Challenges of Information System Use by Knowledge Workers: the Email Productivity Paradox

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ABSTRACT

With the growing importance of social media, cloud computing and mobile device interactions, the digital work environment is being perpetually transformed while forcing users to adapt to the emerging technologies. In this volatile environment, research leading to innovative approaches to better support the information practices of knowledge workers is acquiring a critical importance. Aiming to improve the technological and organizational policy-making decisions for the implementation of new information systems, this paper examines the current challenges of knowledge workers using information systems to perform their daily tasks. A qualitative research approach entailing the use of semi-directed interviews and diary journals is followed to this end. The outcomes of this research are both theoretical and practical. This research provides a critical insight into the key challenges facing knowledge workers in the digital work environment. From a purely practical perspective, this study helps uncover the needs and expectations of knowledge workers as they use email and other technologies to achieve their work tasks. In light of this study, the technological and organizational policy-making decisions for the implementation of new information systems must ensure that email as a tool drives true productivity and avoids the productivity paradox.

Keywords: Personal Information Management, Email Overload, User Study, Productivity

INTRODUCTION

The twentieth century has presented profound transformations in organizational modes of production, moving from a manufacturing to a knowledge-centric industry. This transformation is now so thorough that the most valuable resources of today’s organizations are their knowledge workers and their productivity (Drucker, 1999, p. 79). Organizations are continually implementing new systems to stay abreast in this technological and information metamorphosis. As a result, employees are finding it increasingly difficult to perform their daily work practices using these information systems (Ravasio, Schär & Krueger, 2004; Jones, 2007; Barreau, 2008; Bondarenko, Janssen & Driessen, 2010; Karr-Wisniewski & Lu, 2010).

In their article, Karr-Wisniewski and Lu (2010, p. 1061) discuss the “Productivity Paradox” when MIS researchers in the 1980s found no association between IT investments and productivity. In a groundbreaking article, Brynjolfsson (1993) demonstrated an “alarming correlation” between a sharp drop in productivity and the rapid increase in the use of IT (p. 68). Although these results are debated today (Cardona, Kretschmer, & Strobel, 2013), the research on information system use by knowledge workers still reveals that an increase in the availability of technologies does not necessarily lead to better work productivity having at times the opposite consequence (Bondarenko et al., 2010; Karr-Wisniewski & Lu, 2010). An evocative example is the ‘email phenomenon’, which is a particularly challenging tool for employees in contemporary organizations (Dabbish & Kraut, 2006; Siu, Iverson & Tang, 2006; Barreau, 2008; Sumecki, Chipulua & Ojiako, 2011; Capra, Khanova & Ramdeen, 2013; Jerejian, Reid & Rees, 2013).

The continual evolution of the digital work environment spanked by social media, cloud computing and mobile device interactions has raised the call for new approaches to support the information practices of knowledge workers. With the aim of improving technological and policy-making decisions leading to the implementation of new information systems in organizations, this paper examines the knowledge workers’ challenges while using systems to perform their daily tasks. The research questions are the following:

• Which difficulties do knowledge workers encounter while using information systems to perform their daily tasks?
• What are the knowledge workers’ expectations to improve the use of information systems?
From a theoretical perspective, this research offers an integrated perspective of the various challenges affecting the knowledge workers’ productivity in the digital work environments. For practitioners, the findings offer new insights on the requirements and expectations of these employees when using technologies to accomplish their tasks.

RELATED WORK
A stream of research focusing on the productivity of knowledge workers falls within the area of Personal Information Management (PIM) defined as “both the practice and the study of the activities a person performs in order to acquire or create, store, organize, maintain, retrieve, use, and distribute the information needed to complete tasks” (Jones, 2007, p. 453). Several PIM studies realized in organizational settings have highlighted the technological challenges affecting the employees while performing work-related tasks (Malone, 1983; Barreau & Nardi, 1995; Sellen & Harper, 2002; Boardman & Sasse, 2004; Ravasio et al., 2004; Dabbish & Kraut, 2006; Siu et al., 2006; Karr-Wisniewski & Lu, 2007, 2010; Barreau, 2008; Bondarenko et al., 2010; Capra et al., 2013). From these studies, four main categories of technological difficulties can be identified: 1) interface usability; 2) information fragmentation; 3) task-technology misfit; 4) email overload. These findings are summarized below.

1) Interface Usability
Usability is usually defined as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (ISO 9241-11). The research on usability and PIM in work environments broadly focuses on system features such as the desktop metaphor at the interface level to improve user productivity. Studies on usability reveal that each employee is characterized by a set of individual differences and that the logic of the system is not always adapted to these particularities (Malone, 1983; Barreau & Nardi, 1995; Ravasio et al., 2004).

More recently, Karr-Wisniewski & Lu (2007, 2010) have also examined knowledge workers’ perceptions of information system use and productivity. They have introduced the concept of “technology overload” to represent the difficulties employees have “when additional technology tools begin to crowd out one’s productivity instead of enhancing it” (Karr-Wisniewski & Lu, 2010, p. 1061). The authors reveal how technology usability depends on the amount of tools features available to the users, reaching an optimal level before becoming counterproductive.

To overcome the difficulties inherent to the lack of system usability, many employees still prefer to use paper documents to perform some information practices (Whittaker & Sidner, 1996; Sellen & Harper, 2002; Boardman & Sasse, 2004; Bondarenko et al., 2010). A study by Sellen and Harper (2002) shows that 97% of the activities in the organizational context are activities involving the use of documents. Among these activities, 86% are performed using paper documents. More recent findings by Bondarenko et al. (2010) reveal that employees are still actively using paper-based information collections, in parallel to digital information. PIM practices using paper format present several advantages for the end-users, specifically in the integration of different information sources necessary to perform a task, an important challenge related to digital work environments.

2) Information Fragmentation
Information fragmentation is a core difficulty for PIM practices and a direct consequence of the availability of a wide range of tools and technologies to the end-user (Jones, 2007, p. 453). System integration is an important issue, leading to the fragmentation of information sources such as paper documents, email, office productivity software, storage supports, mobile devices and Web pages. The lack of interoperability between different formats of documents or software versions is also increasing the challenges pertaining to this fragmentation (Bondarenko et al., 2010, p. 468).

In the workplace, the challenges related to information fragmentation entail labor-intensive information search, task interruptions, complicated data backup procedures and continuous switching between paper and digital information (Ravasio et al., 2004; Jones, 2007; Bondarenko et al., 2010). The separation between information systems also leads to unwanted redundancy in the various storage locations (Ravasio et al., 2004, p. 168) and confusion caused by the presence of different passwords and access methods (Barreau, 2007, p. 314). For Boardman and Sasse (2004), synergies between tools should better be leveraged to facilitate not only the integration of different information pieces, but also to better support individual users in their specific tasks.

3) Task-technology Misfit
Task management is a core challenge in many studies related to personal information management in an organizational setting, as employees do not use a system to perform information practices but rather to accomplish work-related tasks. Several studies have examined the problems arising when employees try to accomplish their work with systems having poorly adapted functions to the requirements of the job (Boardman & Sasse, 2004; Dabbish & Kraut, 2006; Barreau, 2008; Bondarenko et al., 2010; Karr-Wisniewski & Lu, 2010). For Jones (2007), information management and task management are simply “two sides of the same coin” (p. 488).

In their research, Karr-Wisniewski and Lu (2010) relate to the task-technology fit theory developed in the 1990’s by Goodhue and Thompson to examine how a system can result in poorer employee performance if the technology is not well adapted to individuals’ specific task requirements.
They argue that a technology must reduce cognitive and system overload while “fitting the task” to be really beneficial to the user (p. 1062).

Bondarenko et al. (2010) recently propose an innovative framework, based on a decomposition of tasks to derive a set of requirements for the design of personal document management systems. One of the core requirements stemming from this research emphasizes the necessity for a system to comply with the “least-effort principle”. This conclusion relates to different studies that have demonstrated how the work tasks in digital work environments are disparate, frequently interrupted and fragmented leading to the need for a system that would integrate and facilitate their realization (Boardman & Sasse, 2004; Dabbish & Kraut, 2006; Barreau, 2008; Bondarenko et al., 2010; Karr-Wisniewski & Lu, 2010). Better task management largely explains the successes and challenges that employees now encounter with email which, originally developed as a communication system, is today greatly used to organize work.

4) Email Overload

Email overload is a phenomenon documented in numerous studies (Whittaker & Sidner, 1996; Venolia et al., 2001; Bellotti et al., 2003; Whittaker, Bellotti & Gwizdka, 2006; Sumecki et al., 2011). In the organizational context, email overload is commonly defined as the act of receiving a large number of messages daily, overwhelming the employees and affecting their overall productivity. In the recent years, email management has become a daunting and time-consuming task and an important source of stress for the employees.

Several studies show that the use of email is constantly gaining ground in the organizational context (Dabbish & Kraut, 2006; Siu et al., 2006; Barreau, 2008; Capra et al., 2013). In fact, this system plays an important role for employees who use email not only to communicate but also as an individual knowledge repository to archive their documents, to plan their daily tasks, to manage appointments and to collaborate on projects. As stipulated by Ducheneaut and Bellotti (2001), email has become an “habitat”, a virtual place where employees live and socialize at work. Since email is heavily use as a tool to plan, organize and delegate work, an important stream of research seeks innovative ways to improve the daily management of email, focusing on the process of dealing with daily task requirements (e.g. Whittaker & Sidner, 1996; Dabbish & Kraut, 2006; Siu et al., 2006; Szóstek, 2011). Less is known on how email overload contributes to the overall employee perception of their difficulties with system use in their work environment.

METHOD

The qualitative study described herein was undertaken in the context of two broader multidisciplinary research projects at the University of Montreal. The study is also part of a doctoral dissertation examining information practices and genres in digital environments (Alberts, 2009). The results presented in the next section focus on knowledge workers’ challenges with information systems. The methodology used to collect the data related to these challenges is detailed below.

Field of Study and Participants

The sample comprises 34 knowledge workers from two Canadian public administrations, one municipality and one federal institution. Among these participants, 17 are middle managers and 17 are administrative assistants. The majority of the participants (n=22) are very skilled in their position, with more than twenty years of related work experience. Most of the participants (n=10 for the managers and n=12 for the administrative assistants) feel they have advanced skills in the use of information systems. Ten others believe they are either beginner or intermediate and one administrative assistant estimates he is a system use expert.

Data Collection

In this study, the triangulation of multiple data collection methods provides rich insights on the daily information practices of the managers and the administrative assistants. To obtain a broad perspective on how employees produce, use, and share information in their work environments, semi-directed interviews were first conducted. An interview guide comprising eighteen open-ended questions divided in five sections was used to examine the participants’ (1) work situation, (2) information practices, (3) document genres, (4) challenges related to the system use and (5) expectations to improve system use productivity. Each interview lasted approximately an hour and a half. They were recorded with the consent of the participants and transcribed for analysis.

To complement and validate these results, the same participants were also asked to keep a diary journal during one regular working day. This journal recorded the tasks involving the use of paper and digital texts, the genres of documents, the systems used, and the interactions with other people. The respondents were also invited to add comments describing any difficulties in the completion of these tasks. To ensure the quality of the data recorded, a template of the diary journal was provided to each participant.

Follow-up interviews were conducted the day subsequent to the diary completion. During the post-diary interviews, each journal entry was reviewed in order to ensure their accuracy and precision. Each interview lasted approximately forty-five minutes. They were also recorded and transcribed for analysis.

Data Analysis

The results presented in the next section are based on the data collected in 64 interviews: 34 semi-directed interviews and 30 follow-up interviews. The data were analyzed according to the qualitative content analysis approach (Patton, 2002; Miles & Huberman, 2003). Given the large
amount of data collected, it was imperative to adopt a common analytical framework to identify recurring themes among heterogeneous data sources. A coding scheme was developed with N6, a tool to assist the researcher in the qualitative analysis process. The results presented in the following section provide a comprehensive and realistic portrait of the different challenges in information system use by knowledge workers.

RESULTS

In the semi-directed interviews and the post-diary interviews, a total of 193 occurrences provide a rich picture of the difficulties faced by employees in their daily use of various information systems. Among these challenges, 51.2% (n=99) relate to the different functional, organizational and social challenges generic to system use. Almost half (48.8%, n=94) are specific to email management. These challenges are summarized in Table 1.

Table 1. Sources of challenges with information systems (n=193)

<table>
<thead>
<tr>
<th>SYSTEM USE</th>
<th>MANAGERS</th>
<th>SECRETARIES</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Usability</td>
<td>22</td>
<td>21</td>
<td>43</td>
</tr>
<tr>
<td>System Integration</td>
<td>13</td>
<td>11</td>
<td>24</td>
</tr>
<tr>
<td>Invasion of Privacy</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Digital Preservation</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Resistance to Change</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Lack of System Features</td>
<td>1</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Lack of User Training</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>EMAIL MANAGEMENT</td>
<td>65</td>
<td>29</td>
<td>94</td>
</tr>
<tr>
<td>Overload</td>
<td>29</td>
<td>13</td>
<td>42</td>
</tr>
<tr>
<td>Task Management</td>
<td>17</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>Psychological Pressure</td>
<td>12</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Message Archiving</td>
<td>7</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>TOTAL</td>
<td>120</td>
<td>73</td>
<td>193</td>
</tr>
</tbody>
</table>

Usability

In the data analyzed, 22% (n=43) of the total sources of challenges with information systems are caused by a lack of interface usability. This category was used each time an employee was expressing difficulties realizing a task with effectiveness, efficiency and satisfaction, as per the classic definition of usability (ISO 9241-11). Five types of challenges arising from usability deficiency were noted. These along with the number of occurrences identified in the interviews are summarized in Table 2.

Table 2. Sources of usability challenges (n=43)

<table>
<thead>
<tr>
<th>Task-technology Misfit</th>
<th>MANAGERS n=22</th>
<th>SECRETARIES n=21</th>
<th>ALL n=43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failures &amp; Inexplicable Errors</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Slowness</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Lack of Flexibility</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Absence of Error Correction</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>22</td>
<td>21</td>
<td>43</td>
</tr>
</tbody>
</table>

Task-technology Misfit

More than half of the usability challenges (n=23) relate to a task-technology misfit at the interface level. First, this category regroups occurrences where information expected to appear on the screen is not displayed. Also, some participants mention the system inadequacy to support their task requirement with specific examples such as the need to print document in batch or to manipulate the layout of a text using software other than a word processor. In these examples, expectations are not met since users anticipate to “save time”, while improving the overall quality of their work.

Many employees also allude to the system shortcomings when reading a text on a computer screen. Concepts such as “eyestrain”, “attention deficit” and “lack of concentration” are used to refer to the challenges associate with digital reading. Some users feel they need to physically manipulate a text to properly read it, and declare that reading on screen is “heavier” than reading on paper.

Failures and Inexplicable Errors

Failures and inexplicable errors are also factors that limit the usability of systems. On ten occasions, participants refer to a “system that blocks”, a “computer that “stalls” or “often freezes”, as well as “small bugs” that frequently occur during work practices. The task must be interrupted, the user is confused and try to understand the cause of these failures. Ranking second among the usability problems, failures and inexplicable errors have a negative impact on overall productivity and employee satisfaction.

Slowness

The fact a computer is not fast enough is also mentioned as a source of difficulty. Faced with a system that takes time to process information and respond to commands, some users say they are forced to realize several tasks simultaneously. Sometimes the implementation of integrated systems at the organization level is reported as a cause of this slowness. The user must “do other things while waiting for a response” (A-29, manager).

Lack of Flexibility

Three participants emphasize the importance of having access to systems that support the point of view of its various users, offering customization options. For instance,
an administrative assistant complains that she has to bypass certain system features when her supervisor is away, in order for her to achieve the approval of documents (AS-3, secretary). Associated with the implementation of large integrated systems within the organizations under study, inflexible systems aim at reducing the error rate of employees when performing a task. However, the rigidity of the workflow compelled by the system hinder the user performance when her task does not fit the practices originally intended by the designers.

Absence of Error Correction
A final source of difficulty due to the lack of interface usability is the inability for a user to correct his error upon requirements. On two occasions, the same administrative assistant mention situations where improper system handling had required to go back to make corrections (ZS-2, secretary). In both cases, these attempts were unsuccessful, forcing the employee to develop labor and time-intensive strategies involving the realization of intermediate tasks on paper.

System Integration
In the data analyzed, 12.4% (n=24) of the total sources of challenges with information systems are caused by a lack of system integration. In both the governmental and the municipal organizations, the strategic planning branch has undertaken a rationalization of resources manifested, among other things, by the creation of integrated management systems (for instance, a financial management system and a HR system). These “mega-systems”, adopting a philosophy of centralized management, are intended to improve the quality of business processes, by promoting a better coordination of tasks. Table 3 summarizes the difficulties stemming from these systems.

<table>
<thead>
<tr>
<th></th>
<th>MANAGERS (n=13)</th>
<th>SECRETARIES (n=11)</th>
<th>ALL (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate for Local Management Needs</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Additional Workload</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Incompatible Systems</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Decrease in Service Quality</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>13</td>
<td>11</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 3. Sources of challenges associated with system integration (n=24)

Inadequate for Local Management Needs
On eight occasions, respondents point out that the integrated systems are ill-suited to manage local problem, a difficulty contributing to the task-technology misfit challenge. What resonates the most in this category is the desire of the strategic planning branch to “standardize” the work of the employees based on best practices, a concept a secretary calls “administrative blah” (ZS-4, secretary). According to some participants, this imposed normalization causes a significant gap between the conceptual design of the systems and their actual use in everyday life.

Additional Workload
Seven occurrences refer to the fact that inadequate system integration also increases the workload of the end users, especially when interacting with these centralized systems. This situation leads employees to carry out additional tasks and to implement work-around practices to overcome the shortcomings in system features.

Incompatible Systems
Technology integration raises difficulties related to compatibility between file format and system features. Since all the features to meet the local management needs are obviously not included in the mega-systems, employees continue to use in-house systems in parallel to perform some of their tasks. This causes compatibility problems that the end user must manage somehow.

Decrease in Service Quality
The implementation of integrated systems also requires a centralized maintenance and user support service. In the data collected, three respondents mention the difficulties caused by a decrease in the quality of services to the end user. This reduction in services is particularly obvious for users who suffer important administrative delays in response to their requests. The user of the system who experiences a failure or a problem “gets stuck”, and is unable to continue her work.

Invasion of Privacy
In the data analyzed, 3.6% (n=7) of the total sources of challenges with information systems are caused by the employees’ fear of loosing their privacy. Seven managers emphasize the threat of technology availability. All in possession of mobile devices to manage their email, receive phone calls and access Internet, these participants use concepts such as “intrusive”, “crutch”, “weight” and “object too present” in reference to the risks of technology invasion. For the employees, loosing privacy results in a reduction of the frontiers between their work life and their personal life. A manager states that “the boundary between her home and her work is much more blurred than before, perhaps at the expense of the house” (F-2, manager). Another says he does not take a real vacation when he leaves, remaining connected to the office all the time (B-28, manager).

The invasion of privacy is also reflected on the psychological level, some managers feel that mobile technologies increase their daily stress. According to a manager, being constantly caught in the “heat of the action” through technology limits his implication in strategic planning and decision-making, which for him constitutes the “real role” of a manager (B-35, manager). Overall, the majority of managers who outline the risks of having technologies available at all time also confirm that mobile
devices facilitate their work. Concepts such as “healthy lifestyle” and “life discipline” are used by participants as expected solution to this important challenge.

Digital Preservation
In the data analyzed, 3.6% (n=7) of the total sources of challenges with information systems are caused by a lack of policies and procedures in digital preservation. In the interviews, seven occurrences allude to the difficulties related to the management of information generated by the systems. At the organizational level, employees denounce the absence of standards and procedures regarding digital information management. This deficiency affects the end users who do not know what to do with the information received and produced in “industrial amounts” (A-6, manager). For many, the application of standards and procedures are expected in order to obtain clear guidance on what is worth keeping.

As a consequence of this lack of standards and procedures, participants also criticize the inadequacy of their preservation strategies. In their digital work environments, employees face many difficulties to organize information. In addition to problems in managing different versions of the same document or choosing the proper location to save it, employees emphasize the shortcomings of archival system features and their “lack of power” in retrieving information. A manager also mentions his feelings of insecurity with regard to the current preservation methods, by highlighting the possibility of creating “false documents” (A-6, manager). The lack of proper approach to manage personal information is also specified as a source of difficulty, some employees feel “completely submerged”.

Resistance to Change
In the data analyzed, 3.6% (n=7) of the total sources of challenges with information systems are caused by behaviors leading to reject the changes brought by a new system. Despite the strong presence of various systems in the lives of the employees, resistance to change is reflected by inertia when it comes to implement new practices through technology. In a context of centralized management, where the different stages of a business process are supported by an integrated system, this inertia causes problems delaying the logical task flow and collaboration patterns; if one employee resists, the entire chain of production is affected.

Working in teams, some managers are pioneering attempt to implement more efficient work practices using technology. The failure of these attempts was noted on several occasions, due to the employees’ habit of using paper format documents to perform their tasks. On this matter, two managers mention that the use of technology goes against their role. According to them, technology use should be reserved to support staff. A manager also asserts “not being paid” to use software such as word processing, preferring to “invest elsewhere” his time and energy (B-35, manager).

Lack of System Features
In the data analyzed, 3.1% (n=6) of the total sources of challenges with information systems are caused by a lack of system features. In the interviews, six participants mentioned the need to have access to features that allow them to perform their tasks more effectively. Several reasons are mentioned to explain their absence. First, a manager emphasizes the “technological limitations” expressing the desire to have a voice recognition system to produce documents, to avoid “the effort of typing in order to write something” (B-37, manager).

Two respondents refer to the lack of interoperability between systems used in federal institutions that do not have the same licenses. The gaps between system feature availability create not only inequality in service provided but also access to information problems. Employees can only “be resigned” to use a tool that is not entirely suited for their needs.

Lack of User Training
In the data analyzed, 2.6% (n=5) of the total sources of challenges with information systems are caused by a lack of user training. At the individual level, some employees feel they do not operate at full capacity the tools that are available to them, often due to a lack of knowledge. Other mention their needs to learn more about technologies, which would improve their satisfaction and overall work performance.

Email Management
In the data analyzed, challenges related to email management account for almost half of the occurrences (48.8%, n=94). During the data collection, all participants asserted with conviction that email has become crucial in their daily work practices. Expressions such as “it has become essential”, “I could no longer live without it”, “everything now goes through there”, “it is vital”, “it is a tool of all times” and “it revolutionizes the earth” were used to describe the impact of email in work environments.

In return, however, it appears that email is, according to a manager, “becoming a victim of its own success” (A-5, manager). If more than one participant point that email has a positive impact on their work, some wonder if the disadvantages are not, ultimately, more important. Recognizing this importance, the data analysis focused on issues specific to email. These have been further grouped into four main categories. These categories and the number of occurrences identified in the interviews are summarized in Table 1. Details are provided below.

Overload
Email overload is a major issue for the organizations under study representing 21.8% (n=42) of the total sources of challenges with information systems. This overload is
manifested in the feeling of not being able to maintain control over the management of email messages. Forty-two times during the interviews, the difficulties caused by this phenomenon are mentioned. Email overload is due to five factors:

1) **Quantity.** Participants complain about the amount of emails they received daily. Terms such as “overload”, “hell”, “insane”, “vicious”, “heavy”, “long”, “flooding”, “free-for-all”, “evil”, “appalling”, and “epidemic” are used to describe the volume of email that “does not cease to grow”. On average, managers receive more than fifty messages daily, this number going up to two hundred in some cases.

2) **Poor Targeting.** Intrinsically linked to the amount of messages received, bad targeting is a major cause of frustration. A manager says that 50% to 70% of messages she receives daily should never reach her (B-35, manager). Employees attribute the poor targeting to the ease of writing an email in comparison to paper-based letters. The insecurity of certain employees, who are sending a large amount of messages in CC to their manager, is also mentioned to explain the poor targeting. Internal communications sent broadly to employees is also an issue.

3) **Large Attachments.** Email overload is also due to the presence of attachments. Four managers emphasize the difficulties to manage messages containing sometimes up to twenty attachments. Participants refer to the time needed to download all the documents, the necessity of having some attachments printed and the effort required to read the most important information according to reasonable deadlines.

4) **Discussion Thread Length.** Email overload is also caused by the presence of discussion threads, their length being sometimes “several pages”. Some respondents explain how they have developed innovative reading skills, “upside down”, “up and down until it makes sense” or “comparative” to try to save time. Some administrative assistants print all the long messages for their managers, in order to categorize and organize in piles the things to do. They also highlight important information with a marker. This practice causes messages to be processed twice, once by the secretary, then by the manager.

5) **Propagation Effect.** A final factor that aggravates email overload is the propagation effect mentioned three times during the interviews. The proliferation of email is caused by senders who are using the CC field without discernment, leading to the messages’ exponential multiplication.

**Task Management**

Twenty-eight times, the difficulties caused by the need to manage tasks through email are mentioned, which represents 14.5% of the total sources of challenges with information systems. More than just a communication tool, email is considered by respondents as a “new way of working” and a “useful tool to plan for the day”. In this regard, a manager says his daily job is orchestrated by his email (Z-2, manager). For the majority of the respondents, opening the email system is the first thing they do in the morning in order to plan for all the pending tasks. Surprisingly, the results show that more than half of the participants print, in whole or in part, important emails they received on a daily basis.

For individuals, the burden of monitoring tasks through email results in difficulties to filter what is relevant from what is not, which leads to additional practices such as the printing of important messages. The need to print is partly caused by the lack of email system features to efficiently support task monitoring. Consequently, several respondents have implemented workarounds enabling them to organize their daily work such as marking as unread the messages containing tasks or leaving in inbox only the important messages.

Task monitoring is often shared between the managers and the secretaries. In the sample twenty-six managers and administrative assistants are collaborating daily to better manage email. In this collaboration, the secretaries are triaging the managers’ email while assigning different level of priority to pending tasks, an activity that generates several difficulties. Inadequate messaging system interfaces is an important cause of difficulties for secretaries who monitor high priority messages. For instance, having to access different messaging systems creates challenges such as message duplication, compatibility errors between accounts and task switching between two systems.

In general, the data demonstrated that task management on an individual or collective basis requires the development of complex strategies that are poorly supported by the current messaging systems.

**Psychological Pressure**

In the data analyzed, 6.7% (n=13) of the total sources of challenges with information systems arise from the psychological pressure exerted by email. Of the thirteen occurrences identified in the interviews, twelve are expressed by the managers. A manager explains that email is “the least pleasant part of the job” (B-16, manager) adding that on Sunday night, he thinks of email and the fact he will spend all Monday morning managing messages. Another participant says she feels like a “slave” of her messaging system (B-34, manager). Many managers refer to the fact that email generates a lot of work, plus the pressure to perform according to shorter deadlines. Email overload generates different feelings of insecurity, such as the “fear of missing out on a vital information” (A-5, manager).

The psychological pressure exerted by email also comes from the fact that employees are constantly interrupted by the arrival of new messages. Perhaps precisely for fear of missing out on something important, many respondents use options such as sounds or pop-ups to signal the arrival of
new messages, which increase the feeling of work-related stress and overload.

Message Archiving
The last category of problems related to email concerns message archiving, which constitutes 5.7% (n=11) of the total sources of challenges with information systems. Eleven times, respondents refer to challenges in 1) the general organization of the messages, 2) the management of attachments and 3) the lack of storage space.

1) General Organization of the Messages. As noted previously, participants encounter many difficulties with regard to the management of digital information. Exclusively responsible and accountable for the management of email, confronted to a lack of standards and procedures, employees must develop their own strategies for organizing their messages. On that matter, the interviews reveal three general approaches in the employees’ organization of messages: those who implement assiduous records systems, those who suppress the majority of messages received after the completion of the task, and those who rely on search tools to locate email afterwards. In both the organizations under study, there is no official archival system.

2) Management of Attachments. The preservation of attachments is also a source of problems that contributes to the difficulties of email management. Not knowing what to do with the documents attached to the messages, respondents mentioned the fact they duplicate backup and the use of storage space. As a security measure, attachments are both preserved in the email system and on the hard drive of the user.

3) Lack of Storage Space. Finally, the lack of storage space is also considered as a source of difficulties in the daily management of email, often caused by the presence of heavy attachments. On four occasions, the participants stressed the irritation caused by a frozen mailbox declared as “full” by the system administrator. Interrupted in their work, employees must then proceed to tedious archiving tasks.

DISCUSSION
In this study, respondents mentioned 193 times their challenges in the use of information systems. These difficulties relate to the lack of interface usability and system integration, the invasion of individual privacy by technology, the absence of procedures and policies regarding digital preservation, the resistance to change, and the lack of system features and user training. As already stated in several studies (Dabbish & Kraut, 2006; Siu et al., 2006; Barreau, 2008; Capra et al., 2013) email is a vital tools for employees. Email management presents important challenges relating to the daily overload of messages, the need for better task management, the psychological pressure and the burden of message archiving. Despite the obvious advantages of this tool, it is quite surprising to discover that almost half of the participants are still printing messages to efficiently perform their tasks.

From the analysis of challenges related to the use of information systems by knowledge workers, three families of needs have emerged. These needs, as described in the following, involve 1) paper affordance, 2) task monitoring, and 3) information value assessment for archival purposes.

1) Paper Affordance
Despite the massive implementation of technologies in the organizations under study, some employees still prefer to use paper to realize their information related tasks. These results are supported in several personal information management studies that highlight the importance of paper for increased productivity (Whittaker & Sidner, 1996; Sellen & Harper, 2002; Boardman & Sasse, 2004; Bondarenko et al., 2010). Although it is expected that the situation will slowly evolve in organizations, it remains that paper is an important feature to improve the realization of knowledge work.

Sellen and Harper (2002) use the concept of “affordance” to refer to the qualities that make paper a medium of choice when performing certain tasks. In this research, respondents cited many reasons to use paper format documents instead of their electronic version, for instance the facility to switch between tasks, the preference of reading a physical document, and the need to perform task completion tracking. In public administrations where business processes are accomplished through the use and production of documents, the handling of paper versions instead of their digital counterparts can be counterproductive and can also impede the adoption of certain technologies.

2) Task Monitoring
The study of the difficulties associated with the use of systems supports previous finding on task management and PIM (Boardman & Sasse, 2004; Dabbish & Kraut, 2006; Barreau, 2008; Bondarenko, et al., 2010; Karr-Wisniewski & Lu, 2010). During their work practices, employees do not use a system to interact with the interface or to manage information, but to realize very goal-oriented work practices. As stated by Bondarenko et al. (2010), document management is “a secondary, supportive process within knowledge work” and an information system “has to satisfy the least-effort principle in order to facilitate performance of information workers” (p. 481). What is the most important for users, it is the work task they aim to achieve.

For that reason, email management constitutes a critical activity, which leads to almost half of the challenges noted by the study participants. In this research, it appears that messaging systems do not adequately support email users. For instance, email systems do not allow employees to organize the messages according to different priority levels, as shown by Dabbish et al. (2005) or organize messages to effectively plan their tasks (Whittaker and Sidner, 1996; Siu et al, 2006; Whittaker et al., 2006). In order to effectively
manage their messages, employees implement various workarounds practices indicative of their real needs and their strong pragmatic requirements (Alberts & Forest, 2012).

3) Information Value Assessment for Archival Purposes
In the conclusion of her study of knowledge workers, Barreau (2008) stated that “to a certain extent, the PIM problem is a records management problem, and the responsibility for records management falls squarely with organizational management” (p. 315). Supporting this conclusion, this study reveals that preserving digital information, particularly email archiving, is a source of concern and difficulties for employees.

As organizations are becoming more and more digital, the field of archival & records management is acquiring a new pivotal importance. Today, there are numerous challenges to appraise the business value of information created by new emergent technologies. These challenges are compounded by the added appraisal responsibilities that now rest with the unprepared employee rather than the skilled information manager. In the design of new technologies, organizations have to embed requirements, policies and procedures leading to better archiving practices and accountability.

CONCLUSION
The outcomes of this research are both theoretical and practical. From a theoretical perspective, this research offers an integrated perspective of the various challenges affecting the knowledge workers’ productivity in the digital work environment. For practitioners, the findings offer new insights on the requirements and expectations of these employees when using information technologies such as email to accomplish their daily tasks.

As reflected in the most recent literature, email is clearly of paramount importance for contemporary knowledge workers despite the challenges presented by its rampant adoption and evolution. In light of this study, the technological and organizational policy-making decisions for the implementation of new information systems must ensure that email as a tool drives true productivity and avoids the productivity paradox.

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REFERENCES


Bondarenko, O., Janssen, R., & Driessen, S. (2010). Requirements for the design of a personal file organization from the desktop. ACM.


