

Technology and the HR field: The Growth of Human Resource Information Systems

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Abstract

The aim of this paper is to review both the professional and academic development of human resource information systems (HRIS), and to critically evaluate its growth, to recommend methods to move research forward. In this context, the relationship between technology development and the HR field, is examined through four key periods of technology namely, client server, mainframe, cloud-based, ERP and web-based systems. For each period, this paper elaborates on the HR practices and how the need to apply these systems has led to the development of the HR field. Furthermore, the HRIS subfield and its relationship are examined with the technological developments in the HR field. The findings reveal that, the majority of the studies on the application of technology to support HR, has been conducted in the last 20 to 25 years, as a response to the use of the web, as a medium for delivering HRIS. The result is achieved through discussing how researchers from the information systems (IS) and HR fields, coordinate and cooperate with each other to support HRIS development.

Keywords: HR Technology, Electronic Human Resource Management, Human Resource Information Systems (HRIS)

1. Introduction

The earliest HRM computer-based systems were used for systematizing and supporting employees' payroll as well as for other data demanding functions such as, keeping employee records. For instance, in 1943, HRM was fundamental for the improvement of the new payroll systems following the tax legislation, through the use of the enhanced first in-house processor system (Javad Shahreki, Ganesan, Raman, Chin, & Chin, 2020; Voermans & van Veldhoven, 2007). Only from the 1940s, HRM initiated the use of technology, so it has often developed relatively slowly compared to the implementation of new technologies in other practical areas such as, supply chain and accounting management (Goodhue, 1995). Until the 1990s, the benefits and importance of technology was not clear for the HRM field (Javad Shahreki et al., 2020; Venkatesh, Speier, & Morris, 2002), due to relatively limited theories and studies that had been carried out in the field (Stone & Dulebohn, 2013). However, in the last 20 years, technology has had a great impact on HRM practices and processes, which led to the development of a new field proposed as, HRIS. The main objective of HRIS, is to implement new technology to assist and reinforce the HR

function. An HRIS is defined as, a system implemented to analyze, store, acquire, manipulate, distribute and retrieve information based on companies' HR, to support managerial decisions and HRM (Stone, Deadrick, Lukaszewski, & Johnson, 2015). This new field is also referred to as, electronic HRM (eHRM) (Bamberger, Biron, & Meshoulam, 2014). The system that started off as a simple processor to automate payrolls has now evolved into a highly systemized HRIS, used in compensation selection, recruitment, and training (Bondarouk, Parry, & Furtmueller, 2017; Bondarouk, Ruël, & van der Heijden, 2009). This has led to a significant improvement in many HRM sub-functions and has additionally reduced administrative burdens, has empowered the field to improve productively, and has provided improved services for retirees, employees, and job applicants. Additionally, the introduction of the internet and new cloud-based technologies has assisted HRM to reach its objectives, of simplifying the implementing of self-service technologies, streamlining selection processes, attracting talented interviewees, and permitting organizations to provide training in distant locations. The evaluations have revealed that, almost all large organizations have implemented HRIS to help core decisions, processes, and functions in their

organizations (Stone et al., 2015). Likewise, the smaller organizations use HRIS to help HRM functions. However, very few studies have been conducted on the implementation of HRIS, and development of this field has received little attention. Studies that have been carried out in this field, just focused on the relationship between technology changes and the IS application in HRM (Fobang, Wamba, & Kamdjoug, 2019; Kumarapeli & Peiris, 2018). In general, knowing the history of the HRM field is essential, since it leads to the continuities and discontinuities related with the development procedure. Moreover, it assists HRM managers to learn from prior errors in order to prevent repeating them (Bondarouk et al., 2017; Galanaki, Lazazzara, & Parry, 2019; Vanhala & Ritala, 2016), and helps them to recognize why the field has not accepted other functions in technology adoption. Therefore, a review of the field's history will provide a basis for change, growth and improvement, to a level where HRM implementation technology can fulfill its main objectives. The growing implementation of IS in HRM and its impact on the field, has led to the development of the objectives of this study. Therefore, this paper aims to; (1) review the history of HRIS based on technology developments, (2) investigate how IS has transformed HRM practices and explore how these practices have changed the new systems' development and implementation, and (3) examine the influence of four main technology innovations on HRM practices and process changes. Particularly, the current paper aims to investigate how (1) client-server computing, (2) mainframe computing, (3) web-based enterprise resource planning systems, and (4) cloud-based software leads to HRM changes. For every technological period, the HRIS and HRM fields' main innovations and the relationship between technological innovation and HRM practices, will be reviewed. This paper not only includes a review of research previously carried out on HRIS, and field milestones, but presents a number of research questions, to direct future studies and practices. The review of the literature will focus mainly on U.S.-based practices. Lastly, the results and conclusion of the current research will focus more on the way that the theory and research of the HRM and IS fields are combined, for the development and growth of the HRIS subfield. In following section, the terms HRIS and eHRM will be elaborated on, and their usage in the field.

2. Differences between HRIS and eHRM

Not only is the rapid growth in the usage of IS in various functional areas essential in organizations (Asadi and Dahlan, 2017; Asadi, Nilashi, et al., 2019), but also equally important in areas of finance, marketing, accounting, and supply chains. One of the biggest challenges for companies, is to identify how these newer fields that are connected to the functional fields and IS (HRIS), will eventually evolve (Kassim, Ramayah, & Kurnia, 2012; Maier, Laumer, Eckhardt, & Weitzel, 2013; Troshani, Jerram, & Rao Hill, 2011). Some researchers have proposed that, defining the field's core and the research types are necessary, in order to

distinguish this field from other related areas (Dery, Grant, & Wiblen, 2009; Serenko, Bontis, Booker, Sadeddin, & Hardie, 2010; Javad Shahreki, 2019a). Therefore, researchers have coined two principal terms to differentiate the related fields namely; HRIS and eHRM (Bondarouk et al., 2017; Galanaki et al., 2019; Marler & Parry, 2016). The term HRIS refers to the wider field of IS, and was initially described as a system to store, acquire, distribute, analyze, manipulate, and retrieve information, based on an organization's HR. The term HRIS does not merely refer to computer hardware or software associated with HR, though it incorporates them too, but rather comprises of forms, people, data, procedures and policies (Ball, 2001). This definition is somewhat similar to the prior definition of IS. However, the HRIS definition emphasizes data about the people of an organization, which is different from conventional structural systems, which centers around inanimate data, that manager's use for planning and decision-making. Thus, it is very important to explore, which employees and job applicants communicate and interact with companies, to enhance connections, and acquire main HRM services. Additionally, the HRIS has a unique feature, in that it facilitates companies in motivating, attracting, and retaining employees, which are essential factors in overcoming competition from other organizations, to attract as well as retain talented and skilled workers. Moreover, the success of HRIS is mainly based on its acceptance and implementation by all internal and external stakeholders, even for those who may not be under the organization's direct control. In the early 1990s, the term eHRM was proposed for web-based commerce, or "e-commerce" (Parry, 2011). According to Bondarouk et al. (2017), eHRM refers to HR transactions over the internet. The term eHRM has also been used to define HR applications that are carried out using web-based technology (Marler & Fisher, 2013). However, the comprehensive definition of eHRM can be explained through the mechanisms by which organizational stakeholders access HR functions and information through the internet or corporate intranet sources (Marler & Parry, 2016). This definition conveys the significance of the web and internet in the HR services delivery, more clearly. The definition of HRIS as, a technology to assist back-office HR applications (Fobang et al., 2019; Javad Shahreki, 2019b) is an inadequate description, which does not do justice to the true complexity of the HR systems. Currently, HR systems have evolved to assist internal managers, personnel and operations, and combining them with external systems, including applicant recruitment, retirement, health benefits as well as tracking. Review of the literature related to HRIS has revealed that, the main focus of research has been centered on the systems themselves, including ways to design and implement the system more effectively (Maier et al., 2013; Javad Shahreki & Nakanishi, 2016). On the other hand, e-HRM related literature, has displayed a more strategic approach by analyzing how HR procedures have transformed (Marler & Parry, 2016; Stone & Dulebohn, 2013). Consequently, HRIS is a general term that includes various HR systems

that companies implement, whereas the term e-HRM is used for the communication system or interactive systems applied by an organization. In summary, HRIS can be defined as a system, which employs web-based technology to store, save, and distribute data based on a companies' HR. In addition, HRIS supports the interaction, communication, and service purposes based on HR processes such as, e-learning, e-recruiting, and e-benefits, which are different from central HR systems, which only include employees' basic data and application of HR for "customer-facing" systems. This system facilitates various functions like, evaluating employee performance, choosing and recruiting potential workers, managing worker benefits, training workers, as well as a range of other activities. Compared to eHRM, HRIS supports companies' collection and implementation of data to help employees, HR processes, applicants, and managers to make decisions, while eHRM is the HR functionality use, which is supported by a HRIS to make connections between applicants, employees, managers, and their decisions. According to Parry (2011), eHRM is a method of conducting HRM, which incorporates the use of technology as the platform or mechanism via which HR functionality and processes are used for both internal as well as external participants. Since e-commerce is supported by IS, eHRM is also supported by HRIS, so its focus was more on applying HRIS to assist and sustain the HRIS itself, as well as the HR transformation to eHRM, and the eHRM implementation by companies.

3. Advances in Technology and the HRM Field

In recent years, the HRM field has experienced significant transformations and has thus implemented numerous forms of IT to achieve its purpose. The evolution and history of transformations in the field of HRM and HRIS, in the four different forms of technology including, cloud-based software, client-server computing, mainframe computing, and web-based enterprise resource planning system, is summarized in Table 1.

3.1 Mainframe Computing (1940s—Mid-1980s)

Government rules and regulations have shaped the HRM field significantly, particularly between the 1940s until the mid-1980s. During this time the continuous growth in organizational size and geographic settings, warranted the development of more effective means of documenting and storing large amounts of employee data, and managing tasks like, payroll. For instance, due to World War II, in the US there was a sudden movement of millions of people into the military, which led the government and related organizations to figure out a way of collecting and categorizing data on jobs of employees. Consequently, the Air Force established and developed a validated system of job descriptions, which they coined, "The Comprehensive Occupational Data Analysis Program" (DeSanctis, 1986; Thite, Kavanagh, & Johnson, 2012) for every employee. Yet another example was in 1943, following the

introduction of the "Current Tax Payment Act", organizations were required to decline taxes from worker's paychecks, which resulted in an increased demand for record keeping in personnel departments. Organizations initially were only required to record and manage basic data information of all employees including; name, postal address and phone numbers, however eventually more complex information and data including, employee federal taxes, overtime hours, and other wage data had to be recorded and stored. Moreover, due to the implementation of new procedures and guidelines by the government, big companies required methods to regulate payroll, worker compensation and personnel records. This led to a number of organizations to begin implementing technology for maintaining payroll procedures. One such organization is, GE, a large organization that developed its own mainframe payroll procedure (Voermans & van Veldhoven, 2007). Some companies on the other hand, outsourced their payroll system to organizations like ADP, one of the first payroll companies, founded in 1949. By the end of the 1950s, the mainframe computer was implemented, to provide support for payroll requests, and IS supported and automated some of the first procedures. In 1961, ADP implemented an 'IBM 1401 mainframe computer', which was used for payroll procedures for key customers (ADP, 2019). The need for proper storing and recording of data increased during the mid-1960s and early 1970s, due to the introduction of various acts namely, the "Age Discrimination in Employment Act" of 1967, the anti-discrimination laws of U.S. Government such as the, "Title VII of the Civil Rights Act" of 1964, and the formation of new governing agencies such as "Equal Employment Opportunity Commission" (EEOC). Meanwhile, a small company in Germany, SAP, was established and developed requests to support payroll and basic HR functioning. An integrated version known as, R/2 was introduced in 1979. This system was the forerunner of the current integrated enterprise systems, used in various companies. Although from the 1940s, the HRM field began to use mainframe systems, studies on HRIS and HRM technology implementation remained slow. The review of related literature to HRIS mainframe systems revealed that, the majority of studies were expert oriented and based on the way of implementation, development, and application of these systems. For instance, Nardoni (1982) carried out a research on the use of technology in supporting HRM practices, in various areas. Another example are the studies carried out by Bloom (1982) and Ceriello and Freeman (1991), who investigated ways of implementing organized systems development practices, as a means to increase the possibility of system implementation. In general, throughout the mainframe phase of HRIS, large organizations started to use HRIS for automating basic HR functions such as, payroll and implemented record keeping based on the reporting needs and government regulations. Implementing mainframe computing had a considerable influence on HRM, through a surge of efficiency in HRM practices. Therefore, according to Muriithi, Gachunga, and Mburugu (2014), technology helped HRs to decrease costs

and administrative problems in most of their departments. However, there is a limited amount of research or academic theories that have focused on investigating the efficacy of these novel systems, albeit a few specific studies that were carried out to elucidate in what way these systems impact HRM activities, as well as the efficacy of the implementation method (Henderson, Hickson, Weatherburn, & Reid, 1979).

3.2 PC-based Applications and Client Server (Mid-1980s—Mid-1990s)

As described in Table 1, during the 1980s and 1990s, the development of computer networks facilitated companies in storing, securing and handling information in several places. As a result the HRM databases began to move from mainframes to other alternatives like, personal computers, which led to companies developing Local Area Networks (LANs), in order for connecting the various hardware. The establishment of personal computers resulted in a decrease in costs for companies, as compared to mainframe computing, and allowed for managers and personnel to retrieve data from their personal workstations. In addition, companies initiated the implementation of a “client-server” method, for business purposes, so that it supported both central computers (minicomputer or mainframe) and local personal computer processing, despite mainframe computing. In conventional mainframe computing, there was a central control system which was only available to personnel working with the mainframe. However, with the client-server approach, organizations could deliver computing authority and maintain employees’ information in various areas. This would potentially allow for data to be stored locally in workplaces, maintained by local HRM personnel. This would allow for easy access and retrievability of relevant data, for managers as well as employers who required the information for employee decision-making. Consequently, the information would be more accurate and current. One of the pioneers in the client-server area, were the developers of PeopleSoft, which was specifically developed and released for this purpose and not for mainframe computing (Strohmeier, 2007). The establishment and release of this software marked an important achievement in the client-server field, since it was the initial software that was designed for supporting HR rather than being a supplementary to an ERP. Software suppliers started to increase product offerings that were not limited to core HR systems in the HRM setting. They additionally offered client-server and PC systems, and settings such as, performance appraisal, applicant tracking, development and training, and HR planning. Therefore, during this course in time, between the 1980s and 1990s, the HRM arena experienced significant changes such as, the refusal of “industrial relations systems” and “private sector unionization” by companies (Arthur, 1994). In addition, manufacturing was shifted to a service economy and organizations considered employees as being critical to their success in the new economy. Furthermore, global competition led organizations to be

more productive, and were involved in extensive restructuring, downsizing, and redesigning, with a continuously growing IS complexity. Organizations believed that they had to compete with other organizations, regarding their employees’ talents and skills, and HR was considered to play a critical role in the structure of a company (Becker & Gerhart, 1996). These transformations generally improved employee personal-control as opposed to administrative control. The client-server approach helped to disperse control within HRIS, which allowed companies to carry out HR development and implementation evaluation, to improve employee skills and abilities and to decrease administrative problems, to make HR a stronger strategic partner in the organization. As result, academic studies on HRIS were not independent of the field’s development in the mainframe setting. The majority of studies were conducted in a survey or case study format, to investigate how organizations used or implemented HRIS (Kovach & Cathcart, 1999; Lippert & Michael Swiercz, 2005; Tansley & Watson, 2000), or which department would be in charge of its maintenance and implementation (HR or IS) (Ashbaugh & Miranda, 2002). The client-server systems supported HRM between the 1980s and 1990s, to accomplish many of its main purposes by offering HR experts and managers with relevant information in order to improve HR development and facilitate in the critical decision making process of hiring. Furthermore, these systems reduced administrative problems and enabled HR experts to be strategic associates, instead of responsive maintenance-focused administrators. Although these new systems are used extensively, there is a paucity of studies that have been carried out on investigating the effectiveness of IS or HRM.

3.3 Enterprise Resource Planning (ERP) & Web-based Systems (Mid-1990s—2010)

As shown in Table 1, the mid-1990s, saw the emergence of the usage of web based systems or ERP in HR practices, for the purpose of selection, recruitment, managing performance, training and compensation. During this period of time, various different software were released, and there was an increased movement towards centralizing web-assisted EPR systems. This movement began in the early 2000s, where web-facilitated software helped companies integrate all their organizational data and HRM, making the data accessible to all users via web browsers, regardless of place or time. Recruiting systems were developed through these platforms. Web-based recruiting systems allowed applicants from all over the world to apply for jobs through online portals. Thus, it is believed that this was the beginning of a new era for HRM, coined “eHRM” wherein HR activities were supported and provided by web-based browsers throughout the networks (Strohmeier, 2007), so the HR department could communicate effectively with internal as well as external participants such as, managers, employees, candidates, payroll and benefit providers. The developers usually considered two different factors while

proposing products namely; “best-of-breed” or an “integrated ERP suite”. The companies labeled as best-of-breed refer to those companies that have obtained and applied distinct systems for every specific HRM field like, a recruitment system, a central HR system, a benefits management system, and an attendance and time system. The benefits of integrating the best-of-breed approach to HRM software use, was that companies could determine and apply the software that was most relevant for their purpose, for particular settings in order enhance their function, however these methods did not integrate satisfactorily, or permit the transfer of whole data, thus organizations had to transfer data between systems manually. One of the common issues associated with best-of-breed organizations was that, they were frequently required to move information manually, from the “talent acquisition software” into the central HR system. Additionally, each of the software required a different username and password, which was challenging for users. Therefore, organizations developed their own software to support data movement between systems, and created a means of connecting between different software, reducing manual entry, and providing single sign-in methods. These systems’ scope, complexity, and price showed however that, they were used only in large organizations. Currently however, many organizations can reap the benefits of ERP implementation, since just a single software package can be used to streamline implementation, maintenance, and IT design. Another advantage is that, HR managers and employees have access to more data to make better decisions, support performance assessments, and manage HR. Therefore, this entire data integration allowed organizations to use employees data effectively (Bissola & Imperatori, 2014; Marler & Fisher, 2013; Javad Shahreki, 2019a; Stone & Dulebohn, 2013; Wiblen, 2016). Meanwhile, the HRIS experienced drastic changes with several mergers of best-of-breed consulting organizations and vendors. Numerous software retailers advanced their recruiting, time and attendance products, while they successfully developed software catering to organizations’ objectives, as well as expanding their HRIS offerings scope. Examples of best-of-breed retailers include, Kronos (time and attendance), Taleo (recruitment), and ADP (payroll), which are forerunners for their “best-in-class offerings” in particular settings. Oracle eventually purchased Taleo, and ADP evolved from a payroll retailer to develop into an integrated ERP. Pioneers in the HR ERP area include, PeopleSoft, SAP, Lawson and Oracle. During this period in time, a major innovation was, employee self-service (ESS), which allowed employee access and management of their basic information, ability to view paychecks, review and assign retirement funds, enroll in health benefits, and receive company information for the first time (Marler & Fisher, 2013; Strohmeier, 2009). ESS is of interest to organizations because of its capability of increasing savings. Based on the analysis, by using ESS, the cycle times and costs per transactions reduces by about 50% (Bondarouk et al., 2017). ESS has also attracted the attention of researchers, and they have conducted some

studies on the advantages of applying ESS in companies (Parry & Tyson, 2011), they also investigated the factors that impact employees’ intension to implement ESS, and their satisfaction (Marler & Parry, 2016; Vanhala & Ritala, 2016). Due to the rapid improvement and growth of internet and web-enabled systems, the implementation of ESS has also increased, so now employees have access to their data anytime, anywhere, as long as they have access to the internet. Academic research on HRIS also increased during this era of technology. The focus of researchers was more on the HRIS strategic value and adoption concerns (Fobang et al., 2019; Kumarapeli & Peiris, 2018; Noutsu, Kamdjoug, & Wamba, 2017). The main focus of academic research was on, the implementations of HRIS in organizations through transformation of their HRM (Al-Dmour, Masa’deh, & Obeidat, 2017; Kassim et al., 2012; Maier et al., 2013; Troshani et al., 2011). Therefore, there is a lot of literature available on the investigation of the acceptance and effectiveness of e-recruiting, e-selection (Stone et al., 2015), e-learning (Derouin, Fritzsche, & Salas, 2005), e-compensation (Stone & Dulebohn, 2013), and e-performance management (Strohmeier, 2009). In summary, the technology evolution helped to facilitate academic research of HRM in multiple functional areas. The studies examined the extent to which an e-recruiting system had influence on applicants’ interest in applying for a job (Uggerslev, Fassina, & Kraichy, 2012), or employee satisfaction of benefit systems (Bondarouk et al., 2009). Some of the research included studies that explored eHRM acceptance, in terms of acceptance of recognizing the significance of communications, as well as the necessary conditions of those systems, to fulfill employee and company objectives (Bondarouk et al., 2017). In addition, other studies evaluated these systems’ effectiveness, especially e-learning (e.g., Abdullah & Ward, 2016; Derouin et al., 2005) and e-recruitment (e.g., Dhamija, 2012; Holm, 2012) systems. Therefore, between the 1990s and 2010, ERP or web-based systems were implemented in HR departments to achieve their essential objectives including, performance management, selection, recruitment, training, and compensation (Table 1). For instance, applicants could apply online for a job in organizations through web-based recruitment systems, and organizations used e-learning methods to train their workers, and improve the convenience, flexibility, and related expenses, as compared to conventional training techniques (Marler & Parry, 2016). Consequently, there were many studies carried out on the acceptance and effectiveness of these novel systems (Al-Dmour et al., 2017; Kumarapeli & Peiris, 2018; Noutsu et al., 2017; Javad Shahreki, 2019a). In summary, web-enabled systems have helped to improve the effectiveness of HR practices, and increased accessibility to employee data, job applications and retirement programs, however studies have not been carried out to investigate whether these novel systems facilitate HRM in achieving its primary goal of retaining, motivating, and attracting workers (Galanaki et al., 2019; Marler & Parry, 2016; Wiblen, 2016).

Table 1

Evolution and changes of HRM and HRIS

Timeframe	Changes in HRM	Changes in HR Technology
Before 1940	Data recording and payroll conducted manually	
1940s–1950s	Implementation of federal tax policies	Development of original payroll systems
	Accounts for skills and job classifications required for government and military	Introduction of “electronic data processing systems” on computer processors, for employee assistance and payroll
	Big organizations (GE, GM, Mobil and AT&T) implement “personnel” technology	Establishment of ADP
1960s–1970s	Personnel reporting rises, as a result of higher labor costs	Mid-size organizations implement personnel information systems, as a result of lowered costs and changing technology
	An increasing growth of HR information requirements, leads to streamlining and eliminating data redundancy	SAP establishment and R/2 released: precursor of integrated ERP
1980s–1990s	Increased growth and globalization lead to systems integration (HR, finance, accounting, manufacturing)	Development of central servers, client-server computing, LANs and “microcomputers” leads to personal workstations having access to HR information
1990s–2010	Establishment of the balanced scorecard to evaluate HR efficacy	Development of metrics to facilitate reporting system of balanced scorecard
	HR and IT call centers outsourced offshores	Development of “best-of-breed” systems centered around single HR activities such as, e-learning, e-recruiting, etc. Primary leading retailers include, Taleo, Kronos, and Hewitt.
2010–present	Emphasis on improving effectiveness of HR functions and cost control	Establishment of cloud-based software for HR practices. Primary leading retailers include, Success Factors and Workaday.

3.4 Cloud-based Applications (since 2010)

For several years, HR experts attempted to move from HRIS practices to the cloud, and investigate its relevance to HRM. Cloud computing provides software to users as a service, which is different from HRIS software of previous generations, that could only be accessed at the users' location and was often customized based on the organization's specific needs, however now vendors can suggest a standard software for all organizations. This particular software is not personalized and each organization can arrange and configure it based on their particular requirements and personal preferences. Therefore, companies do not have to purchase and provide different software and hardware anymore, as the software can be retrieved from the web via a web browser. Thus, expenditures like, purchasing hardware or software will be greatly reduced and since most of the technical activities will be outsourced to cloud retailers, the need of internal IT personnel will be greatly reduced as well. Additionally, research has revealed that, companies which prefer to use cloud-based HR software, tend to implement the latest versions of the software (Florkowski, 2018) compared to those implementing an “on-premise placement” approach. The movement to cloud-based software has changed the

HRIS delivery functionality significantly. Review of the related literature has shown that, above 50% of the organizations that were investigated, planned to move to the cloud (Qadir & Agrawal, 2017; Asadi et al., 2017). This allowed for the opportunity of new software retailers to join the market of small and big organizations. Earlier, smaller companies were unable to install HR technology because of the substantial initial investment required to invest in cloud systems, but it became more feasible when the price of ownership was reduced. Currently, the forerunners in cloud-based ERP are, Success Factors, Oracle, and Workday. The movement to cloud-based applications has evolved in accordance with a surge in the usage of mobile devices and social media. Cloud-based solutions are proposed by software vendors, which are compatible with mobile devices, for example, Workday follows a “mobile-first” method to develop software (A. Wilson, 2019). Likewise, as previous eras, the related studies on HRIS are based on, the strategic significance of IT on HRM (Eckhardt, Laumer, Maier, & Weitzel, 2014), and the elements that influence the implementation of these systems. Furthermore, the technology acceptance model is used by researchers (Davis, Bagozzi, & Warshaw, 1989) to illustrate the reason behind usage of HRIS among employees or applicants (Venkatesh, Thong, & Xu, 2016).

Although most of the studies have proposed models of decision-making to apply in the HRM setting (Marler & Parry, 2016), the communication and contact between HRM and IS, continues to be largely ignored. The related research on the ERP period has concentrated more around how selection and recruitment has changed, with the advent of the web. For instance, the influence of the layout of websites on candidate's opinions of the company, is still interesting researchers (Stone et al., 2015), as well as the technology used in the selection process (Florkowski, 2018; Marler & Parry, 2016; Javad Shahreki & Nakanishi, 2016). On the other hand, Bondarouk et al. (2017) proposed a methodical approach to review the related literature on users' responses to the validity and relevance of applying technology to facilitate the selection process, which was an important breakthrough in the HRIS field. This study is the first of its kind, which methodically reviewed the position of technology in one functional part of HRM. Due to the new cloud-based systems and the global reach of the web, organizations proposed new ways to deliver HR functionality, particularly in employee selection. In the selection process, organizations often use social media as well as "Unproctored Internet testing (UIT)", so a lot of scholars have started to examine the efficacy of these methods. Through UIT, a job candidate should take an online-based selection test, like a personality test or a cognitive ability test. However these online tests are taken under unsupervised conditions, thus the risk of cheating is increased, and is not equivalent to the traditional forms of testing such as, paper-pencil tests, although it is the popular method that organizations use today (Cascio & Scott, 2017). Consequently, the validity and legitimacy of these tests should be considered (Nesnidol & Highhouse, 2018), and ways to eliminate these potential problems should be explored, by applying UIT methods like, "cross validation studies" (Stone & Dulebohn, 2013). Furthermore, advanced statistical techniques should be proposed, to increase the validity of these tests as well as reducing the risk of cheating (Tendeiro & Meijer, 2014). Nevertheless, the majority of these types of studies have been carried out by researchers of HR, but they have yet to examine how to develop the layout of these systems. Here the IS researchers could contribute significantly by providing their insight to the discussion. The use of social media on the other hand, has also garnered a lot of research attention on its application as a selection instrument, thus the risks and benefits of social media should also be investigated (Miller & Barbour, 2014; R. E. Wilson, Gosling, & Graham, 2012) and its effects on personality, should also be examined (Van Dijck, 2013). Finally, the objective of current study is not to investigate the 'predictive validity' of social media application in the hiring process, which has not deterred companies from accepting and applying social media in the decision making process, although it could potentially be the cause of a number of legal concerns like, impact of adverse and discrimination (Noe, Hollenbeck, Gerhart, & Wright, 2017; Roth, Bobko, Van Iddekinge, & Thatcher, 2016; Stewart, 2019).

4. Evolution of the HRIS Academic Field

Technology developments have driven the HRIS expert field to support various HR functions and processes. The past 30-35 years were the golden ages of innovation, because of developments in calculating power and cost reductions. HRIS has developed and evolved not only in large organizations, but also in smaller organizations which consist of up to only 5-10 people. The HRIS academic development has evolved even more extensively particularly with the expansion of the IS field. For instance, recently, HRIS researchers asked whether technology can facilitate HRM in becoming more strategic or whether it contributes to strategic importance and significance to HRM (Bondarouk et al., 2017; Galanaki et al., 2019; Kumarapeli & Peiris, 2018; L'Écuyer, Raymond, Fabi, & Uwizeyemungu, 2019), which refers to the productivity paradox (Bharadwaj, 2000) and the technological imperative (Orlikowski, 1992), research that has been carried out by IS scholars for several years. The studies mentioned above are not necessarily classic studies, but HR researchers are often involved in discussions regarding HR practitioners, and usually overlook the related IS literature because IS researchers are not trained and do not have a background in HR. Moreover, the majority of the important eHRM research questions comprise of issues, for example, the HRM practices transformation or employee or applicant responses, that usually do not relate to or involve IT directly. Consequently, IS researchers might not be interested in conducting research related to this subject. Likewise, the HR scholars are usually not technologically oriented, and are not trained or skilled in IS. According to Kavanagh and Johnson (2017), limited HR programs include IS concepts.

4.1 Milestones in HRIS

Despite the apparent gap between the IS and HR fields, significant milestones exist in the growth of the HRIS field, which both HR and IS researchers agree that, they have contributed significantly to the growth of the HRIS field. The main milestone related to the primary study on the application of technology to facilitate "personnel administration" was published in Management Science. In that paper, Johnson and Huber (1977) carried out a study on the importance of applying computers to simulate the decision-making procedures of those interpreting and administering selection tests. In 1993, a similar paper was published in a key HR and psychology journal, which investigated the application of computers in interpreting the scores of selection tests (Burke, 1993). Furthermore, Goodhue (1995) published his work, where he examined the way that organizations were using technology to support HR. Another milestone of the field was the first major development in HRIS. According to the Society of Human Resource Management (SHRM), HRIS is considered a valuable field in HRM education (SHRM, 2019). On the other hand, according to Kavanagh and Johnson (2017), HRM programs examination showed that, less than 40 US programs had a course on HRIS, and no evidence is available to demonstrate that this condition has

changed or developed. Based on the fact that technology has had a significant impact and change on the HR profession, it is imperative that schools infuse the HRIS subject into the curriculum. In this sense, a wonderful prospect has emerged for the IS faculty to contribute, by developing HR capability and providing broader skills in supporting students in learning in an area with great development opportunities. Additionally, the HRIS program required a textbook, they used the book by Kavanagh, Gueutal, and Tannenbaum (1990) entitled, "Application and Development". In the mentioned book, the authors first define what a HRIS is, the value of using the client server applications and personal computers and its development process to support HR. The authors of this book discussed the first attempt of this field in collecting the HRIS research, and provides suggestions to experts based on ways it can be applied in transforming HRM processes, and how technology has altered the HR association with personnel. In 2009, another HRIS book was published, with the third edition being the latest (Kavanagh & Johnson, 2017). The authors have compiled a collection of leading research in the field of HR/HRIS, with every study concentrating on a distinct HRIS issue and in what way it impacts implementation, design, and HRIS use. For instance, some of the topics of the book were related to conventional IS studies like, the database design, systems life cycle, IS, and how technology influences different practical areas like, selection, recruitment, HR administration, and training.

4.2 HRIS Special Issues

Further evidence that demonstrates the rapid growth of the HRIS field, is the ever growing number of special issue publications in the HRIS field. From 2009, there has been an increase of up to six special issues in both HR and IS journals. For example, in *Managerial Psychology Journal*, the first HRIS and eHRM special issue was published in 2009 but the first IS special issue was published in 2010 in the *Journal of Electronic Commerce Research*. In the year 2013, special issues were published in two highly reputable IS and HR journals namely; the *Journal of Strategic Information Systems and Human Resource Management Review*. Though HRIS and its related special issues has attracted the attention of many researchers, the majority of studies were case studies of discussions or implementations of field developments, but one particular study conducted by Stone et al. (2015) was an exception in this area. Their study was an important research milestone in HRIS. In the current study, the author has reviewed the related literature on e-selection systematically, in order to develop several hypotheses and a research framework for advancing research towards the development of e-selection. Therefore, this paper is a significant study milestone in this field, and can be considered one of its kind in reviewing literature in a specific area.

5. IS Theories and Research Prospects in HRIS

The review of related literature revealed several exciting chances for IS scholars to support and participate in further HRIS development. The current study discussion is illustrative rather than exhaustive of where IS researchers can contribute. Firstly, research of e-commerce can be informative and facilitate the e-recruiting or e-benefits areas. For instance, recommendation agents are able to increase users' online shopping experience and purchase decision making (Benlian, 2015). The major interest of employees are the issues related to employee benefits, which is the best in a selection of options. Companies that offer online benefits systems are consumer-oriented and simulate online shopping sites. Therefore, studies that focus on applying recommendation agents, might potentially help in designing benefits systems with higher efficiency. They also provide a better understanding in supporting personnel in making further benefit decisions. Furthermore, one of the main objectives of e-recruiting is to increase the possibility of a job applicant to be accepted in an offered job. Accordingly, the recommendation agents' ideas are used by consumer-oriented sites or hiring organizations, to inform applicants about more job opportunities and to increase post-hire consequences. Yet another research area focused on design science. Design science experts might significantly improve the discussion on HRIS development, administration, and design. As previously mentioned, the majority of HRIS researchers consider technology a static tool used by an organization, which is different from the IS scholars view. The studies that have been conducted on design science can help HRIS researchers to update software vendors, to develop systems effectively for organizations. While the majority of design values were stable across functional subjects, the scholars contribute importance to the field, by integrating these particular designs based on the various kinds of devices. In this way, HR specialists can access data as well as functionality, very easily. Besides, the scholars could demonstrate HRM issues that might influence HCI design issues, which are distinct from other areas such as, accounting or supply chain. The researches' third area is, decision support systems (DSS). DSS is a critical factor in moving the HRIS field forward. They are very important for HRM, by providing the characteristic of the pivotal nature of decision-making, by utilizing HR data in companies. Thus, companies should examine the efficacy of their employee selection process and their agreement with appropriate laws. The managers have to decide based on data, for example, how to structure reward systems for all employees of an organization, which applicants should be hired, and how to evaluate the employees' performances. On the other hand, personnel have to decide on which benefits to enroll for such as, healthcare, flex spending, retirement and also handle their accounts. Thus, this procedure is imperative for retirement benefits, as they are in charge of handling their own 401K portfolios. Researchers started to explore the role of investing experience and using technology in online investing (Montazemi & Qahri-Saremi, 2015), however

more studies should be conducted, to assist organizations to develop their instruments to facilitate managing employees' 401K. DSS support is required throughout several HR functions, and more research should be carried out to elucidate how technology could be applied to facilitate all kinds of decisions that need to be reached by HR employees, executives, and managers (Stone et al., 2015). Though several studies have been conducted on the use of professional systems and DSS in HRM (Navimipour, Rahmani, Navin, & Hosseinzadeh, 2015), a systematic approach is needed to investigate the use of DSS by HR professionals. Therefore, IS and HR researchers could collaborate to propose and come up with a systematic approach to study the effects of DSS in the HRM decisions context. Moreover, additional research is required on the acceptance and utilization of technology in the field of HRIS, that could contribute significantly to IS study theories like, the technology acceptance model (Davis, 1993; Venkatesh, Morris, Davis, & Davis, 2003). HR and IS researchers should work together to identify common factors in IS and HRIS, adapt theories to the HR context, and identify unique factors in HRIS. Finally, more research should be carried out to contribute further to the discussion on the HRIS strategic value to an organization, due to the lack of technological focus in HR. However, the majority of HR research on the mentioned area, has not integrated the IS research on managing IT infrastructure (Durmuşoğlu, 2009) and IT productivity factors (Brynjolfsson & McAfee, 2014). Some researchers are even questioning whether technology "makes the HR function more strategic" (Marler & Parry, 2016). The technological imperative approach was based on IS researcher's discussion on the nature of structural and technology transformation, over 20 years ago (Orlikowski, 2000). In summary, according to HR and eHRM strategy, IT scholars can provide important contributions in elucidating how processes and technology can develop and support the HR sector more effectively.

6. Conclusion

The current critical review on HRIS related literature has revealed that, the expert and academic field of eHRM/HRIS have developed significantly from the beginning of the mainframe computer. Although there has been up to 50 years of research carried out on using technology to support HR, the authors of this study believe that, the field has hardly investigated the interesting, deep, and valuable questions which could potentially assist managers to better understand how to implement HR technology in their companies, most effectively. In this sense, more "boundary-spanning" research is warranted to encompass IS and HR technologies and theories. In addition, for the development, scholars from both fields must work together to investigate and come up with answer for the most pressing questions. This study aimed to present a brief history of the HRIS field in order to further motivate discussions among researchers from the IS and HR field, to continue the discussions regarding HR technology and the

significance of both HR and IS contributions to these discussions.

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