0.162
Load01	0.468	**0.569**	-0.094	0.202	0.223
Load02	0.297	**0.325**	-0.259	0.031	-0.047
Load03	0.327	**0.562**	0.003	0.173	0.136
Load04	0.188	**0.299**	-0.312	-0.128	-0.195
Load05	0.152	**0.469**	-0.015	0.178	0.231
Load06	0.322	**0.707**	0.508	0.365	0.448
Load07	0.270	**0.653**	0.594	0.347	0.435
Load08	0.389	**0.682**	0.219	0.189	0.156
Load09	0.445	**0.384**	-0.056	0.064	0.048
Need01	0.144	0.208	**0.671**	0.234	0.165
Need02	0.008	0.136	**0.426**	0.155	0.154
Need03	0.051	0.103	**0.591**	0.048	0.130
Need04	0.095	0.264	**0.709**	0.117	0.246
Need05	0.122	0.333	**0.721**	0.309	0.298
Need06	0.212	0.281	**0.781**	0.327	0.266
Need07	0.268	0.157	**0.645**	0.324	0.193
Need08	0.161	0.303	**0.857**	0.356	0.393
Need09	0.138	0.262	**0.869**	0.392	0.439
Need10	0.140	0.296	**0.872**	0.362	0.416
Need11	0.229	0.294	**0.792**	0.373	0.329
Need12	0.162	0.291	**0.135**	0.584	0.529
Seek01	0.198	0.124	0.334	**0.666**	0.410
Seek02	0.117	0.230	0.482	**0.644**	0.356
Seek03	0.255	0.348	0.063	**0.598**	0.428
Seek04	0.462	0.348	0.414	**0.376**	0.061
Seek05	-0.021	0.256	0.183	**0.684**	0.506
Seek06	0.218	0.264	0.206	**0.769**	0.749
Seek07	0.189	0.298	0.473	**0.655**	0.553
Seek08	0.218	0.198	0.476	**0.676**	0.620
Seek09	0.118	0.319	0.266	**0.726**	0.573
Seek10	0.272	0.262	0.362	**0.390**	0.189

Source: Prepared by the author (SmartPLS)

Table 23 – First Pretest: Cross-Loadings (N = 56) (final)

Item	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Use01	0.202	0.530	0.298	0.682	**0.828**
Use02	0.084	0.394	0.356	0.666	**0.858**
Use03	0.177	0.326	0.284	0.594	**0.819**
Use04	0.137	0.275	0.408	0.436	**0.332**
Use05	0.146	0.259	0.544	0.164	**0.315**
Use06	0.038	0.162	0.555	0.117	**0.136**
Use07	0.136	0.071	0.381	0.229	**0.429**
Use08	0.168	0.157	0.327	0.238	**0.451**
Use09	0.066	0.144	0.129	0.388	**0.654**
Use10	-0.185	0.068	0.290	0.466	**0.610**

Source: Prepared by the author (SmartPLS)

First Pretest Conclusion

The principal conclusion of the first pretest was the need to review the items developed and repeated the data collection process. MacKenzie et al. (2011) scale development procedure indicate the possibility to iterate during the purification and refinement of the development of new scales. The purification and refinement procedures were started inviting subject matter experts to review the scale items. As will be described in the next section, the researchers decided to reduce the number of items on the instrument, review the wording, and perform a new data collection.

Scale Purification and Refinement

The scale purification and refinement comprise five processes using confirmatory factor analysis (CFA) technique (MACKENZIE et al. 2011). The five processes are the evaluation of goodness of fit of the measurement model, assessment of the validity of the set of indicators at the construct level, assessment of the reliability of the set of indicators ate the construct level, evaluation of individual indicator validity and reliability, and elimination of problematic indicators. During this step, it is possible to iterate the scale development procedure by creating a new set of indicators in case the current set does not present unidimensionality. Once the first

pretest did not result in a unidimensional instrument, the following actions were taken to review, correct, and generate a new set of indicators for the constructs:

- Adjust the number of indicators in each construct. The primary task was to detect overlaps and ambiguity, and keep the main items to measure the domain;
- Reword items. Identify the indicators with high factor loading in more than one construct, targeting to a specific construct;
- Remove items. Identify the indicators with low factor loading for removal;
- Generate new items. In some constructs, such Information Diversity, new indicators were generated to strengthen psychometric properties;
- Use of formative indicators. The literature of Information Seeking, for instance, have content and conceptualization that form the construct, which suggests this construct may be a candidate for the use of sub-dimensions of the formative specification;
- Apply the new survey for academic students for review. This is important for face and content validity;
- Collect a new sample for the pretest.

The new survey was composed of 36 indicators evaluating five constructs, 07 control data questions, and 22 device and app usage questions.

Second Pretest Analysis

The new set of items were initially developed in English and translated to Portuguese. The survey was applied to information workers in different companies, offering the Portuguese and English version of the questionnaire. The information workers were invited by email. The email contained information in English and Portuguese describing the purpose of the survey and links to access the Qualtrics platform. The Appendix C and D have the complete questionnaires in English and Portuguese (the English version contain two consents forms, only the consent form number 2 was used during the second pretest). There were 91 answers to the survey. The respondent demographics are presented in table 26. Figure 17 presents the

geolocation of the respondents, which shows that the majority of the respondents were located in Brazil.

Table 26 – Second Pretest: Demographic Data of the Respondents (N = 91)

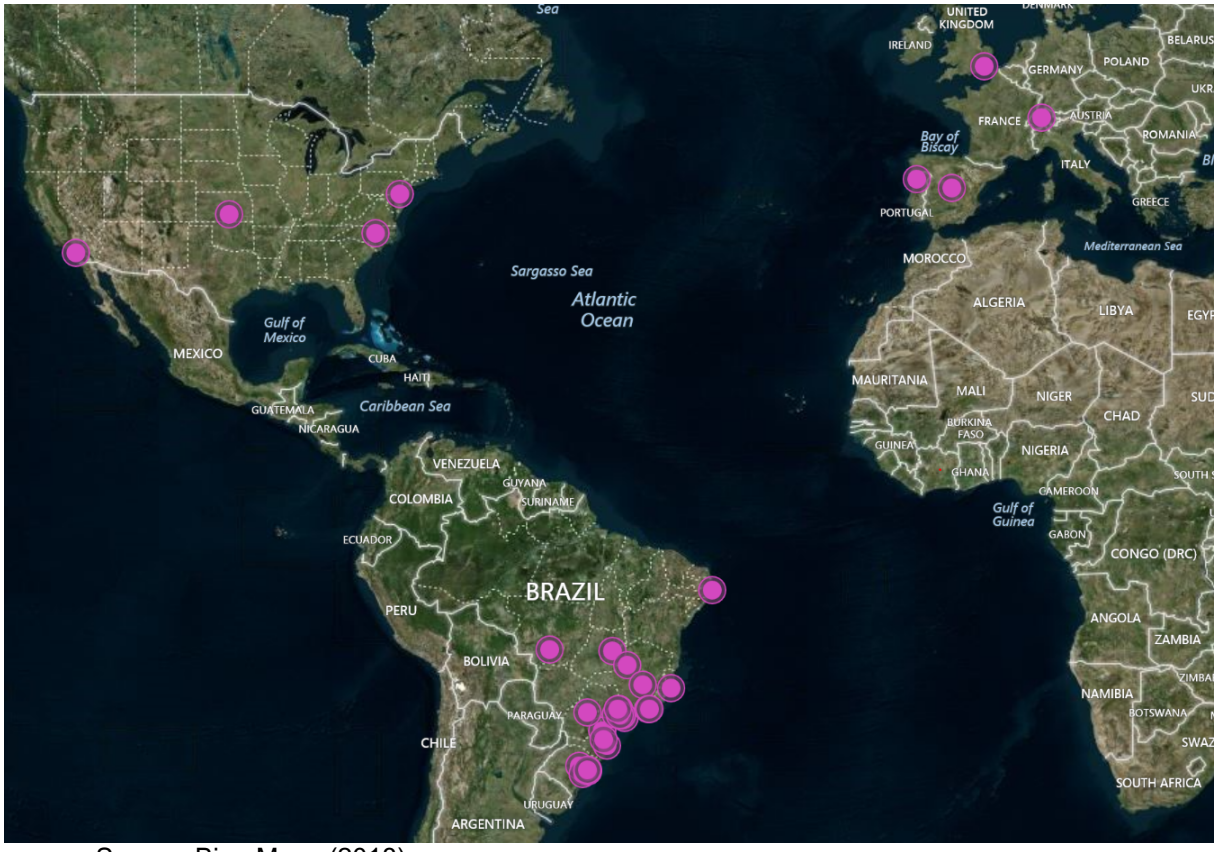
GENDER	Female	23,08%
	Male	75,82%
	Not Binary	1,10%
AGE RANGE	18 - 24	1,10%
	25 - 34	18,68%
	35 - 44	45,05%
	45 - 54	28,57%
	55 - 64	5,49%
	65 - 74	1,10%
TIME IN LABOR MARKET	Under 5	2,20%
	06 - 10	8,79%
	11 - 15	15,38%
	16 - 20	15,38%
	21 - 25	30,77%
	26 - 30	16,48%
	31 - 35	4,40%
	36 - 40	5,49%
	41 or more	1,10%
EDUCATION	High school graduate	7,69%
	Graduation or bachelor's degree	36,26%
	Master's degree	51,65%
	Doctoral degree	4,40%
EMPLOYMENT STATUS	Employed full time	76,92%
	Employed part-time	2,20%
	Other	12,09%
	Student	2,20%
	Unemployed looking for work	6,59%

Source: Prepared by the author

The second pretest study procedures were the same as in the pretest one: first, the author employed exploratory techniques (KOUFTEROS 1999), and, second, the convergent, discriminant, and nomological validity with SmartPLS (MACKENZIE et al., 2011). The exploratory study was developed analyzing the Cronbach Alpha, Item-Total Correlations (ITC), and Exploratory Factor Analysis on the complete scale and in the

block (CHURCILL 1979; KOUFTEROS 1999; HAIR et al. 2010). Table 27 presents the results described.

Figure 17 – Second Pretest: Respondents Geolocation (N = 91)



Source: Bing Maps (2018)

Table **27 – Second Pretest: CITC and Cronbach Alpha (N = 91)**

CONSTRUCT	NUMBER OF INDICATORS	CITC	CRONBACH ALPHA
Information Diversity	5	0.390 to 0.537	0.727
Information Load	6	0.458 to 0.741	0.847
Information Need	10	0.650 to 0.878	0.945
Information Seeking	9	0.048 to 0.515	0.629
Information Use	6	0.564 to 0.724	0.846
Complete Scale	36	-	0.856

Source: Prepared by the author

The complete scale and each construct presented Cronbach Alpha above 0.700, except for the Information Seeking construct with a value of 0.629. The results indicate satisfactory reliability for the instrument. On the other side, the Item-Total

Correlation had unsatisfactory results with correlation below 0.500 in many cases, suggesting a low correlation among the items (HAIR et al. 2010). To exanimate the correlations, the Exploratory Factor Analysis (EFA) was performed (table 28).

Table 28 – Second Pretest: Exploratory Factor Analysis (N = 91)

CONSTRUCT	NUMBER OF INDICATORS	KMO	COMPONENTS EXTRACTED
Information Diversity	5	0.709	2
Information Load	6	0.768	1
Information Need	10	0.902	2
Information Seeking	9	0.590	3
Information Use	6	0.781	2
Complete Scale	36	0.738	10

Source: Prepared by the author

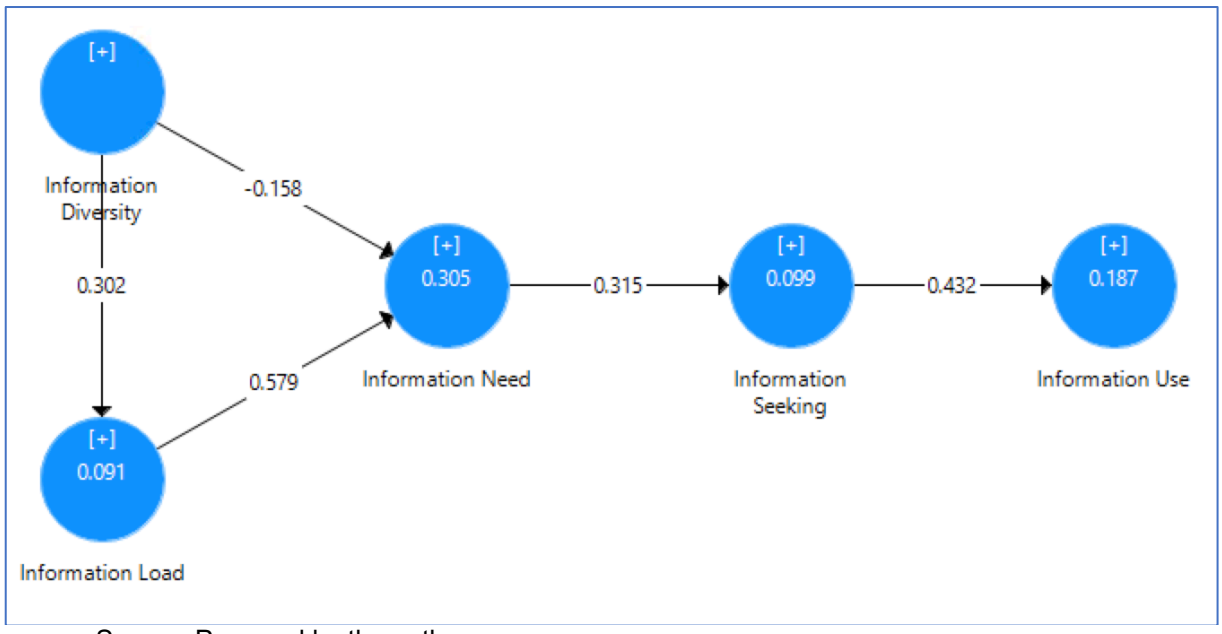
During the EFA, the KMO measure of sampling adequacy and the number of extracted components were analyzed to determine the dimensionality of the indicators with their constructs. The acceptable KMO measure of sampling adequacy should be above 0.500, but to evaluate the factor adjustment adequacy, the KMO should be above 0.800 (HAIR et al. 2010). The complete scale has KMO of 0.738, which is explained given the sample ratio of 2.5:1 of the respondent to the number of indicators. The lowest result was Information Seeking with KMO of 0.590. This construct also extracted three components, similar to other constructs that extracted more than one component, with except to Information Load. The number of indicators in each construct and the presence of sub-dimensions may explain the result. However, comparing the results of first and second pretests, the second pretest has higher consistency than the first one. The next step was to evaluate the model using the PLS-SEM.

Second Pretest Measurement Model

Figure 18 presents the second pretest measurement model calculated with PLS Algorithm. The measurement model was evaluated to analyze the convergent, discriminant, and nomological validity. The Information Seeking construct was validated as a formative latent variable due to the characteristics of the indicators with different traits in sub-dimensions. It can explain the low correlations among indicators

of the construct identified in the exploratory analysis (HAIR et al. 2017). The goal of the measurement model evaluation is to assess the quality and adjustment of the constructs with their indicators. Table 29 presents the results of the convergent, discriminant, and nomological validity.

Figure 18 – Second Pretest: Measurement Model (N = 91)



Source: Prepared by the author

Table 29 – Second Pretest: CR, AVE, and Correlations (N = 91)

CONSTRUCT	CR	AVE	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Information Diversity	0.821	0.538	**0.733**				
Information Load	0.888	0.572	0.302	**0.756**			
Information Need	0.953	0.673	0.017	0.531	**0.821**		
Information Seeking	--	--	0.064	0.085	0.315	--	
Information Use	0.879	0.550	0.007	0.033	0.011	0.432	**0.741**

Source: Prepared by the author

The results demonstrated adequate indices for Factor Loadings, Composite Reliability (CR) and Average Variance Extracted (AVE). The factors loadings for the reflective indicators presented values above the acceptable threshold of 0.500 and in line with the recommendation of 0.700 (HAIR et al., 2017). The AVE for the constructs presented satisfactory results, with values above 0.500. The Information Diversity

(AVE = 0.538), Information Load (AVE = 0.572), and Information Use (AVE = 0.550) where slightly above the threshold, but it is essential to consider the small sample size and the pretest phase. The CR provides the degree that indicators describe the construct and should have values above 0.700 for reliability. The constructs presented CR above 0.800, suggesting good fit between the indicators and its construct.

The discriminant validity was re-evaluated using the Fornell-Larcker criterion, cross-loadings, and Heterotrait-Monotrait Ratio (HTMT) criterion (HENSELER et al., 2015). The Fornell-Larcker criterion compares the square root of the AVE with the correlation of the latent constructs, and the AVE should be higher than the correlation. The Fornell-Lacker criterion indicates the discriminant validity of the model with values the square root of the AVE higher than the correlation of the latent constructs as can be observed on table 29. The cross-loadings also suggested that the discriminant validity was established. Finally, analyzing the HTMT criterion, the indices are below the 0.900 between the constructs, indicating that discriminant validity has been established between the reflective constructs.

Table 30 – Second Pretest: Heterotrait-Monotrait Ratio (HTMT) criterion (N = 91)

LATENT CONSTRUCT	Information Diversity	Information Load	Information Need	Information Use
Information Diversity	1.000			
Information Load	0.356	1.000		
Information Need	0.138	0.593	1.000	
Information Use	0.137	0.183	0.125	1.000

Source: Prepared by the author

Second Pretest Conclusion

Besides, the EFA did not ultimately reach the quality thresholds defined by Koufteros (1999), mainly in the Item-Total Correlation, the other thresholds were satisfactory. The low Item-Total Correlation between some indicators can be explained due to a large number of indicators and the use of sub-dimensions on the model specification. Nevertheless, the measurement model indicates adequate quality level.

The conclusion of the second pretest with the new set of indicators was the improvement in measurement model quality. The EFA and measurement model

analysis presented improvements on tests performed. Thus, the purification and refinement pretest procedures were concluded, and a new sample data were collected for the evaluation of the EFA, measurement model, and path analysis in the final study.

Table 31 – Second Pretest: Cross Loadings (N = 91)

CONSTRUCT	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Div01	**0,682**	0,101	-0,117	0,075	0,076
Div02	**0,814**	0,285	-0,014	0,076	-0,013
Div03	**0,820**	0,260	0,063	0,046	-0,007
Div04	**0,593**	0,149	0,055	-0,016	0,016
Load01	0,196	**0,608**	0,343	0,015	0,038
Load02	0,383	**0,820**	0,333	0,039	-0,076
Load03	0,389	**0,801**	0,334	0,044	-0,042
Load04	0,061	**0,720**	0,436	0,073	0,139
Load05	0,268	**0,843**	0,430	0,107	0,049
Load06	0,046	**0,721**	0,532	0,097	0,059
Need01	-0,076	0,452	**0,739**	0,208	0,016
Need02	0,044	0,474	**0,777**	0,318	0,046
Need03	-0,003	0,434	**0,910**	0,308	-0,013
Need04	-0,059	0,401	**0,842**	0,281	-0,003
Need05	-0,043	0,416	**0,820**	0,286	-0,009
Need06	0,084	0,473	**0,711**	0,146	-0,038
Need07	0,048	0,508	**0,889**	0,217	-0,049
Need08	0,074	0,373	**0,874**	0,270	0,025
Need09	-0,006	0,375	**0,765**	0,282	0,129
Need10	0,087	0,421	**0,854**	0,256	-0,001
Seek01	0,342	0,241	0,259	**0,258**	-0,018
Seek02	0,047	0,035	-0,065	**0,084**	0,103
Seek03	0,117	0,104	0,020	**0,233**	0,140
Seek04	0,079	0,053	-0,224	**-0,046**	0,133
Seek05	0,170	0,253	0,036	**0,010**	-0,020
Seek06	0,240	0,028	-0,059	**-0,186**	-0,080
Seek07	-0,048	-0,108	-0,007	**0,378**	0,256
Seek08	-0,067	-0,141	0,058	**0,422**	0,237
Seek09	0,079	0,057	0,129	**0,748**	0,401
Use01	-0,030	0,083	0,116	0,290	**0,680**
Use02	0,176	0,182	0,088	0,211	**0,652**
Use03	-0,013	0,107	0,018	0,170	**0,685**
Use04	0,003	0,043	-0,087	0,148	**0,775**
Use05	-0,064	-0,019	0,026	0,464	**0,842**
Use06	0,029	-0,094	-0,101	0,392	**0,795**

Source: Prepared by the author

Complete Study Results

The complete study was performed with the same questionnaires developed during the second pretest with versions in English and Portuguese. The English version of the questionnaire had two types, one applied to general information workers of multiple companies, and another for a specific multinational technology company. The questions were the same, and the only difference was the consent form presented to the respondents of the multinational technology company which required a specific form due to the legal reasons. Both consent forms are available on appendix C. The survey was applied to information workers in multiple companies, offering the Portuguese and English version of the questionnaire. The information workers were invited by email. The researcher sent 3,959 emails to information workers of multiple companies, and 1,982 emails to the information workers of the multinational technology company. The email for the general information workers of multiple companies contained the invitation letter in English and Portuguese, describing the purpose of the survey and links to access the survey in the Qualtrics platform. For the information workers of the software company, the invitation letter was sent only in English with the link to the survey. The total of 971 people accessed the survey and 565 completed the questions. The response-items ratio was 16:1. The summary of the responses type is on table 32. The respondent demographics are presented in table 33. Figure 19 present geolocation of the respondents. The majority of the respondents were located in Brazil and the United States.

The data collected for the complete study was analyzed with exploratory factor analysis (EFA), measurement model analysis, and path model analysis for the evaluation of the hypotheses developed on the research. For the EFA, the Cronbach Alpha, Corrected Item-Total Correlations (CITC), and Exploratory Factor Analysis were

Table 32 – Complete study: Summary of responses (N = 565)

ANSWERS PROFILE	MULTIPLE COMPANIES		MULTINATIONAL TECHNOLOGY COMPANY	TOTAL
	PORTUGUESE	ENGLISH	ENGLISH	
Complete survey	269	65	228	565
Incomplete survey	141	68	168	377
Declined the consent form	8	3	18	29
Total	418	139	414	971

Source: Prepared by the author

Table 33 – Complete study: Demographic Data of the Respondents (N = 565)

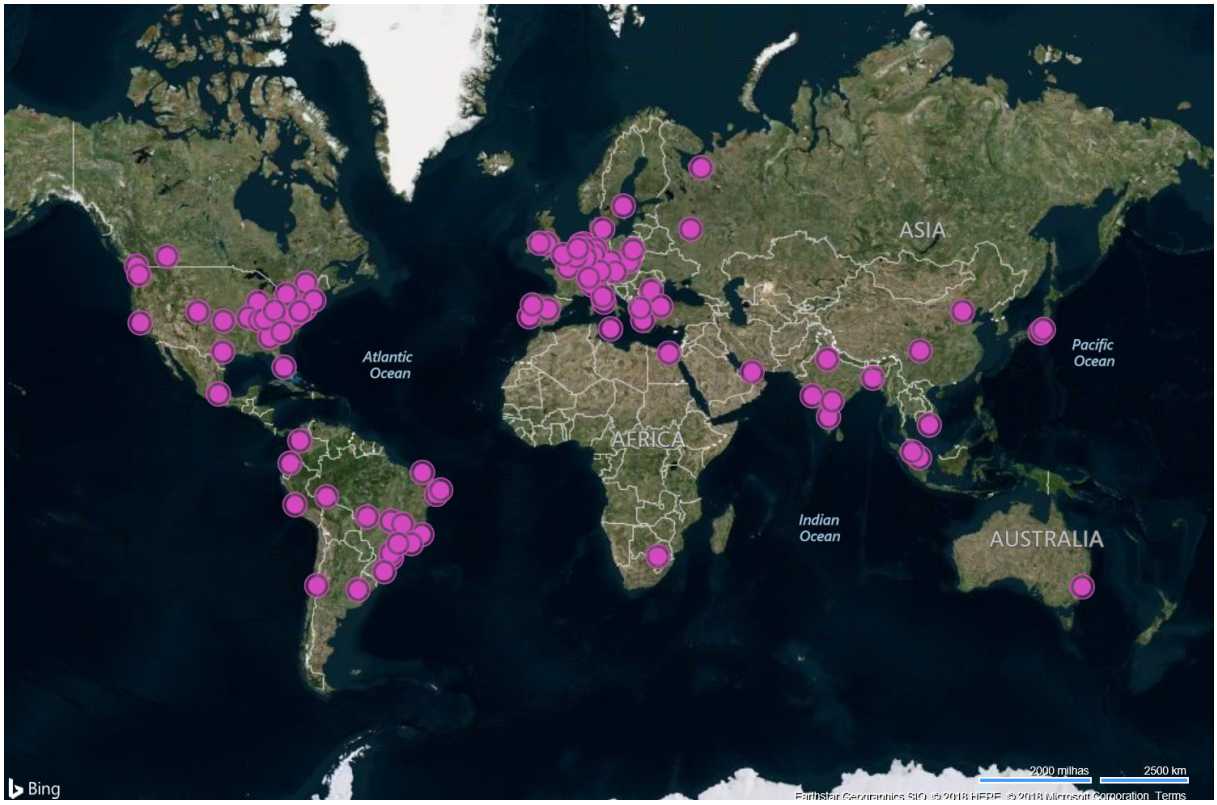
GENDER	Female	23.40%
	Male	76.30%
	Not Binary	0.02%
	Do not want to inform	0.02%
AGE RANGE	18 - 24	3.00%
	25 - 34	20.09%
	35 - 44	45.00%
	45 - 54	24.40%
	55 - 64	6.50%
	65 - 74	0.02%
TIME IN LABOR MARKET	Under 5	6.00%
	06 - 10	9.00%
	11 - 15	16.80%
	16 - 20	21.80%
	21 - 25	22.50%
	26 - 30	11.20%
	31 - 35	7.30%
	36 - 40	3.70%
	41 or more	1.80%
EDUCATION	High school graduate	6.40%
	Graduation or bachelor's degree	40.90%
	Master's degree	48.80%
	Doctoral degree	3.70%
EMPLOYMENT STATUS	Employed full time	86.50%
	Employed part-time	2.80%
	Other	5.50%
	Student	1.40%
	Unemployed looking for work	3.00%
	Unemployed not looking for work	0.40%

Source: Prepared by the author

evaluated for the entire scale and within block (CHURCILL 1979; KOUFTEROS 1999; and HAIR et al. 2010). Table 34 presents the results. The complete scale and each construct presented Cronbach Alpha above 0.700, except for the Information Diversity and Information Seeking construct with a value of 0.677 and 0.656, respectively. The Cronbach Alpha for the complete scale was 0.876. The results indicate satisfactory reliability for the instrument. On the other side, the ITC had unsatisfactory results with correlations below 0.500 in some cases, suggesting a low correlation among the items

(HAIR et al. 2010). To exanimate the correlations, the Exploratory Factor Analysis (EFA) was performed (table 35).

Figure 19 – Complete study: Respondents Geolocation (N = 565)



Source: Bing Maps (2018)

Table 34 – Complete study: CITC and Cronbach Alpha (N = 565)

CONSTRUCT	NUMBER OF INDICATORS	CITC	CRONBACH ALPHA
Information Diversity	5	0.377 to 0.562	0.677
Information Load	6	0.463 to 0.630	0.812
Information Need	10	0.678 to 0.835	0.940
Information Seeking	9	0.114 to 0.498	0.656
Information Use	6	0.650 to 0.798	0.904
Complete Scale	36	-	0.876

Source: Prepared by the author

During the Exploratory Factor Analysis (EFA), the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the number of extracted components were analyzed to determine the dimensionality of the indicators with their constructs. The

number of extracted components is determined for eight values with indices higher than 1.000 (KOUFTEROS, 1999). The results are presented in table 35. The minimum acceptable KMO measure of sampling adequacy should be above 0.500, but to evaluate the factor adjustment adequacy, the KMO should be above 0.800 (Hair et al. 2010). The complete scale has KMO of 0.882, above the threshold. The lowest result within block was Information Diversity with KMO of 0.654 and Information Seeking with 0.669. The Information Diversity, Information Load, Information Seeking extracted more than one component as expected due to the use of sub-dimensions on the scale development. The number of indicators in each construct and the presence of sub-dimensions may explain the number of extracted components.

Table 35 – Complete study: Exploratory Factor Analysis (N = 565)

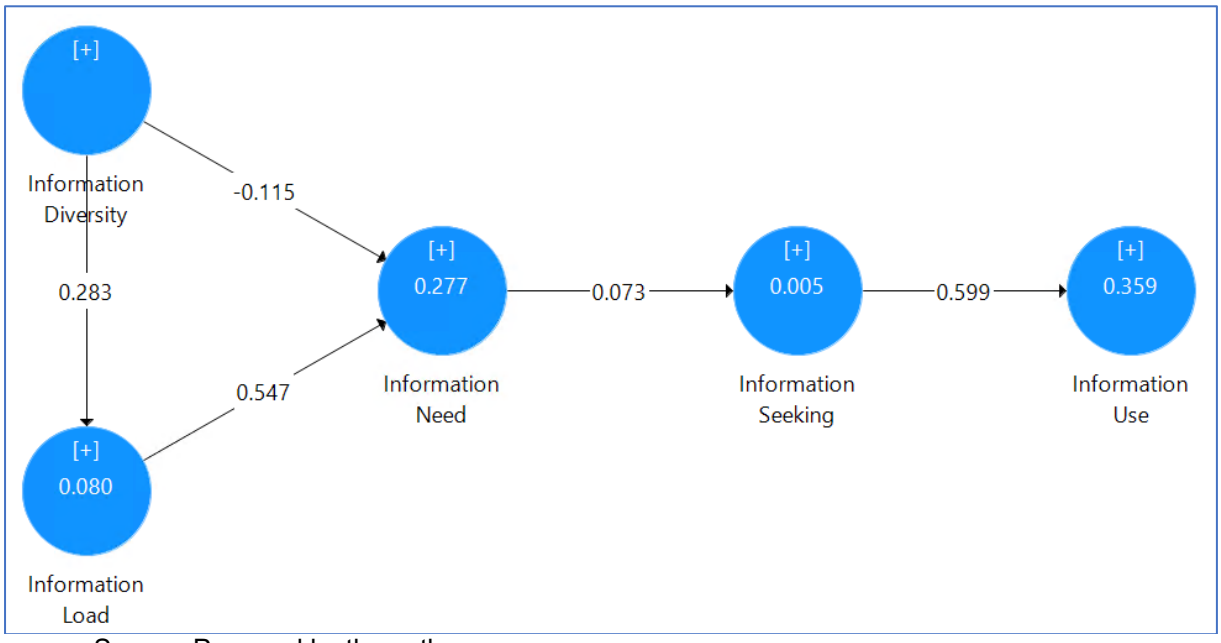
CONSTRUCT	NUMBER OF INDICATORS	KMO	COMPONENTS EXTRACTED
Information Diversity	5	0.654	2
Information Load	6	0.762	2
Information Need	10	0.929	1
Information Seeking	9	0.669	3
Information Use	6	0.855	1
Complete Scale	36	0.882	9

Source: Prepared by the author

Complete Study Measurement Model

Figure 20 presents the measurement model evaluated with the PLS algorithm. The measurement model was evaluated regarding the convergent, discriminant, and nomological validity. The Information Seeking construct was validated as a formative latent variable due to the characteristics of the indicators with different traits in sub-dimensions and the low reliability, CITC and factorial analysis within block. The formative constructs do not require a high correlation between indicators as each indicator represent a different psychometric property and uniquely contribute to the compose of the construct (HAIR et al. 2017). Table 36 presents the results of the convergent and discriminant validity, the last evaluated with the Fornell-Larcker criterion.

Figure 20 – Complete study: Measurement Model (N = 565)



Source: Prepared by the author

Table 36 – Complete study: CR, AVE, and Correlations (N = 565)

CONSTRUCT	CR	AVE	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Information Diversity	0.794	0.437	**0.661**				
Information Load	0.864	0.516	0.283	**0.718**			
Information Need	0.949	0.650	0.040	0.515	**0.806**		
Information Seeking	--	--	0.251	0.233	0.073	--	
Information Use	0.926	0.676	0.203	0.147	-0.047	0.599	**0.822**

Source: Prepared by the author

The results demonstrated adequate indices for Factor Loadings, Composite Reliability (CR) and Average Variance Extracted (AVE), except Information Diversity construct AVE (0.437). The AVE below 0.500 compromises the measurement model quality as more error explain the variance than the trait. Three actions were taken to adjust the AVE: first, analyze the scale psychometric properties to determine if it represents a formative construct; second, the dataset cleanup; and third, analyze the factor loadings to identify weak indicators. These actions are detailed in the next section.

The other metrics presented adequate indices. The factors loadings for the reflective indicators presented values above 0.500, matching the recommended thresholds (HAIR et al., 2017). The AVE for the other constructs presented values above 0.500. The CR, which provides the degree that indicators describe the construct, is above the threshold of 0.700, indicating adequate reliability. The discriminant validity was re-evaluated using the Fornell-Larcker criterion, cross-loadings, and Heterotrait-Monotrait Ratio (HTMT) criterion (HENSELER et al., 2015). The Fornell-Larcker criterion compares the square root of the AVE with the correlation of the latent constructs, and the AVE should be higher than the correlation. The Fornell-Lacker criterion established the discriminant validity of the model with values the square root of the AVE higher than the correlation of the latent constructs as can be observed on table 36. The cross-loadings also suggested that the discriminant validity was established once the higher cross-loadings were on their own constructs (table 36). Finally, the HTMT criterion presents the indices below the 0.900 among constructs (table 37), indicating that discriminant validity has been established between the reflective constructs.

Table 37 – Complete study: HTMT criterion (N = 565)

LATENT CONSTRUCT	Information Diversity	Information Load	Information Need	Information Use
Information Diversity	**1.000**			
Information Load	0.356	**1.000**		
Information Need	0.138	0.593	**1.000**	
Information Use	0.137	0.183	0.125	**1.000**

Source: Prepared by the author

Complete Study Model Adjustment

Once the model quality was compromised due to the Information Diversity AVE below 0.500, three actions were taken to adjust the model: first, analyze the scale psychometric properties to determine if it represents a formative construct; second, the dataset cleanup; and third, analyze the factor loadings to identify weak indicators.

Table 38 – Complete study: Cross-Loadings (N = 565)

Item	Information Diversity	Information Load	Information Need	Information Seeking	Information Use
Div02	**0.621**	0.189	0.014	0.101	0.116
Div03	**0.716**	0.203	0.033	0.199	0.145
Div04	**0.746**	0.215	0.059	0.191	0.146
Div05	**0.617**	0.176	0.023	0.179	0.115
Load01	0.188	**0.635**	0.370	0.061	-0.044
Load02	0.238	**0.694**	0.296	0.167	0.076
Load03	0.238	**0.710**	0.292	0.242	0.159
Load04	0.18	**0.764**	0.421	0.188	0.163
Load05	0.203	**0.748**	0.388	0.172	0.158
Load06	0.188	**0.751**	0.426	0.178	0.115
Need01	-0.002	0.441	**0.749**	0.003	-0.102
Need02	0.091	0.478	**0.790**	0.104	-0.054
Need03	0.046	0.434	**0.855**	0.051	-0.063
Need04	-0.011	0.367	**0.825**	0.081	-0.047
Need05	-0.026	0.365	**0.757**	0.080	-0.014
Need06	0.038	0.422	**0.768**	0.045	-0.010
Need07	0.046	0.436	**0.867**	0.024	-0.047
Need08	0.068	0.424	**0.844**	0.061	0.020
Need09	0.017	0.386	**0.788**	0.055	-0.012
Need10	0.045	0.365	**0.807**	0.094	-0.041
Seek01	0.185	0.276	0.224	**0.364**	0.194
Seek02	0.122	0.123	-0.041	**0.437**	0.271
Seek03	0.156	0.079	-0.053	**0.477**	0.296
Seek04	0.148	0.052	-0.124	**0.458**	0.294
Seek05	0.23	0.350	0.199	**0.361**	0.195
Seek06	0.193	0.069	0.014	**0.399**	0.241
Seek07	0.061	-0.036	-0.035	**0.441**	0.272
Seek08	0.034	0.005	-0.016	**0.585**	0.358
Seek09	0.122	0.110	0.017	**0.839**	0.508
Use01	0.145	0.103	-0.057	0.440	**0.752**
Use02	0.207	0.146	-0.031	0.475	**0.836**
Use03	0.197	0.179	-0.004	0.505	**0.867**
Use04	0.167	0.138	-0.038	0.490	**0.842**
Use05	0.156	0.092	-0.024	0.526	**0.825**
Use06	0.132	0.067	-0.080	0.513	**0.807**
Div01	0.591	0.142	-0.010	0.158	**0.157**

Source: Prepared by the author

The first action was to analyze the scale to determine if Information Diversity is a formative construct. Formative latent variables are composed of indicators that likely represent the construct's independent causes and do not necessarily correlate highly (HAIR et al., 2017). Once formative indicators are assumed to be error-free, the internal consistency reliability is not appropriate for the evaluation of measurement quality. Instead, the content validity must be established before to evaluate the formative measured constructs empirically. "In creating formative constructs, content validity issues are addressed by the content specification in which the researcher clearly specifies the domain of content the indicators are intended to measure" (HAIR et al., 2017, p. 161). The Information Diversity scale was completed developed from scratch based on the literature and qualitative data in which indicators are available in table 39.

Table 39 – Information Diversity Indicator's Questions

INDICATOR	QUESTION
DIV01	When I am performing my tasks and using my devices, I use diverse information sources.
DIV02	When I am performing my tasks and using my devices, I use distinct information sources.
DIV03	When I am performing my tasks and using my devices, I use many information sources.
DIV04	When I am performing my tasks and using my devices, I use alternative information sources.
DIV05	When I am performing my tasks and using my devices, I use unrelated information sources.

Source: Prepared by the author

The conceptualization determines if it is being measured as a unidimensional construct or a multidimensional construct with many distinct facets (MACKENZIE et al., 2011). The definition of Information Diversity "is the number of independent or unrelated variables in an information set provided to the user in a given period of time" (ISELIN 1989; HWANG and LIN 1999). Hence, the Information Diversity construct was designed to be a reflective latent variable once the indicators cause the construct.

The second aspect is the dataset cleanup. The activity comprises the removal of missing values and outliers from the sample. The missing values are automatically handled by the Mean Replacement of the SmartPLS, applying the expectation-maximization algorithm to replace missing values with the variable's mean. There were

66 missing values in 10 responses on the dataset. To reduce the influence of missing values, the 10 responses were removed. The multivariate outlier analysis was performed by calculating the Mahalanobis Distance using SPSS (HAIR et al. 2010). The variables of the constructs Information Diversity, Information Load, Information Need, and Information Seeking constructs were compared against the one dependent variable of Information Use (Need1) since SPSS allows one case (besides Mahalanobis Distance does not use the dependent variable for actual comparison, SPSS requires the setup of a variable to execute the algorithm). The results indicated the presence of outliers on the sample and, to analyze the effect, five levels of outliers were removed from the sample, and the measurement model indices were compared. As can be observed on table 40, the indices improved with the removal of outliers on Information Diversity construct until a certain level (N = 491), as well as all other indices on the complete model. However, the AVE still below the 0.500 threshold.

Table 40 – Information Diversity Construct Indices – Removing Outliers

INDICATOR	FACTOR LOADINGS (N = 565)	FACTOR LOADINGS (N = 530)	FACTOR LOADINGS (N = 513)	FACTOR LOADINGS (N = 491)	FACTOR LOADINGS (N = 471)
Div01	0.591	0.610	0.610	0.617	0.610
Div02	0.621	0.632	0.629	0.653	0.666
Div03	0.716	0.712	0.714	0.720	0.718
Div04	0.746	0.753	0.772	0.775	0.775
Div05	0.617	0.671	0.683	0.692	0.697
--	AVE = 0.437 CR = 0.794	AVE = 0.459 CR = 0.809	AVE = 0.468 CR = 0.814	AVE = 0.481 CR = 0.822	AVE = 0.484 CR = 0.823

Source: Prepared by the author

The third aspect is to analyze the factor loadings of the weak indicators. As can be observed on table 38, Div01 had the lower factor loading compared to the other factors. Hair et al. (2017) recommended following the outer loading relevance test to determine the elimination of a reflective indicator. Outer loadings above 0.400 and below 0.700 are candidates for removal if the removal increases the measures above the threshold. The first item removed was Div01, and the results are presented on table 41. On the second level of outliers, the AVE was above 0.500 and improved consistently until the four levels (N = 491), and slightly after this level. For this reason,

the dataset with N = 491 was adopted for the final measurement model validation and structural model study.

Table 41 – Information Diversity Construct Indices – Div01 Removed

INDICATOR	FACTOR LOADINGS (N = 565)	FACTOR LOADINGS (N = 530)	FACTOR LOADINGS (N = 513)	FACTOR LOADINGS (N = 491)	FACTOR LOADINGS (N = 471)
Div02	0.617	0.625	0.623	0.641	0.650
Div03	0.693	0.690	0.692	0.699	0.695
Div04	0.789	0.799	0.813	0.814	0.813
Div05	0.660	0.717	0.725	0.737	0.741
--	AVE = 0.480 CR = 0.785	AVE = 0.505 CR = 0.802	AVE = 0.514 CR = 0.807	AVE = 0.526 CR = 0.815	AVE = 0.529 CR = 0.847

Source: Prepared by the author

Revised Measurement Model

The measure model validation aims to explain the relationship between the indicator's variables and the latent variables (HAIR et al., 2017). The empirical model is composed of five latent variables and 34 indicators. Four latent variables were specified with the reflective construct and one with the formative construct. Figure 21 presents the measurement model.

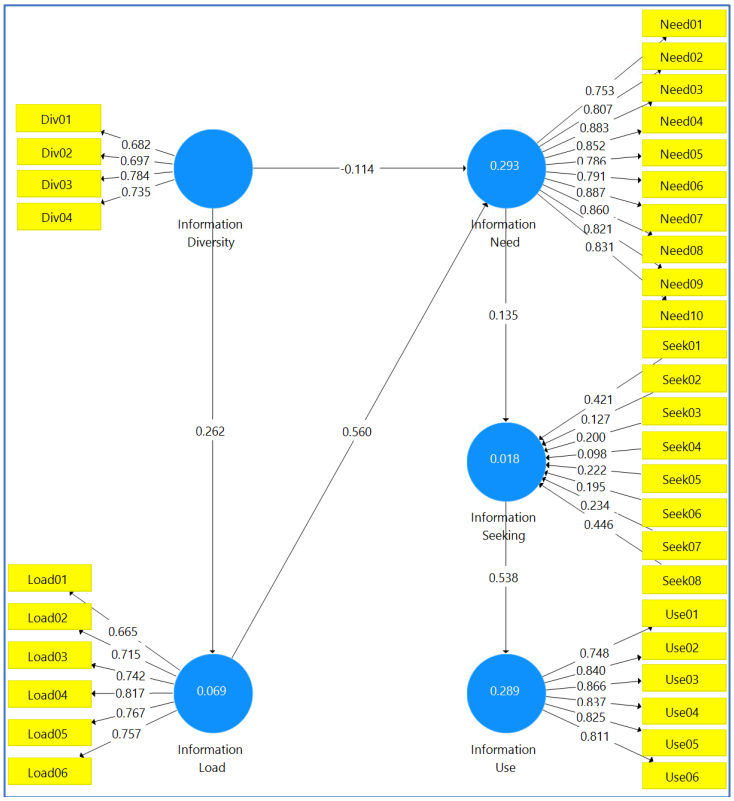
The convergent validity for reflective constructs was validated thru indicator reliability, Cronbach's Alpha, average variance extracted, and composite reliability. The discriminant validated was established thru three methods: cross-loadings examination, Fornell-Larcker criterion, and heterotrait-monotrait ratio (HTMT) assessment (HENSELER et al., 2015). For the formative construct, the collinearity issues were assessed.

The first assessment on convergent validity was the indicator reliability by examining the outer loadings for reflexive indicators. The outer loadings should be higher than 0.708 for consistency. Three reflective indicators presented values below the threshold: DIV04 (0.699), LOAD01 (0.644), and LOAD02 (0.700). In the three cases, there was no compromise on other indices (AVE and CR), and the indicators were retained. Hair et al. (2017) explain that in social sciences studies and development of new scales, moderate outer loadings are expected and acceptable.

The Cronbach's Alpha (CA), average variance extracted (AVE), and composite reliability (CR) for the measurement model were evaluated (table 40).

The AVE must be above 0.500, which was achieved for all the reflective constructs. The CA and CR are indices for the model reliability, and both should be above 0.700 for the reflective model. The results were satisfactory as can be observed in table 42. Next, the discriminant validity was evaluated using the cross-loadings method, which consists in analyzing if an indicator has higher outer loading in other constructs than their own. The cross-loading test established the discriminant validity once each indicator presented the higher loading on its own construct. The next test was the Fornell-Larcker criterion, which compares the root square of AVE and with the correlations of the constructs (table 40). This criterion also established the discriminant validity. Finally, the HTMT assessment is used as an additional test for PLS-SEM. The test consists in to examine the values closer to 1.000 of the HTMT table, which could indicate a lack of discriminant validity. As indicated in table 43, no values were close to 1.000.

Figure 21 – Complete study: Measurement Model (N = 491)



Source: SmartPLS (Ringle et al., 2015)

Table 42 – Complete study: Measurement Model Evaluation for Reflective Constructs (N = 491)

Construct	CA	CR	AVE	ID	IL	IN	IS	IU
Information Diversity (ID)	0.703	0.816	0.526	**0.726**				
Information Load (IL)	0.839	0.882	0.555	0.262	**0.745**			
Information Need (IN)	0.949	0.956	0.686	0.033	0.530	**0.828**		
Information Seeking (IS)	--	--	--	0.268	0.273	0.137	**--**	
Information Use (IU)	0.903	0.926	0.675	0.255	0.159	-0.038	0.603	**0.822**

Source: Prepared by the author

Table 43 – Complete study: HTMT Assessment (N = 491)

CONSTRUCT	ID	IL	IN	IU
Information Diversity (ID)	**1.000**			
Information Load (IL)	0.344	**1.000**		
Information Need (IN)	0.066	0.584	**1.000**	
Information Use (IS)	0.321	0.192	0.054	**1.000**

Source: Prepared by the author

The Information Seeking construct was specified as formative once it describes five independents causes of the construct with low correlation among the indicators. To validate the formative construct, the content validity must be established, capturing the major facets of the construct (HAIR et al., 2017). This step was performed during the scale development phase, and due to the different facets identified (five), this construct was specified as formative. The collinearity was assessed to identify redundant indicators, which can compromise the weight estimation and statistical significance of the indicators. The variance inflation factor (VIF) was investigated for values above 4.000, but there are no values over the threshold, reporting value below than 2.000.

Structural Model and Hypotheses Testing

The structural model was evaluated regarding its predictive capabilities and relationship among constructs for hypotheses testing (HAIR et al., 2017). The predictive capabilities were tested with the coefficient of determination R^2, the effect size f^2, and the predictive relevance Q^2 thru the blindfolding procedure. The results are presented in table 44.

Table 44 – Complete study: Coefficient of Determination R2, Effect Size f 2, and Predictive Relevance Q2 (N = 491)

Construct	Pearson R^2	Cohen (f^2)	Stone-Geisser (Q^2)
Information Load	0.069	0.074	0.036
Information Need	0.293	0.430	0.185
Information Seeking	0.019	0.019	0.002
Information Use	0.363	0.570	0.225

Source: Prepared by the author

The coefficient of determination R^2 is a measure that represents in-sample predictive power. While there is no threshold for evaluation, for behavioral studies 0.20 can be considered high (Hair et al., 2017). The index on the endogenous variable (Information Use) was satisfactory, explaining 36,3% of the variance. The f^2 effect size represents the change in the R^2 when an endogenous variable is omitted from the model. Guidelines for evaluating f^2 are that values of 0.02, 0.15, and 0.35 represent small, medium, and large effects of the exogenous construct, respectively. The index for the endogenous variable was satisfactory (0.570). Finally, the Stone-Geisser's Q^2 measure is an indicator of the model's out-of-sample predictive power or predictive relevance (HAIR et al. 2017). Q^2 values larger than 0 suggest that the model has predictive relevance for the endogenous construct, which is the case besides Information Seeking that present value slight above than 0.

Once the measurement model and predictive capabilities presented positive results regarding the model quality, the Bootstrapping procedure was performed to test the structural model relationships (table 45).

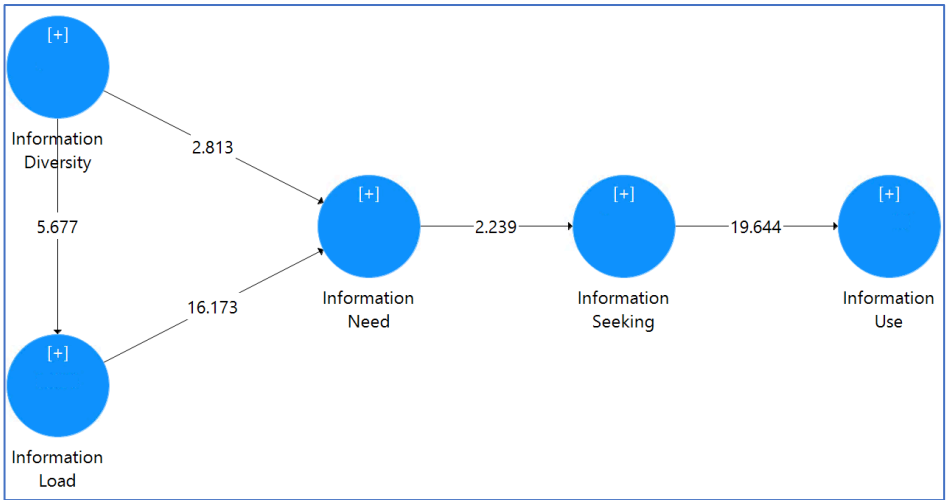
Table 45 – Complete study: Evaluation of Significance and Relevance of the Structural Model Relationships (N = 491)

RELATIONSHIP DIRECTION	ORIGINAL SAMPLE	STANDARD DEVIATION	T STATISTICS
Information Diversity -> Information Load	0.262	0.046	5.677
Information Diversity -> Information Need	-0.113	0.040	2.813
Information Load -> Information Need	0.560	0.035	16.173
Information Need -> Information Seeking	0.137	0.061	2.239
Information Seeking -> Information Use	0.603	0.031	19.644

Source: Prepared by the author

The structural paths coefficients represent the hypothesized relationships between constructs. The minimum T-value for empirical support is 1.96 with the significance level of 0.05. The tests demonstrated support for the relationship between the constructs. Figure 22 presents the hypothesized paths.

Figure 22 – Complete study: Structural Model (N = 491)



Source: Prepared by the author

The analysis in table 5 demonstrates the support for all hypotheses developed on the model. Next to the result, the significance level was reported. The implications of the results are discussed in chapter 46.

Table 46 – Complete study: Hypotheses Evaluation (N = 491)

#	HYPOTHESIS	RESULT
H1	The Information Diversity negatively impacts the Information Need.	Supported (p < 0.005)
H2	The Information Diversity positively impacts the Information Load.	Supported (p < 0.000)
H3	The Information Load positively impacts the Information Need.	Supported (p < 0.000)
H4	The Information Need positively impacts the Information Seeking.	Supported (p < 0.025)
H5	The Information Seeking positively impacts the Information Use.	Supported (p < 0.000)

Source: Prepared by the author

Complete Study Conclusion

The conclusion of the revised measurement model and the structural model study demonstrate a consistent scale development and model validation. The removal

of outliers improved the indices, and the new sample was adopted for the structural model study. The combination of MacKenzie et al. (2011) and Koufteros (1999) procedures for scale development and validation presented consistent results. The next sections present some additional insights and tables analyzed during the pre-test and the final data analyzed for reference.

Second Pretest – Additional Statistical Information

Table 47 – Second Pretest: Item Statistics (N = 91)

INDICATOR	MEAN	STD. DEVIATION	N
Div01	6,516	0,689	91
Div02	6,253	0,914	91
Div03	5,912	1,226	91
Div04	5,473	1,377	91
Div05	4,670	1,745	91
Load01	4,879	1,357	91
Load02	5,330	1,407	91
Load03	5,473	1,241	91
Load04	4,736	1,541	91
Load05	4,879	1,534	91
Load06	4,308	1,704	91
Need01	3,923	1,572	91
Need02	3,758	1,622	91
Need03	3,462	1,809	91
Need04	3,495	1,834	91
Need05	3,725	1,654	91
Need06	4,231	1,838	91
Need07	3,429	1,758	91
Need08	3,396	1,699	91
Need09	3,330	1,674	91
Need10	2,824	1,630	91
Seek01	5,088	1,404	91
Seek02	5,505	1,433	91
Seek03	5,681	1,210	91
Seek04	5,143	1,304	91
Seek05	5,868	1,284	91
Seek06	5,143	1,841	91
Seek07	4,956	1,490	91
Seek08	4,670	1,491	91
Seek09	4,736	1,645	91
Use01	6,055	0,821	91
Use02	6,055	0,911	91
Use03	5,703	1,080	91
Use04	5,901	1,012	91
Use05	5,407	1,291	91
Use06	5,736	1,228	91

Source: Prepared by the author

Table 48 – Second Pretest: Collinearity Statistics – Outer VIF Values (N = 91)

INDICATOR	VIF
Div01	1.312
Div02	1.205
Div03	1.438
Div04	1.577
Div05	1.419
Load01	1.373
Load02	2.297
Load03	2.258
Load04	1.874
Load05	1.859
Load06	2.051
Need01	2.241
Need02	2.808
Need03	4.264
Need04	3.199
Need05	2.003
Need06	2.517
Need07	4.260
Need08	3.576
Need09	2.911
Need10	3.160
Seek01	1.167
Seek02	1.790
Seek03	1.628
Seek04	1.454
Seek05	1.164
Seek06	1.107
Seek07	1.270
Seek08	1.748
Seek09	1.731
Use01	2.338
Use02	3.284
Use03	2.984
Use04	2.806
Use05	2.665
Use06	2.162

Source: Prepared by the author

Complete Study – Additional Statistical Information

Table 49 – Complete Study: Item Statistics (N = 491)

INDICATOR	MEAN	STD, DEVIATION	N
Div01	6.491	0.661	491
Div02	6.024	1.064	491
Div03	5.961	1.120	491
Div04	5.242	1.454	491
Div05	4.224	1.799	491
Load01	5.100	1.286	491
Load02	5.420	1.244	491
Load03	5.320	1.285	491
Load04	4.723	1.461	491
Load05	4.798	1.530	491
Load06	4.226	1.718	491
Need01	4.161	1.565	491
Need02	3.916	1.624	491
Need03	3.540	1.628	491
Need04	3.617	1.746	491
Need05	3.672	1.562	491
Need06	3.878	1.841	491
Need07	3.403	1.670	491
Need08	3.475	1.647	491
Need09	3.409	1.679	491
Need10	2.941	1.635	491
Seek01	5.295	1.336	491
Seek02	5.501	1.240	491
Seek03	5.621	1.094	491
Seek04	5.464	1.420	491
Seek05	5.399	1.562	491
Seek06	5.047	1.397	491
Seek07	4.692	1.449	491

Source: Prepared by the author

Table 50 – Complete Study: Collinearity Statistics – Outer VIF Values (N = 491)

INDICATOR	VIF
Div01	1.379
Div02	1.304
Div03	1.490
Div04	1.649
Div05	1.469
Load01	1.462
Load02	2.326
Load03	2.337
Load04	2.268
Load05	1.988
Load06	2.158
Need01	2.391
Need02	3.189
Need03	5.430
Need04	3.946
Need05	2.212
Need06	2.840
Need07	5.287
Need08	4.173
Need09	3.619
Need10	3.778
Seek01	1.195
Seek02	1.811
Seek03	1.643
Seek04	1.413
Seek05	1.182
Seek06	1.126
Seek07	1.373
Seek08	1.798
Seek09	1.739
Use01	2.416
Use02	3.393
Use03	2.937
Use04	2.730
Use05	2.724
Use06	2.267

Source: Prepared by the author

APPENDIX B – INTERVIEW PROTOCOL

Obrigado pelo seu tempo. O objetivo dessa pesquisa é entender a influência da tecnologia no comportamento das pessoas no uso da informação. O interesse da pesquisa é estritamente acadêmico e os dados serão analisados em conjunto, não de forma individual. O sigilo da identidade é preservado.

Para possibilitar a análise de conteúdo, peço permissão para gravar a entrevista. Você autoriza a gravação da entrevista?

Pode dizer seu nome, sua profissão e o tempo no mercado de trabalho?

Qual sua faixa etária?

Vou realizar uma série de perguntas buscando identificar como os estímulos informacionais gerados pela tecnologia influenciam no uso da informação no trabalho.

Apenas para ter clareza, quando perguntar sobre estímulos informacionais eles são as notificações ou alertas gerados através de tecnologia, sejam dispositivos ou aplicativos, que despertam seu interesse e “interrompem a tarefa”.

INFORMATION STIMULI

1	Quantos dispositivos digitais você utiliza diariamente entre computadores e dispositivos móveis?	Número de componentes (Duncan, 1972)
2	Quando você inicia suas atividades de trabalho, quais software ou aplicativos você utiliza? Por exemplo, rede social, planilhas, e-mail, blogs, CRM, ERP.	Número de componentes (Duncan, 1972)
3	Durante suas tarefas de trabalho, você recebe muitas notificações ou estímulos de dispositivos digitais? Como influência no seu trabalho?	Volume de estímulos informacionais (nova escala)
4	Enquanto realiza tarefas de trabalho utilizando dispositivos digitais, você consegue bloquear estímulos que geram distrações? Como você faz isso?	Bloqueio de distrações (Agarwal and Karahanna, 2000; Burton-Jones and Stroub, 2006)
5	Quando você usa um aplicativo ou sistema no trabalho que gera muita informação, como você lida com o volume de informações? Ex: Volume de dados na tela, diversos artigos, etc.	Volume de informação (nova escala)
6	Durante suas atividades de trabalho usando tecnologia, você consegue ficar completamente imerso na tarefa que está realizando?	Imersão na tarefa (Agarwal and Karahanna, 2000; Burton-Jones and Stroub, 2006)
7	Durante suas atividades de trabalho usando tecnologia, você perde sua atenção facilmente?	Atenção controlada (Agarwal and Karahanna, 2000; Burton-Jones and Stroub, 2006)

INFORMATION SEEKING

8	Imagine que você está realizando uma tarefa e recebe uma notificação que gera necessidade de olhar o que se trata. Quais são seus pensamentos e sentimentos?	Necessidade visceral de informação (Cole, 2011; Taylor, 1968)
9	Como o volume ou quantidade de estímulos dos seus dispositivos influenciam o nível de incerteza durante a execução de uma tarefa? Você percebe que essa incerteza gera necessidade de informação?	Nível de incerteza (Choo, 2006)
10	Quando você recebe um estímulo ou notificação, você sente um *gap de conhecimento*? Você percebe conscientemente a necessidade de informação?	Gap de conhecimento (Dervin, 2003)

INFORMATION SEEKING

11	Quando você precisa realizar uma tarefa, quais as fontes de informação você utiliza para buscar informação?	Fontes de informação (Geminden, 1993; Wilson, 1991)
12	Os estímulos informacionais influenciam nas ações de busca de informação?	Ações de busca (Hemmer and Heinzl, 2011)
13	O que faz (Como) você perceber que buscou informações suficientes para realizar uma tarefa de trabalho?	*Satisficing* (Simon, 1971; Bawden and Robinson, 2009).
14	Os estímulos informacionais influenciam no limite de busca de informação?	Influência dos estímulos na *satisficing* (desenvolvida)

INFORMATION USE

15	Durante o uso de informação para realizar uma tarefa de trabalho, você percebe uma mudança no seu nível conhecimento? Pode dar um exemplo?	Nível de conhecimento (Cole, 2011)
16	Quando você recebe um estímulo, você percebe uma mudança nas suas intenções, motivações, sentimentos ou urgência durante o uso de informação para resolver uma tarefa? Pode dar um exemplo?	Engajamento afetivo (Saracevic, 1997)
17	Durante o uso de informação para realizar uma tarefa, você percebe que está evoluindo com a tarefa ou resolvendo um problema? Como os estímulos influenciam sua percepção?	Fatores cognitivo (Choo, 2006; Cole, 2011; Saracevic, 1997)

APPENDIX C – SURVEY (ENGLISH VERSION)

Consent Form Model 1

Microsoft Research Project Participation Consent Form

INTRODUCTION

Thank you for deciding to volunteer in a Microsoft Corporation research project. The purpose of this project is to completing part of doctoral degree requisites of Gustavo Zimmermann, doctoral candidate, and Microsoft employee, which will evaluate the impact of information stimuli generated by digital technologies on the human information behavior.

You have no obligation to participate and you may decide to terminate your participation at any time. You also understand that the researcher has the right to withdraw you from participation in the project at any time. Below is a description of the research project, and your consent to participate. Read this information carefully. If you agree to participate, sign in the space provided.

TITLE OF RESEARCH PROJECT

The impact of information stimuli on the human information behavior.

PROCEDURES

During this project, the following will happen: you will access an online survey and respond to the questions.

Microsoft may document and collect information about your participation by recording your survey response electronically on Qualtrics Online Survey tool (homologated by Microsoft Research team).

The data will be analyzed using statistical analysis tools, such as SPSS, Amos, Lisrel, SmartPLS, R, and other tools necessary to test hypotheses and develop the dissertation.

PERSONAL INFORMATION

- **Personal information we collect**. During the project we may collect personal information about you such as your response to the survey and control data, like your age range, time in market, profession, industry, etc. We do not collect any personal information that allow your identification, such as your name.
- **How we use personal information**. The personal information and other data collected during this project will be used primarily to perform research for purposes described in the introduction above. Such information and data, or the results of the research may eventually be used to develop and improve our commercial products, services or technologies.
- **How we store and share your personal information**. Your name and other personal information will be kept separate from the other information you give, and these two things will be stored in different places. Your personal data will stored for a period of up to 18 months or less. Except as otherwise described in this document, personal information you provide during this project will not be shared outside of Microsoft and its subsidiaries and affiliates without your permission.
- **How you can access and control your personal information**. If you wish to review or copy any personal information you provided during the study, or if you want us to delete or correct any such data, email your request to the research team at gustavoz@microsoft.com.

If you have a privacy concern, complaint, or a question for the Chief Privacy Officer/Data Protection Officer of Microsoft, please contact us by using our Web form (https://go.microsoft.com/fwlink/?LinkId=321116). We will respond to questions or concerns within 30 days. For additional information on how Microsoft handles your personal information, please see the Microsoft Privacy Statement (https://privacy.microsoft.com/en-us/privacystatement).

RESEARCH RESULTS FEEDBACK

Microsoft will own all of the research data and analysis and other results (collectively "Research Results") generated from the information you provide and your participation in the research project. You may also provide suggestions, comments or other feedback ("Feedback") to Microsoft with respect to the research project. Feedback is entirely voluntary, and Microsoft shall be free to use, disclose, reproduce, license, or otherwise distribute, and leverage the Feedback and Research Results.

CONFIDENTIALITY

The research project and the information you learn by participating in the project is confidential to Microsoft. Accordingly, you agree to keep it secret as you would your own confidential information and never disclose it to anyone else (unless you are required to do under judicial or other governmental order).

However, you do not need to keep secret specific information that is general public knowledge or that you legally receive from another source that is not affiliated with Microsoft so long as that source was entitled to share the information with you and did not obligate you to keep it a secret.

You agree not to disclose to Microsoft any non-public information, whether yours or a third party's without notifying Microsoft in advance.

BENEFITS AND RISKS

- **Benefits**: The research team expects to learn how the information stimuli impacts the human information behavior from this project which we hope will help on technology and information presentation design. You will not receive any direct benefit after completing the online survey, but will receive the indirect benefit of new product design and improvements.
- **Risks**: During your participation, you may experience slight anxiety in answering the questions. To help reduce such risks, you can skip any question or stop participating at any time.

You accept the risks described above and whatever consequences may come of those risks, however unlikely, unless caused by our negligence or intentional misconduct. You hereby release Microsoft and its affiliates from any claim you may have now or in the future arising from such risks or consequences. In addition, you agree that Microsoft will not be liable for any loss, damages or injuries that may come of improper use of the study prototype, equipment, facilities, or any other deviations from the instructions provided by the research team. Don't participate in this study if you feel you may not be able to safely participate in any way including due to any physical or mental illness, condition or limitation. You agree to immediately notify the research team of any incident or issue or unanticipated risk or incident.

YOUR AUTHORITY TO PARTICIPATE

You represent that you have the full right and authority to sign this form, and if you are a minor (under 18), you are not eligible to participate in this survey. Please, terminate your participation now.

By signing this form, you confirm that you understand the purpose of the project and how it will be conducted and consent to participate on the terms set forth above. Should you have any questions concerning this project, please contact Gustavo Zimmermann, at gustavoz@microsoft.com.

Please confirm your acceptance by selecting Yes on the bottom of this form. Upon request, a copy of this consent form will be provided to you for your records. On behalf of Microsoft, we thank you for your contribution and look forward to your research session.

Please confirm your acceptance by signing the bottom of this form selecting Yes. Would you like to be anonymous in this study?

	Yes
	No

Consent Form Model 2

INTRODUCTION

Thank you for deciding to volunteer for this research project. My name is Gustavo Zimmermann Montesdioca. I am a doctoral student at Universidade Federal do Rio Grande do Sul and I am also an employee of Microsoft. The purpose of my research is to evaluate the impact of information stimuli generated by digital technologies on the human information behavior. I am completing this research as part of my doctoral degree.

This study is anonymous, and it is not the intention of the researcher to collect your name. You have no obligation to participate, and you may decide to terminate your participation at any time. You also understand that the researcher has the right to withdraw you from participation in the project at any time. Below is a description of the research project, and your consent to participate. Read this information carefully. If you agree to participate, indicate in the space provided below.

TITLE OF RESEARCH PROJECT

The impact of information stimuli on the human information behavior.

PROCEDURES

During this project, the following will happen: you will access and complete an online survey. It should take no longer than 10 minutes to complete.

PERSONAL INFORMATION

Personal information. During the project we may collect personal information about you such as your response to the survey and control data, for instance, your age range, time in market, profession, industry, etc. We do not collect any personal information that allow your identification, such as your name.

How we use data collected. The data collected during this project will be used primarily to perform research for purposes described in the introduction above. The data will be analyzed using statistical analysis tools, such as SPSS, Amos, Lisrel, SmartPLS, R, and other tools necessary to test hypotheses and develop the dissertation.

CONFIDENTIALITY

The information you provide will be kept confidential to the extent allowable by law. Some steps taken to keep your identity confidential are not collect and use your name. The answers will be anonymized. The people who will have access to your information are the researcher, researcher advisor, and/or, dissertation chair. The Institutional Review Board may also review the research and view your information. To prevent this exposure, you can choose to participate anonymously. Your information security is kept by not extract your name from the survey results.

BENEFITS AND RISKS

- **Benefits**: The research team expects to learn about the impact of information stimuli on the human information behavior. There are no direct benefits to you. The potential benefits for others are improving the technology designed, and the information presented to improve people quality of life.
- **Risks**: During your participation, there are minimal risks that include slight anxiety in answering the questions. To help reduce such risks, you can skip any question or stop participating at any time.

YOUR AUTHORITY TO PARTICIPATE

You represent that you have the full right and authority to participate in this survey, and if you are a minor (under 18), you are not eligible to participate in this survey. Please, terminate your participation now.

By continuing, you confirm that you understand the purpose of the project and how it will be conducted and consent to participate on the terms set forth above. Should you have any questions concerning this project, please contact Gustavo Zimmermann Montesdioca at gustavo.percio@ufrgs.br. My dissertation advisor is Antonio Carlos Gastaud Maçada. He works as Associate Professor at Universidade Federal do Rio Grande do Sul. You can contact him at acgmacada@ea.ufrgs.br. Please confirm your acceptance by signing the bottom of this form selecting Yes. Would you like to be anonymous in this study?

	Yes
	No

INFORMATION DIVERSITY

Instructions: Read the question and select the option that best represents your answer. There is no correct or incorrect answer. Avoid selecting all answer with the same value. Information stimulus represents all stimuli you receive from technology during a typical working day.

#	QUESTION	STRONGLY AGREE - STRONGLY DISAGREE						
Div01	When I am performing my tasks and using my devices, I use diverse information sources.	7	6	5	4	3	2	1
Div02	When I am performing my tasks and using my devices, I use distinct information sources.	7	6	5	4	3	2	1
Div03	When I am performing my tasks and using my devices, I use many information sources.	7	6	5	4	3	2	1
Div04	When I am performing my tasks and using my devices, I use alternative information sources.	7	6	5	4	3	2	1
Div05	When I am performing my tasks and using my devices, I use unrelated information sources.	7	6	5	4	3	2	1

INFORMATION LOAD

Definition: Informational stimuli are the stimuli received through technology (notifications, alerts, messages) with information that demands cognitive attention. Informational stimuli occur when you receive alerts on your smartphone or messages on your laptop from various apps that contain information, generating cognitive activity.

#	QUESTION	STRONGLY AGREE - STRONGLY DISAGREE						
Load01	When I am performing my tasks and using my devices, the information load becomes inappropriate due to the information stimuli.	7	6	5	4	3	2	1
Load02	When I am performing my tasks and using my devices, the information load becomes elevated due to the information stimuli.	7	6	5	4	3	2	1
Load03	When I am performing my tasks and using my devices, the information load becomes intense due to the information stimuli.	7	6	5	4	3	2	1

Load04	When I am performing my tasks and using my devices, the information becomes ambiguous due to the information stimuli.	7	6	5	4	3	2	1
Load05	When I am performing my tasks and using my devices, the information becomes complex due to the information stimuli.	7	6	5	4	3	2	1
Load06	When I am performing my tasks and using my devices, the information becomes uncertain due to the information stimuli.	7	6	5	4	3	2	1

INFORMATION NEED

#	QUESTION	STRONGLY AGREE - STRONGLY DISAGREE						
Need01	When I need information to complete a task and receive information stimuli, I perceive difficulty to express my information need.	7	6	5	4	3	2	1
Need02	When I need information to complete a task and receive information stimuli, I perceive dissatisfaction to express my information need.	7	6	5	4	3	2	1
Need03	When I need information to complete a task and receive information stimuli, I perceive an inability to express my information need.	7	6	5	4	3	2	1
Need04	When I need information to complete a task and receive information stimuli, I perceive difficulty in determining the words to express my information need.	7	6	5	4	3	2	1
Need05	When I need information to complete a task and receive information stimuli, I feel lack of knowledge to express my information need.	7	6	5	4	3	2	1
Need06	When I need information to complete a task and receive information stimuli, I feel the anxiety to express my information need.	7	6	5	4	3	2	1
Need07	When I need information to complete a task and receive information stimuli, I feel confusion to express my information need.	7	6	5	4	3	2	1
Need08	When I need information to complete a task and receive information stimuli, I feel doubt to express my information need.	7	6	5	4	3	2	1
Need09	When I need information to complete a task and receive information stimuli, I face barriers to express my information need.	7	6	5	4	3	2	1
Need10	When I need information to complete a task and receive information stimuli, I face inability to express my information need.	7	6	5	4	3	2	1

INFORMATION SEEK

#	QUESTION	STRONGLY AGREE - STRONGLY DISAGREE						
Seek01	When I seek for information to complete a task and receive information stimuli, I seek for more information than necessary.	7	6	5	4	3	2	1
Seek02	When I seek for information to complete a task and receive information stimuli, I seek enough information.	7	6	5	4	3	2	1

Seek03	When I seek for information to complete a task and receive information stimuli, I seek good enough information.	7	6	5	4	3	2	1
Seek04	When I seek for information to complete a task and receive information stimuli, I find enough information.	7	6	5	4	3	2	1
Seek05	When I seek for information to complete a task and receive information stimuli, I receive too much information.	7	6	5	4	3	2	1
Seek06	When I seek for information to complete a task and receive information stimuli, I use my apps to seek for information.	7	6	5	4	3	2	1
Seek07	When I seek for information to complete a task and receive information stimuli, I keep my focus when I seek for information.	7	6	5	4	3	2	1
Seek08	When I seek for information to complete a task and receive information stimuli, I reduce my anxiety when I seek for information.	7	6	5	4	3	2	1
Seek09	When I seek for information to complete a task and receive information stimuli, I increase my happiness when I seek for information.	7	6	5	4	3	2	1

INFORMATION USE

#	QUESTION	STRONGLY AGREE - STRONGLY DISAGREE						
Use01	When I use the information to complete a task and receive information stimuli, I perceive a change in my level of knowledge.	7	6	5	4	3	2	1
Use02	When I use the information to complete a task and receive information stimuli, I perceive an increase in my level of knowledge.	7	6	5	4	3	2	1
Use03	When I use the information to complete a task and receive information stimuli, I perceive the development of practical knowledge.	7	6	5	4	3	2	1
Use04	When I use the information to complete a task and receive information stimuli, I perceive evolution of tasks while using my knowledge.	7	6	5	4	3	2	1
Use05	When I use the information to complete a task and receive information stimuli, I perceive focus while using my knowledge.	7	6	5	4	3	2	1
Use06	When I use the information to complete a task and receive information stimuli, I perceive positive feelings while using my knowledge.	7	6	5	4	3	2	1

CONTROL DATA

	Please, select your gender.	
Gender		Female
		Male
		Not Binary
		Do not want to inform

Age	Please, select your age.	
		18 - 24
		25 - 34
		35 - 44
		45 - 54
		55 - 64
		65 - 74
		75 - 84
		85 or older

Labor	Please, select the time in the labor market.	
		Under 5
		6 - 10
		11 - 15
		16 - 20
		21 - 25
		26 - 30
		31 - 35
		36 - 40
		41 or older

Education	Please, select your education.	
		Less than high school
		High school graduate
		Graduation or bachelor degree
		Master degree
		Doctoral degree

Employment	Please, select your employment status.	
		Employed full time
		Employed part time
		Unemployed looking for work
		Unemployed not looking for work
		Retired
		Student
		Other

Profession	What is your profession? (Examples: accountant, salesperson, software engineer, etc) _____

Industry	What industry do you work? (Examples: chemical industry, healthcare industry, technology industry, etc) _____

Please, select the frequency you use each device on the list below during your work hours. Select both personal and professional apps. Mark Never if you do not use the device.

When I am performing my work tasks, I use the following devices:

#	QUESTION	DAILY-NEVER						
Dvc01	Desktop	7	6	5	4	3	2	1
Dvc02	Laptop	7	6	5	4	3	2	1
Dvc03	Smartphone	7	6	5	4	3	2	1
Dvc04	Tablet	7	6	5	4	3	2	1
Dvc05	Others	7	6	5	4	3	2	1

Please, select the frequency you use each app on the list below during your work hours. Select both personal and professional apps. Mark Never if you do not use the app.

When I am performing my work tasks, I use the following apps:

#	QUESTION	DAILY-NEVER						
App01	Chrome	7	6	5	4	3	2	1
App02	CRM	7	6	5	4	3	2	1
App03	ERP	7	6	5	4	3	2	1
App04	Excel	7	6	5	4	3	2	1
App05	Facebook	7	6	5	4	3	2	1
App06	Instagram	7	6	5	4	3	2	1
App07	Internet banking	7	6	5	4	3	2	1
App08	Mobile banking	7	6	5	4	3	2	1
App09	Other Internal Systems	7	6	5	4	3	2	1
App10	Outlook	7	6	5	4	3	2	1
App11	PowerPoint	7	6	5	4	3	2	1
App12	Skype for Business	7	6	5	4	3	2	1
App13	Travel App	7	6	5	4	3	2	1
App14	Twitter	7	6	5	4	3	2	1
App15	WhatsApp	7	6	5	4	3	2	1
App16	Word	7	6	5	4	3	2	1
App17	Others	7	6	5	4	3	2	1

APPENDIX D – SURVEY (PORTUGUESE VERSION)

Consent Form

INTRODUÇÃO

Obrigado por ser voluntário nesse projeto de pesquisa. Meu nome é Gustavo Zimmermann Montesdioca. Sou estudante de doutorado na Universidade Federal do Rio Grande do Sul e sou funcionário da Microsoft. O objetivo da minha pesquisa é avaliar o impacto do estímulo informacional gerado por tecnologias digitais no comportamento humano com a informação. Eu estou completando esta pesquisa como parte do meu doutorado.

Este estudo é anônimo e não é intenção do pesquisador coletar seu nome. Você não tem obrigação de participar e pode encerrar sua participação a qualquer momento. Você também entende que o pesquisador tem o direito de desistir da sua participação no projeto a qualquer momento. Abaixo está uma descrição do projeto de pesquisa e seu consentimento para participar. Leia estas informações com cuidado. Se você concordar em participar, indique no espaço fornecido abaixo.

TÍTULO DO PROJETO DE PESQUISA

O impacto dos estímulos informacionais sobre o comportamento humano com a informação.

PROCEDIMENTOS

Durante este projeto, você acessará e completará uma pesquisa online. Essa pesquisa não deve demorar mais que 10 minutos para ser concluída.

INFORMAÇÃO PESSOAL

- **Informações pessoais**. Durante a pesquisa, coletaremos informações sobre seu comportamento frente a estímulos informacionais e dados de controle, como faixa etária, tempo no mercado de trabalho, etc. Não serão coletadas informação pessoais que possam identificar você, como seu nome.
- **Como usamos os dados coletados**. Os dados coletados durante este projeto serão usados principalmente para realizar a pesquisa para os propósitos descritos acima. As informações e dados, ou os resultados da pesquisa, podem ser usados para desenvolver a tese de doutorado, artigos acadêmicos e casos de pesquisa.

CONFIDENCIALIDADE

As informações que você fornecer serão mantidas confidenciais até o limite permitido por lei. Algumas medidas foram tomadas para manter sua identidade confidencial, como não coletar e usar seu nome ou qualquer informação pessoal. As respostas serão anonimizadas. As pessoas que terão acesso às suas informações são o pesquisador, o orientador do pesquisador e/ou a banca de avaliação da pesquisa. O Programa de Pós-Graduação em Administração (PPGA) da Universidade Federal do Rio Grande do Sul também pode revisar a pesquisa e visualizar as informações. Para evitar qualquer exposição, você participará anonimamente.

BENEFÍCIOS E RISCOS

- **Benefícios:** A equipe de pesquisa espera aprender sobre o impacto dos estímulos informacionais sobre o comportamento humano com a informação. Não há benefícios diretos para você. Os potenciais benefícios indiretos estão na evolução da tecnologia e na apresentação da informação para melhorar a qualidade de vida das pessoas.
- **Riscos:** Durante a sua participação, existem riscos mínimos que incluem ligeira ansiedade em responder às perguntas. Para reduzir esses riscos, você pode ignorar qualquer pergunta ou parar de participar a qualquer momento.

SUA AUTORIDADE PARA PARTICIPAR

Você representa todos os direitos e autoridade para participar desta pesquisa e, se for menor de idade (menor de 18 anos), não poderá participar desta pesquisa. Por favor, encerre sua participação agora.

Ao continuar, você confirma que entende o propósito do projeto e como ele será conduzido e consente em participar nos termos estabelecidos acima. Caso tenha alguma dúvida sobre este projeto, entre em contato com Gustavo Zimmermann Montesdioca pelo e-mail gustavo.percio@ufrgs.br. Meu orientador de tese é Antonio Carlos Gastaud Maçada. Ele trabalha como Professor Associado da Universidade Federal do Rio Grande do Sul. Você pode entrar em contato com ele através do email acgmacada@ea.ufrgs.br.

Por favor, confirme sua aceitação selecionando Sim a parte inferior deste formulário. Você deseja participar de forma anônima nessa pesquisa?

	Sim
	Não

INFORMATION DIVERSITY

Instruções: Leia cada pergunta e selecione a opção que melhor representa sua resposta. Não há resposta correta ou incorreta. Evite selecionar todas as respostas com o mesmo valor. O estímulo da informação representa todos os estímulos que você recebe da tecnologia durante um dia típico de trabalho.

#	QUESTION	CONCORDO TOTALMENTE – DISCORDO TOTALMENTE						
Div01	Quando estou executando minhas tarefas e usando meus dispositivos, eu uso diversas fontes de informação.	7	6	5	4	3	2	1
Div02	Quando estou executando minhas tarefas e usando meus dispositivos, eu uso distintas fontes de informação.	7	6	5	4	3	2	1
Div03	Quando estou executando minhas tarefas e usando meus dispositivos, eu uso muitas fontes de informação.	7	6	5	4	3	2	1
Div04	Quando estou executando minhas tarefas e usando meus dispositivos, eu uso fontes de informação alternativas.	7	6	5	4	3	2	1
Div05	Quando estou executando minhas tarefas e usando meus dispositivos, eu uso fontes de informação não relacionadas.	7	6	5	4	3	2	1

INFORMATION LOAD

Definição: Estímulos informacionais são todos os tipos de estímulos recebidos através da tecnologia (notificações, alertas, mensagens) com informações que demandam a atenção cognitiva. Os estímulos informacionais ocorrem quando você recebe alertas no celular ou mensagens no laptop de vários apps que contenham informações, gerando atividade cognitiva.

#	QUESTION	CONCORDO TOTALMENTE – DISCORDO TOTALMENTE						
Load01	Quando estou executando minhas tarefas e usando meus dispositivos, a carga de informação torna-se inadequeda devido aos estímulos informacionais.	7	6	5	4	3	2	1
Load02	Quando estou executando minhas tarefas e usando meus dispositivos, a carga de informação torna-se elevada devido aos estímulos informacionais.	7	6	5	4	3	2	1

Load03	Quando estou executando minhas tarefas e usando meus dispositivos, a carga de informação torna-se intensa devido aos estímulos informacionais.	7	6	5	4	3	2	1
Load04	Quando estou executando minhas tarefas e usando meus dispositivos, a informação torna-se ambígua devido aos estímulos informacionais.	7	6	5	4	3	2	1
Load05	Quando estou executando minhas tarefas e usando meus dispositivos, a informação torna-se complexa devido aos estímulos informacionais.	7	6	5	4	3	2	1
Load06	Quando estou executando minhas tarefas e usando meus dispositivos, a informação torna-se incerta devido aos estímulos informacionais.	7	6	5	4	3	2	1

INFORMATION NEED

#	QUESTION	CONCORDO TOTALMENTE – DISCORDO TOTALMENTE						
Need01	Quando preciso de informações para completar uma tarefa e recebo estímulos informacionais, eu percebo dificuldade em expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need02	Quando preciso de informações para completar uma tarefa e recebo estímulos informacionais, eu percebo insatisfação para expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need03	Quando preciso de informações para completar uma tarefa e recebo estímulos informacionais, eu percebo incapacidade de expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need04	Quando preciso de informações para completar uma tarefa e recebo estímulos informacionais, eu percebo dificuldade em determinar as palavras para expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need05	Quando necessito de informações para completar uma tarefa e recebo estímulos informacionais, eu sinto falta de conhecimento ao expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need06	Quando necessito de informações para completar uma tarefa e recebo estímulos informacionais, eu sinto a ansiedade de expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need07	Quando necessito de informações para completar uma tarefa e recebo estímulos informacionais, eu me sinto confuso ao expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need08	Quando necessito de informações para completar uma tarefa e recebo estímulos informacionais, eu sinto dúvida ao expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need09	Quando necessito de informações para completar uma tarefa e recebo estímulos informacionais, eu enfrento barreiras ao expressar minha necessidade de informação.	7	6	5	4	3	2	1
Need10	Quando necessito de informações para completar uma tarefa e recebo estímulos informacionais, eu enfrento incapacidade ao expressar minha necessidade de informação.	7	6	5	4	3	2	1

INFORMATION SEEK

#	QUESTION	CONCORDO TOTALMENTE – DISCORDO TOTALMENTE						
Seek01	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu busco mais informações do que o necessário.	7	6	5	4	3	2	1
Seek02	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu busco informações suficientes.	7	6	5	4	3	2	1
Seek03	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu busco informações adequadas.	7	6	5	4	3	2	1
Seek04	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu encontro informações suficientes.	7	6	5	4	3	2	1
Seek05	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu recebo muitas informações.	7	6	5	4	3	2	1
Seek06	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu uso meus apps para buscar informações.	7	6	5	4	3	2	1
Seek07	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu mantenho meu foco enquanto busco informações.	7	6	5	4	3	2	1
Seek08	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu reduzo minha ansiedade enquanto busco informações.	7	6	5	4	3	2	1
Seek09	Quando busco informações para completar uma tarefa e recebo estímulos informacionais, eu aumento minha felicidade enquanto busco informações.	7	6	5	4	3	2	1

INFORMATION USE

#	QUESTION	CONCORDO TOTALMENTE – DISCORDO TOTALMENTE						
Use01	Quando uso informação para completar uma tarefa e recebo estímulos informacionais, eu percebo uma mudança no meu nível de conhecimento.	7	6	5	4	3	2	1
Use02	Quando uso informação para completar uma tarefa e recebo estímulos informacionais, eu percebo um aumento no meu nível de conhecimento.	7	6	5	4	3	2	1
Use03	Quando uso informação para completar uma tarefa e recebo estímulos informacionais, eu percebo o desenvolvimento do meu nível de conhecimento prático.	7	6	5	4	3	2	1
Use04	Quando uso informação para completar uma tarefa e recebo estímulos informacionais, eu percebo a evolução das tarefas enquanto uso meu conhecimento.	7	6	5	4	3	2	1
Use05	Quando uso informação para completar uma tarefa e recebo estímulos informacionais, eu percebo o foco enquanto uso meu conhecimento.	7	6	5	4	3	2	1
Use06	Quando uso informação para completar uma tarefa e recebo estímulos informacionais, eu percebo sentimentos positivos enquanto uso meu conhecimento.	7	6	5	4	3	2	1

CONTROL DATA

Gender	Por favor, selecione seu gênero.	
		Feminino
		Masculino
		Não binário
		Prefiro não informar

Age	Por favor, selecione sua faixa etária.	
		18 - 24
		25 - 34
		35 - 44
		45 - 54
		55 - 64
		65 - 74
		75 - 84
		85 ou mais

Labor	Por favor, selecione o tempo no mercado de trabalho.	
		Menos de 5
		6 - 10
		11 - 15
		16 - 20
		21 - 25
		26 - 30
		31 - 35
		36 - 40
		41 ou mais

Education	Por favor, selecione sua escolaridade.	
		Menos que ensino médio
		Ensino médio
		Graduação superior
		Mestrado ou pós-graduação
		Doutorado

Employment	Por favor, selecione seu status de emprego.	
		Empregado em tempo integral
		Empregado em tempo parcial
		Desempregado procurando emprego
		Desempregado não procurando emprego
		Aposentado
		Estudante
		Outros

Profession	Qual é a sua profissão? (Exemplos: contador, vendedor, engenheiro de software, etc) _____

Industry	Qual indústria você trabalha? (Exemplos: indústria química, indústria de saúde, indústria de tecnologia, etc) _____

Por favor, selecione a frequência que você usa cada dispositivo na lista abaixo durante o seu horário de trabalho. Selecione dispositivos de uso pessoal e profissional. Marque Nunca se você não usar o dispositivo.

Quando estou executando minhas tarefas de trabalho, uso os seguintes dispositivos:

#	QUESTION	DIARIAMENTE - NUNCA						
Dvc01	Desktop	7	6	5	4	3	2	1
Dvc02	Laptop	7	6	5	4	3	2	1
Dvc03	Smartphone	7	6	5	4	3	2	1
Dvc04	Tablet	7	6	5	4	3	2	1
Dvc05	Outros	7	6	5	4	3	2	1

Por favor, selecione a frequência que você usa cada aplicativo na lista abaixo durante suas horas de trabalho. Selecione aplicativos pessoais e profissionais. Marque Nunca se você não usar o aplicativo.

Quando estou executando minhas tarefas de trabalho, uso os seguintes aplicativos:

#	QUESTION	DIARIAMENTE - NUNCA						
App01	Chrome	7	6	5	4	3	2	1
App02	CRM	7	6	5	4	3	2	1
App03	ERP	7	6	5	4	3	2	1
App04	Excel	7	6	5	4	3	2	1
App05	Facebook	7	6	5	4	3	2	1
App06	Instagram	7	6	5	4	3	2	1
App07	Internet banking	7	6	5	4	3	2	1
App08	Mobile banking	7	6	5	4	3	2	1
App09	Outros Sistemas Internos	7	6	5	4	3	2	1
App10	Outlook	7	6	5	4	3	2	1
App11	PowerPoint	7	6	5	4	3	2	1
App12	Skype for Business	7	6	5	4	3	2	1
App13	Travel App	7	6	5	4	3	2	1
App14	Twitter	7	6	5	4	3	2	1
App15	WhatsApp	7	6	5	4	3	2	1
App16	Word	7	6	5	4	3	2	1
App17	Outros	7	6	5	4	3	2	1