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Abstract:

The "war for talent" is still on. Annually conducted surveys have indicated for years that one third of all organizations are unable to fill vacant job positions with suitable candidates. Responding to these and other challenges, human resource management (HRM) is expected to transform itself. General opinion holds that the HRM transformation has just begun and that the potential of IT in HRM is not yet fully exploited. Examining the value potential of IT in HRM, existing IS research predominately studies the impact of IT on HRM. We contribute by examining the reverse impact in three steps. First, we use Thompson's theory of organizations in action to examine the expected impact of the HRM transformation on IT ("to-be" situation). Second, we use Kohli and Grover's IT value typology and review 20 years of the publication history ("as-is" situation). Finally, we relate expectations to actual review findings. We find that the HRM transformation should lead to a major shift in technology type used in organizations. However, this shift is not recognized yet, which is why our literature review reveals considerable unaddressed value potential of IT in HRM. We finish the paper by outlining IS research avenues in the context of HRM.

Keywords: e-HRM, HRIS, IT Value, HRM Transformation.

1   Introduction

Human resource management (HRM) is crucial for organizations to successfully compete in the future—especially in light of an emerging knowledge society (Bartlett & Ghoshal, 2002; Campbell, Coff, & Kryscynski, 2012; Drucker, 1993; Dyer, 1993; Pfeffer, 1994; Porter, 1990). Competition for talented human resources is fierce. Indicating an ongoing "war for talent" (Chambers, Foulon, Handfield-Jones, Hankin, & Michaels, 1998), annually conducted surveys have reported for years that more than a third of all organizations experience difficulties filling vacant positions due to a lack of suitable candidates (ManpowerGroup, 2013; von Stetten et al., 2014). HR managers are expected to react and to transform their departments from administrative support functions to providers of strategic business value, which is referred to as HRM transformation (Ulrich, Allen, Brockbank, Younger, & Nyman, 2009; Ulrich, 1997; Wright et al., 2011). This transformation seems to be just in the beginning. The few available findings on its progress indicate that non-HRM executives of Western organizations have not seen a major transformation in HRM yet (Hussain, Wallace, & Cornelius, 2007) and that Eastern HRM organizations are even further behind their Western counterparts (Cooke, 2009).

Similarly, IT managers are also expected to assume more strategic and business-aligned roles to ensure that IT adds value to business functions (Carter, Grover, & Bennett, 2011; Weill & Woerner, 2013). However, aligning business and IT has remained one of the most pressing challenges for IT organizations for years (Kappelman, McLean, Luftman, & Johnson, 2013). The envisioned goal of an emancipated IT that is on equal footing with primary business functions seems yet to be a distant prospect (Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013).

Since IT and HR departments are still in the process of individually growing into new organizational roles, it does not come as a surprise that organizations and researchers seldom address their collective concern (i.e., IT support of HRM (e-HRM)) (Laumer, Eckhardt, & Weitzel, 2010; Strohmeier, 2007). The software vendor consolidation in the 2000s, which reduced the variety of and innovation in HR software (Jacobs & Weston, 2007), (and both HR practitioners' (Hempel, 2004; James, 1997; Karakanian, 2000; Lawler & Mohrman, 2003) and HR researchers' (Strohmeier, 2000) limited interest in e-HRM has further contributed to IT's neglect in HRM. However, it has become apparent that "(of) the various forces affecting HR, the development of technology is perhaps the most significant" (Adler, 2003, p. 54). As such, we can see that an IT value potential exists waiting to be tapped, which, in turn, has led to calls for more e-HRM research, to publications of e-HRM books (for a review, see Strohmeier, 2012), and to publications of special journal issues exclusively focusing on e-HRM (e.g., *Employee Relations*, Volume 36, Issue 4; *Human Resource Management Review*, Volume 23, Issue 1; *Journal of Electronic Commerce Research*, Volume 11, Issue 4; *Journal of Managerial Psychology*, Volume 24, Issue 6*; and *Journal of Strategic Information Systems,* Volume 22, Issue 3). Leading to controversial results, e-HRM research primarily examines IT's impact on HRM (i.e., whether and how IT enables the strategic transformation in HRM) (for a review, see Marler & Fisher, 2013). Some studies have found that it does (e.g., Bell, Lee, & Yeung, 2006; Gardner, Lepak, & Bartol, 2003; Haines & Lafleur, 2008; Hussain et al., 2007; Parry & Tyson, 2011; Parry, 2011; Shrivastava & Shaw, 2003) while others have found that it does not (Bondarouk & Ruël, 2013; Dery, Hall, Wailes, & Wiblen, 2013; Kinnie & Arthurs, 1996; Marler & Fisher, 2013). These controversial findings might stem from an unclear understanding on what "being strategic" actually means (Barrett & Oborn, 2013).

Research on the reverse relationship (i.e., on how the transformation in HRM impacts IT use) is, however, scarce. IT value research suggests that IT needs to be aligned with business for it to add value (Henderson & Venkatraman, 1993; Nevo & Wade, 2010; Powell & Dent-Micallef, 1997; Wagner, Beimborn, & Weitzel, 2014). That is, for IT resources to add value to HRM, HRM first needs to define the goals of what it wants to be capable of doing (i.e., HRM capabilities) before examining the potential of IT resources to enable these HRM capabilities. A clearer understanding of new HRM capabilities that result from the HRM transformation could, therefore, help to uncover the potential value of IT in HRM. Furthermore, HRM capabilities could categorize and inspire a broader discussion of digital changes in HRM that is currently missing in the literature (Parry & Strohmeier, 2014).

In this review, we deliver such a broader discussion and categorization. The paper proceeds as follows: in Section 2, we derive a "to-be" situation of IT in HRM given the organizational change caused by the HRM transformation. Several organizational theories discuss the relationship between organizations and technology recognizing its reciprocal nature (e.g., Orlikowski, 1992), but we use Thompson's theory of organizations in action because it especially focuses on the impact that a change in an organization has on technology (Thompson, 1967). To describe the organizational change, we identify transformative HRM

capabilities, which are necessary to respond to the HRM transformation. Resources and capabilities pertain to the resource-based view (Barney, 1991), a perspective that e-HRM research can benefit from (Marler & Fisher, 2013; Strohmeier, 2007). In Section 3, we derive an "as-is" situation of IT in HRM via a comprehensive literature review. The review includes more than 20 years of publishing history of 76 relevant journals. Specifically, based on Kohli and Grover's (2008) IT value typology, we first classify and describe the current state of how IT is creating value in HRM. Second, based on transformative HRM capabilities identified in Section 2, we uncover IT's unrealized value potential to enable the HRM transformation whose existence many researchers suspect (e.g., Grant & Newell, 2013; Strohmeier, 2007; Willcocks, 1991). In Section 4, by relating the "to-be" situation described in Section 2 to the "as-is" situation outlined in Section 3, we explain not only what unrealized IT value potential exists in HRM but also why it exists and why it has not been addressed yet. Thus, we contribute well-founded, promising avenues for future e-HRM research.

2 Examining the Impact of HRM Transformation on IT

In this section, we examine the impact of the HRM transformation on IT and derive a "to-be" situation of IT in HRM. We need to fulfill two requisites to achieve this goal. We first need to understand the impact of HRM transformation on organizations, their HRM functions, and their HRM capabilities. In this regard, we argue that HRM transformation refers to the impact of primary labor market challenges on HRM functions, which forces organizations to build new, transformative HRM capabilities in response. Second, we need to understand the impact of organizations and their HRM capabilities on IT in HRM. As such, we use Thompson's theory of organizations in action that argues that it is the interdependency of capabilities that determines the IT to be used (Thompson, 1967). Figure 1 provides a high-level illustration of the following discussion from the HRM transformation (i.e., primary labor market challenges) to IT's expected impact.

In Sections 2.1, we introduce Thompson's theory of organizations in action (Thompson, 1967). It provides a theoretical foundation for Sections 2.2 and 2.3, where we describe interdependencies of HRM capabilities and examine their expected impact on IT in HRM.
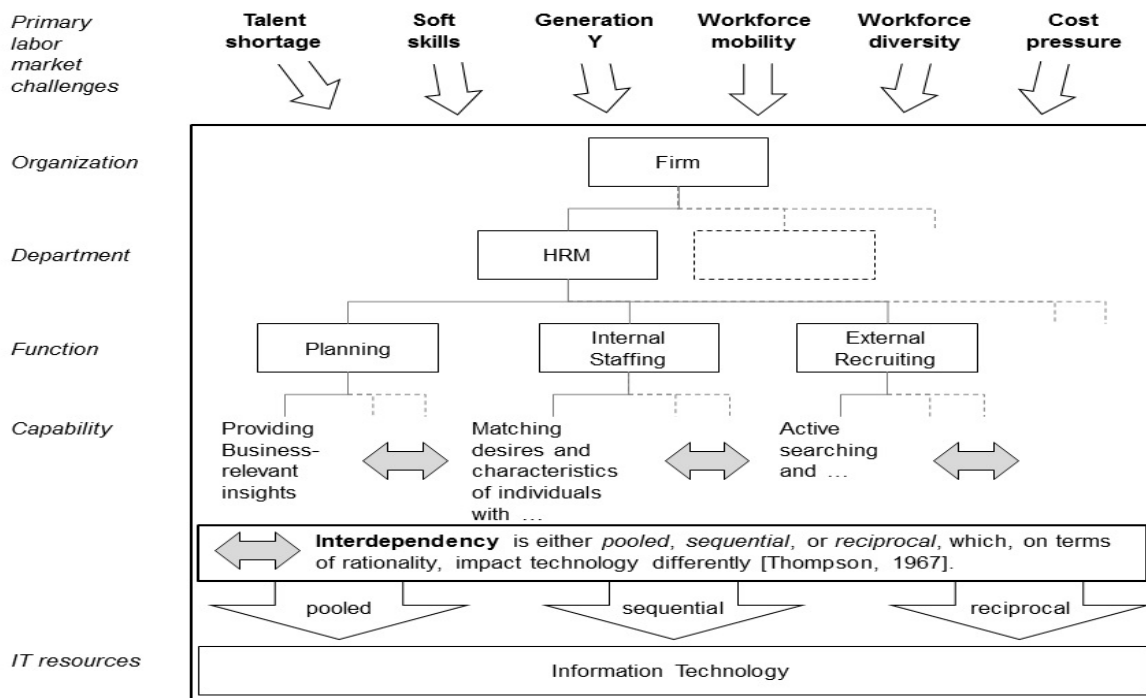

Figure 1. Impact of Primary Labor Market Challenges on Information Technology
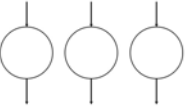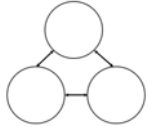
2.1 Thompson's Theory of Organizations in Action

Thompson's theory comprises 95 propositions about organizations' behavior (Thompson, 1967). Thompson views technology as a general facilitator to convert inputs into outputs and considers

technology as "an important variable in understanding the actions of complex organizations" (Thompson, 1967, p. 15). He further notes that, under rational norms, organizations use different types of technology depending on the interdependence of tasks that technology facilitates. Task interdependence refers to the way tasks' inputs and outputs depend on each other. The theory uses concepts from March and Simon (1958) and distinguishes three types of task interdependence that imply three corresponding kinds of coordination and three corresponding types of technology (see Table 1). First, pooled interdependence characterizes mediating technology and refers to tasks being largely independent of each other. Coordination of tasks is standardized. For instance, the tasks of a bank's lending department are operationally largely independent from those in its deposit department. Coordination between the lending and deposit businesses is usually standardized in terms of, for example, common accounting and reporting standards. With an increasing number of lending and deposit transaction, operations improve and uncertainty reduces. Second, sequential interdependence characterizes long-linked technology and refers to a direct, serial dependence of tasks. Coordination of tasks need to be carefully scheduled (e.g., tasks at a manufacturer's assembly line). To avoid interruptions, tasks are usually vertically integrated and inventories are used to reduce uncertainty. Third, reciprocal interdependence characterizes intensive technology and coordination by mutual adjustment, which "involves the transmission of new information during the process of action" (Thompson, 1967, p. 56). For instance, tasks in a general hospital are reciprocally dependent and require a high level of coordination to ensure the adequate treatment of each individual patient. To optimize operations (e.g., the treatment of patients), individual tasks are highly specialized. Furthermore, "Organizations employing intensive technologies…seek to expand their domains by incorporating the object worked on" aiming for greater control of the object and for reduced impact of external, uncontrolled forces (Thompson, 1967, p. 43). For instance, hospitals tend to electronically monitor the health of patients so they can quickly react to unexpected events.

This threefold distinction of task interdependence and technology type applies regardless of how granular a task is defined (i.e., regardless of the hierarchical organizational level such as divisions, departments, or even subunits of departments). Thompson further examines task granularity (i.e., the grouping of tasks across organizational hierarchies) and posits that, under norms of rationality, tasks are grouped to minimize coordination costs (Thompson, 1967). For this reason, organizations favor coordination by standardization and the use of mediating technology over coordination by mutual adjustments and the use of intensive technology, respectively.

Table 1. Task Interdependence, Coordination, and Types of Technology (Jones, 2011)

Task interdependence	Type of coordination	Cost of coordination	Mean of reducing uncertainty	Type of technology
Pooled	Standardization	Low	• Increase repetition of tasks	Mediating
Sequential	Scheduling	Medium	• Vertical integration of tasks • Introduce slack resources (i.e., inventories) between tasks	Long linked
Reciprocal	Mutual adjustment	High	• Incorporate work object into task domain • Specialization of tasks	Intense

The view of technology in organizations has evolved since the 1960s when Thompson developed his theory. For instance, researchers commonly understand not only that organizational design impacts human agency and technology but also that technology and human agency impacts organizational design (Orlikowski, 1992). However, to understand technology in organizations, it often helps to focus on a single relationship assuming other variables as constant, which Thompson labels as a "closed-system strategy"

(Thompson, 1967). Thus, Thompson's theory is still valid and part of many organization theory text books (Daft, Murphy, & Willmott, 2010; Jones, 2011).

2.2   Transformative HRM Capabilities and their Interdependencies

Before describing transformative HRM capabilities and their interdependencies by HRM function, we follow Figure 1 and begin with an impact description of external labor market challenges.

External labor market challenges, which stem from global trends such as technological progress, demographic change, globalization, and environmental sustainability (Aggarwal, 2011), force HRM to become more involved in the business it supports and to assume a more strategic role as business partner, which is termed HRM transformation (Ulrich et al., 2009; Wright et al., 2011). Thus, HRM transformation refers to the transformative impact of challenges in the external environment on HRM functions, which force the functions to adapt. In other words, organizations are forced to build new capabilities to respond to external challenges. For instance, if employees with IT skills are in demand and are increasingly using social media, HRM organizations are forced to be capable of actively searching and approaching these particular employees using social media (Dychtwald, Erickson, & Morison, 2006; Weitzel et al., 2015). We subsequently refer to this and other capabilities resulting from labor market challenges as transformative HRM capabilities.

Researchers generally define HRM capabilities as an HRM organization's capacity to deploy resources such as IT. As Amit and Schoemaker (1993, p. 35) note: "They can abstractly be thought of as 'intermediate goods' generated by the firm to provide enhanced productivity of its Resources, as well as strategic flexibility and protection for its final product or service". Viewing these capabilities as tasks to be accomplished by the HRM organization, it is their interdependence that determines the impact on technology according to Thompson (1967).

Unfortunately, discussions in the current HRM transformation literature on required HRM capabilities are rare and generic, which impedes determining the interdependencies of HRM capabilities and their impact on IT in HRM. As we mention in Section 1, no findings on the progress of HRM transformation seem to exist, which also indicates that its outcome is too general to be measurable. For instance, Ulrich et al. (2009) do use internal capabilities to describe the outcome of HRM transformation, but their list of required capabilities stays at a general level that comprises fairly generic items such as talent, speed, leadership, and strategic unity (Ulrich et al., 2009). Similarly, the current e-HRM literature also rarely discusses capabilities and seldom applies an organization-internal resource-based view (Marler & Fisher, 2013; Strohmeier, 2007).

Thus, in Section 2.2.1 to 2.2.6, we derive a set of more specific HRM capabilities by discussing the impact of labor market challenges on HRM functions. First, however, we briefly define the entities "labor market challenge" and "HRM function". Table 2 lists commonly discussed external labor market challenges because "HR professionals who want to contribute to strategy formulation and to sustain a transformation should be more than casual observers of these [challenges]" (Ulrich et al., 2009). This list is, however, not exhaustive particularly because we exclude local, political, and legal challenges for the findings to remain geographically independent. Distinguishing between the primary and secondary labor markets in accordance with the dual labor market theory (Dickens & Lang, 1971), we further consider the challenges listed in Table 2 to be valid for only the primary labor market. Challenges in the secondary, low-wage labor market might be different. For instance, opposed to the primary labor market, technological progress does not lead to a shortage of labor but rather to an increase in unemployment rates because it replaces low-wage jobs in the secondary labor market (Brynjolfsson & McAfee, 2011; Rifkin, 2004).

With regards to HRM functions, we note that academics and practitioners use a variety of classifications such as attract, develop, and retain and detailed lists of HRM tasks. For our purposes, we regroup Noe, Hollenbeck, Gerhart, and Wright's (2011) eight HRM practices into six HRM functions so they follow a natural sequence of HRM processes (see Figure 2). In the beginning, business departments need skilled and motivated personnel. Thus, HRM organizations start with analyzing and planning the need for personnel (1). They then have the choice to either re-assign existing employees (i.e., placement or staffing (2)) or to attract new employees (i.e., recruiting (3)). Once on-board, employees need to be developed (4) and motivated (5). In addition, HRM has to manage a range of administrative support processes (6) such as employee record keeping, controlling, and payroll. We cross-verified the list of six HRM functions with the HRM literature (e.g., Eckhardt, Laumer, & Weitzel, 2008; Lee, 2007; Noe et al., 2011; Ulrich, Younger, Brockbank, & Ulrich, 2012; Ulrich, 1997; Wright et al., 2011) to ensure that the list

is as mutually exclusive and collectively exhaustive as possible. However, as the great variety of classification in the literature indicates, the goal of mutual exclusivity in particular cannot be entirely met.
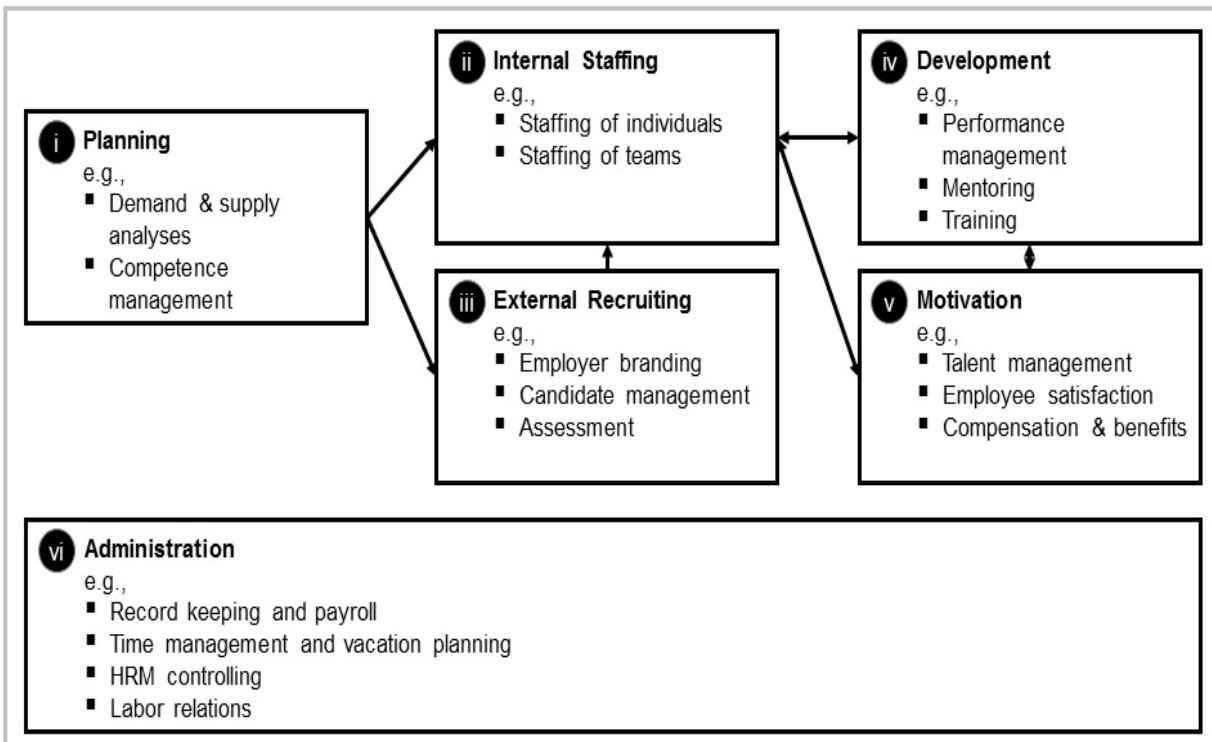

Figure 2. HRM Functions

Table 3 summarizes the subsequent discussion and lists transformative HRM capabilities by HRM function indicating both root labor market challenge that the capability is responding to and interdependency with other capabilities in the sense of Thompson (1967). Since we exclude geography-dependent labor market challenges such as political and legal challenges, the list of transformative HRM capabilities is not exhaustive. However, it represents the kind of capabilities that HRM departments across geographies need to build in response to external market challenges (i.e., in response to the HRM transformation).

2.2.1   Planning

HR planning entails determining "the number of personnel and their skills that best meets the future operational requirements of an enterprise" (Gass, 1991, p. 65). Therefore, it comprises analyzing long-term personnel demand and supply and matching long-term demand with supply (Noe et al., 2011). Compared to other more operational HRM functions such recruiting, staffing, and administration, organizations tend to be less effective in HR planning despite the fact that it can have a greater impact on company performance (Huselid, Jackson, & Schuler, 1997).

The talent shortage increases the uncertainty of any long-term personnel planning. To manage this uncertainty, HRM needs to be capable of providing business-relevant insights and foresights regarding externally and internally available personnel. In essence, such capability includes monitoring the labor market and incorporating both global and local challenges into internal forecasts. As Dychtwald et al. (2006) state: "Ignoring the trends in workforce composition guarantees an organization's decline". For instance, to predict future work demand for its stores, Wal-Mart uses statistical models that take numbers of store customers into account (Maher, 2007).

The planning function and its capabilities are sequentially interdependent if HR departments merely assume the role of request receivers, In this case, planning is followed by subsequent staffing and recruiting stages. However, if HRM wants to be more than a request receiver that truly collects information from different sources, delivers insights and foresights to business departments, and impacts their

decisions (Ulrich, 1997), then HRM planning capabilities need to become more reciprocally interdependent of other capabilities inside and outside the HR department.

Table 2. Primary Labor Market Challenges

Challenge	Description	Sources
Talent shortage	Talent shortage is arguably the most obvious labor market challenge, which is also referred to as the war for talent. Critics of this challenge doubt that there is a quantitative shortage of human resources provided that the global population, working age, percentage of working women, and workforce mobility are all increasing. However, the numbers provided by annually conducted surveys report for years that more than a third of all organizations experience difficulties filling vacant positions due to a lack of suitable candidates, which indicates at least a qualitative talent shortage and an increasing demand for highly skilled employees.	Cappelli (2003), Chambers et al. (1998), Laumer et al. (2010), ManpowerGroup (2013), Michaels, Handfield-Jones, & Axelrod (2001), Weitzel et al. (2015)
Soft skills	As technology replaces repetitive, transactional work, the work of human resources becomes increasingly relational, which increases the need for soft skills (i.e., teamwork abilities). A survey among the top 1,000 German organizations has indicated that only about 21% of the HR professionals believe that soft skills can be trained, which, in turn, causes 66% of the recruiters to report that soft skills have recently become an even more important recruiting criterion than hard skills.	Cascio (1995), von Stetten et al. (2014)
Generation Y	Another labor market challenge refers to a generation of employees that entered the workforce shortly after the millennium and might have a new set of values ("generation Y"). While it is unclear if this is a generation (age cohort) or an age phenomenon, the observation is that job candidates have become more demanding. Demands differ individually and include, but are not limited to, improved work-life balance, greater work flexibility, meaningful work in terms of sustainability of organizational outcome, and greater rewards. A global survey among HR executives also report that integrating generation Y employees is a greater challenge compared to employees of previous generations.	Erickson (2008a), Helgesen (2014), Weitzel et al. (2015)
Workforce mobility	Due to the globalization, organizations increasingly require their workforce to be mobile and to trade and to operate at an international level. However, surveys also report of an increasing reluctance of applicants and employees to relocate or to travel.	Steger (2013), Laumer et al. (2010), von Stetten et al. (2014)
Workforce diversity	Workforce diversity, not only in terms of nationality but also in terms of age and gender, is yet another undisputed labor market challenge, which is primarily fueled by demographic changes. The United Nations Secretariat has reported that the population of many developed countries barely grows and sometimes even shrinks. However, this effect is offset by an increasing longevity extending the average working age and by an increasing share of women available to the labor market. The World Bank reports the global average life expectancy to have increased by 3 years in only 12 years' time—from 67.7 to 70.8 years between 2000 and 2012. Longevity of high income countries has similarly increased but at a higher level—from 76.2 to 79.3 years between 2000 and 2012. Surveys among HR professionals indicate demographic change to be their most pressing challenge.	Cappelli (2003), Dychtwald et al. (2006), Erickson (2008b), Laumer et al. (2010), United Nations Secretariat (2012), von Stetten et al. (2014), World Bank (2014)
Cost pressure	Globalization leads not only to increased workforce mobility and diversity but also to increased rivalry and cost pressure.	Steger (2013)

2.2.2   Internal Staffing

Similar to planning, internal staffing also matches demand and supply. The output, however, is not a long-term plan but an immediate operational job-employee assignment. Researchers often discuss the staffing function as part of the recruiting process (e.g., Lee, 2007; Münstermann, von Stetten, Laumer, & Eckhardt, 2010). However, with increasing flexibility of working modes (Houseman, 2001; Störmer et al., 2014), staffing people already known to an organization becomes quite distinct from finding and recruiting people unknown to an organization. Therefore, HRM textbooks tend to separate recruiting from staffing

(e.g., Noe et al., 2011). Inspired by Edwards (1991) and Malinowski, Weitzel, and Keim (2008), we can see staffing as a match in three aspects. First, it entails a match between a candidate's skills and a job vacancy's required skills. Second, staffing matches a candidate's desires with a job's features. Finally, the candidate needs to fit the team. We term the first match an objective match of facts and the latter two subjective matches of people.

Responding to the increased need for soft skills and the demands of generation Y (see Table 1), HRM needs to be especially capable with regards to subjectively matching people (i.e., assessing individuals' desires and characteristics and matching them with job features and team characteristics). Professional services firms in particular need to have a strong focus on their employees' desires and development needs (Maister, 1997). For instance, at the consulting firm McKinsey, a staffing coordinator helps employees incorporate their "personal needs and requests into staffing decisions" (McKinsey, 2015).

With regards to task interdependence, the traditional objective match of facts depends merely on the prior assessment of skills and job features that characterize sequential dependence on capabilities in the HRM staffing function. Furthermore, the objective match of facts appears to be independent of other HRM functions. However, the subjective matches of people require greater coordination inside and outside the HRM department. For instance, HRM needs to consider existing team structures that change with every staffing decision and employees' desires that change depending on the available choices of vacant jobs. Thus, the subjective match of people is reciprocally interdependent with other capabilities.

2.2.3   External Recruiting

Once vacant positions cannot be filled in the internal staffing process, potential candidates outside the organization need to be attracted, selected, and managed, which comprise external recruiting's goals. Therefore, it includes activities such as employer branding and candidate assessment (Chen, Lee, & Chen, 2005; Eckhardt et al., 2008; Lee, 2007; Noe et al., 2011).

Four recruiting-related HRM capabilities are crucial for responding to the labor market challenges outlined in Table 1. First, the talent shortage suggests employers to not only passively wait for applications ("post and pray") but also be capable of actively seeking and approaching potential employees (e.g., Dychtwald et al., 2006). In fact, organizations are already building active searching capabilities using social media, which entails dramatically changing recruiters' skillset (Eckhardt, Laumer, Maier, & Weitzel, 2014). This capability further entails early assessments of candidates' fit with organization, team, and job prior to a potential application. While waiting and processing incoming applications requires less coordination and can be standardized, actively seeking candidates needs more coordination and a greater use of the organization's social networks such as via employee referral campaigns or external recruiting services and agencies. Thus, this capability's interdependence is reciprocal.

Second, since employees of generation Y are more demanding and less willing to adapt themselves to their work environments, organizations cannot be perceived equally attractive to all potential candidates (Erickson & Gratton, 2007). Thus, organizations benefit from displaying their culture and their distinctiveness by providing candidates with a "signature experience" already during recruiting efforts (Erickson & Gratton, 2007). Such a capability requires recruiters to be trained accordingly (Eckhardt, Brickwedde, Laumer, & Weitzel, 2011) and, ultimately, allows organizations to not only attract the right candidates but also discourage low-fitting candidates from applying (Erickson & Gratton, 2007). For instance, to attract the "right-minded" employees, Google presents itself in a unique way on the recruiting website (e.g., "Number of New York Googlers: About one-half of Kaprekar's constant" (Google, 2015). We cannot determine this capability's interdependence because its implementation varies significantly.

Third, the increasing need for soft skills requires HRM to be capable of assessing candidates' soft skills and cultural in the recruiting process since, in particular, these kind of skills are perceived as challenging to train (von Stetten et al., 2014). Two-thirds of large organizations in Germany believe soft skills to be more important than hard skills in recruiting (von Stetten et al., 2014). With applicants and assessment results being clearly defined inputs and outputs, this capability is rather sequentially interdependent.

Fourth, the talent shortage and the increasing labor diversity requires and allows organizations to exploit an increasing labor market potential of women, foreigners, and mature candidates. Thus, HRM needs to be capable of targeting recruiting efforts accordingly (e.g., Dychtwald et al., 2006). Such a capability needs to go beyond attracting candidates using workforce diversity. In fact, targeting recruiting efforts is also required when actively approaching candidates (see transformative HRM capability 3 in Table 3) as an e-recruiting case study indicates (Eckhardt et al., 2014). Similar to the first capability of actively seeking

candidates, this capability is also reciprocally interdependent on others because identifying labor market potentials in line with organizational needs requires greater coordination across the organization. It also requires HRM to develop and motivate a more diverse workforce. We discuss both development and motivation in subsequent sections.

2.2.4 Development

Researchers have always viewed developing human resources as critical for organizations (e.g., Drucker, 1993). Reasons include employee motivation, organizational productivity increases, and innovation enablement. Labor market challenges intensify the need for personnel development. For example, the need to reduce costs leads to a reduction in hierarchical levels and the delegation of responsibilities to lower levels, which, in turn, increases the need for employee development at lower levels (Spell, 2001). Employee development includes performance management (i.e., the understanding of development needs), mentoring (i.e., informal development), and formal development. We note that some authors further distinguish between training intended to increase an employee's current job performance and development intended to prepare employees for future jobs (Fitzgerald, 1992; Noe et al., 2011), the latter of which we deem not relevant in this paper. However, we further note that employee development does not include one single training activity but a meaningful combination of several activities and that most development actually occurs on the job and outside HR departments (Hatch & Dyer, 2004).

While organizations are increasingly recognizing the importance of developing personnel, they require three specific development-related HRM capabilities to respond to labor market challenges. First, although organizations perceive soft skills as challenging to teach (Laker & Powell, 2011; von Stetten et al., 2014), they are increasingly in demand, difficult to recruit, and, therefore, require organization-internal development. Second, to train generation Y's talents, HRM needs to be able to consider not only organizational needs but also employees' desires. Thus, development becomes a benefit, which increases employee motivation (Dychtwald et al., 2006). For example, when transforming its HRM function, Intel introduced a "rotation engineer program", which they maintained even in economically difficult times (Taylor & Murray, 2009). As such, organizations should focus exclusively on employees' desires because employees are paid to acknowledge the desires of the organization and because expressed desires of individuals may not accurately reflect their development needs (Carrier, 1984). Third, due to an increasing workforce diversity, HRM needs to be capable of training employees from all generations. While the average employment rate of all OECD countries has remained stable for persons between 25 and 55, it has clearly increasing over time for persons between 55 and 64 (OECD, 2013). Currently, most organizational trainings focus on younger employees (Dychtwald et al., 2006). However, other employees such as mature employees have distinct training needs, which organizations need to address (Erickson, 2008b).

With regards to interdependence, the first and the last capability (i.e., training soft skills and training a greater diversity of workers) seem to be rather independent of other organizational capabilities. However, the second capability (i.e., considering both an organization's and its individual employees' desires) is reciprocally interdependent because it requires more coordination across the organization such as performance management, planning, and motivation.

2.2.5 Motivation

Similar to HR development, employee motivation is also increasing in relevance due to labor market challenges such as the war for talent (Michaels et al., 2001). Research findings on the importance of employee motivation are considerable, but organizations often neglect to apply them in practice (Friedman, 2014). Although the responsibility for employee motivation does typically not exclusively reside with HRM, certain HRM activities exist that aim to increase employees' motivation by either improving workforce morale (e.g., diversity management, employee satisfaction) or providing motivational incentives for performance (e.g., talent management, compensation, and benefits). Incentives include monetary compensations, such as salary and pension plans, and non-monetary benefits, such as opportunities for development, responsibility, and career perspectives.

In response, labor market challenges require HRM to build two motivation-related capabilities. First, generation Y's increasing demands, increasing workforce diversity, and increasing mobility require HRM to be capable of providing flexibility in terms of working benefits and modes. Preferences regarding motivating incentives differ between young and mature employees (Dychtwald et al., 2006). Mature employees and employees under family pressure are increasingly relying on a variety of part-time

arrangements (Dychtwald et al., 2006; Erickson, 2008b). Flexible work arrangements have been provided since the 1960s and many studies indicate their benefits for both employers and employees (Perrin, 2001). With regards to interdependence, this capability (flexible work arrangements) is sequentially dependent on other capabilities. It requires some coordination because flexibility in terms of benefits and working modes is dependent on the individual's job. The number of inputs (i.e., preferences and possibilities) and outputs (i.e., individual choice on benefits and working mode) is limited. Several subsequent processes such as compensation, performance evaluation, and vacation planning are dependent on the employee's choice.

Second, the talent shortage extends the talent management capability. Traditionally, talent management refers to the individual care of only a few selected employees with leadership potential (i.e., executive talent) (Chambers et al., 1998) and entails selecting, supporting, developing these few employees. However, the talent shortage requires organizations to manage all kind of talents (i.e., those with key skills, knowledge, or relationships (Beechler & Woodward, 2009). Examples for key personnel in need are engineers and IT staff (ManpowerGroup, 2013; von Stetten et al., 2014). This capability is reciprocally interdependent because talent management has always required significant coordination across and beyond HRM functions including supervisors of the business departments, performance evaluations, and development.

Table 3. Transformative HRM Capabilities

HRM function	Labor market challenge						Transformative HRM capability	Interdependence		
	1	2	3	4	5	6		A	B	C
Planning	x						1) Providing business-relevant insights and foresights			x
Internal staffing		x	x				2) Matching desires and characteristics of individuals with job features and team characteristics			x
External recruiting	x						3) Active searching and approaching of candidates			x
			x				4) Providing a 'signature experience' to candidates	depends on "signature experience"		
		x					5) Assessing of soft skills and cultural fit of candidates		x	
	x				x		6) Targeting labor market potentials such as women, foreigners, and mature candidates			x
Development		x					7) Training of soft skills	x		
			x				8) Shifting focus from organizational needs to employees' desires			x
					x		9) Training employees of all generations	x		
Motivation			x	x	x		10) Providing flexibility in terms of work modes and benefits		x	
	x						11) Managing talent not only with leadership potential, but also with any other key skill, knowledge, or relationships			x
Administration						x	12) Optimizing processes and costs	x		
Labor market challenges (see Table 2): 1) Talent shortage 2) Soft skills 3) Generation Y 4) Workforce mobility 5) Workforce diversity 6) Cost pressure							Interdependence of tasks (Thompson, 1967) A) Pooled B) Sequential C) Reciprocal			

2.2.6   Administration

HRM administration includes not only HRM-internal activities such as record keeping, payroll, and HRM controlling but also activities such as time management, vacation planning, HR policy administration, and work union negotiations. In the past, HR department personnel usually performed administrative activities, but the more recent introduction of HRM portals allows employees to perform some administrative activities themselves (e.g., Noe et al., 2011).

The global challenge of technological progress has enabled organizations to introduce HRM portals for administrative purposes, but it was globalization that increased the cost pressure on organizations and that actually caused the need for HRM portals. Thus, responding to cost-pressure challenges, HRM needs to be generally capable of optimizing costs—especially with regards to administrative tasks, which are often repetitive and do not require a lot of human skill. The literature discusses many examples of this capability (e.g., case studies on HRM portal integration (Klein & Krcmar, 2005; Ruta, 2005)). Lastly, optimizing costs is independent of other capabilities.

2.3   Expected Impact of the HRM Transformation on IT

In this section, we derive expectations about using IT in HRM based on our discussing using Thompson's (1967) theory of organizations in action (see Section 2.1 and 2.2).

Applied to the HRM context, Thompson's (1967) theory suggests that HRM organizations should have shifted from using mediating technology to intense technology. In the past, prior to the turn of millennium and before the need for an HRM transformation became evident, IT in HRM was primarily used to optimize administration (Ball, 2001). Furthermore, HRM administration and other HRM functions such as external recruiting and development were largely independent of each other (Lengnick-Hall & Lengnick-Hall, 1988; Wright & Snell, 1991). Thompson would even argue that organizations minimize interdependency across HRM functions to minimize coordination costs and that organizations use highly standardized mediating technology. In fact, due to low task interdependency and with little need for software specialization or customization, IT support in HRM was predominately based on standardized software packages whose vendors further standardized and consolidated their efforts in the 2000s (Jacobs & Weston, 2007). However, changes in the environment (i.e., labor market challenges: see Table 1), have forced HRM to build HRM capabilities that are increasingly reciprocally interdependent (see Section 2.2 and Table 3). The strategic HRM literature also suggests that HRM capabilities and functions should become increasingly interdependent (Barney & Wright, 1998; Wright & McMahan, 1992). Thompson's theory, therefore, suggests that HRM should use intense rather than mediating technology.

Thompson's (1967) theory further suggests that the shift towards intense technology should have four general impacts on IT in HRM. First, we have to expect an increase in IT integration and information exchange inside and beyond HRM organizations because greater interdependence "involves the transmission of new information during the process of action" (Thompson, 1967, p. 56). This expectation is in line with transformative HRM capabilities listed in Table 3 that include, for instance, HRM's greater cooperation with business departments to deliver insights. Second, since organizations employing intense technology seek to incorporate the object worked on (Thompson, 1967), we have to expect future IT solutions in HRM to consider individual employee differences. The need to train employees of all generations and to focus on their individual needs (HRM capabilities 8 and 9 in Table 3) are just two examples corroborating this general expectation. Third, we have to expect IT to become more specialized due to reciprocally interdependent capabilities (Thompson, 1967). For instance, IT support that assesses cultural fit (HRM capability 5 in Table 3) is both organization specific and capability specific because it also differs from other interview and training assessments. Finally, we have to expect the cost of IT in HRM to increase because, according to Thompson (1967), coordination costs increase (see Table 1).

We discuss whether IT in HRM actually meets these four expectations in Section 4 after conducting a literature review.

3   Examining the Value Potential of IT in HRM

In this section, we provide IT's "as-is" situation in HRM via a comprehensive literature review. Several researchers suspect IT to have the potential of contributing additional value to HRM that has yet to be uncovered (e.g., Grant & Newell, 2013; Strohmeier, 2007; Willcocks, 1991). In two steps, we identify this potential. We first attain a state of research on IT support of HRM. We then follow a somewhat iterative

approach (Boell & Cecez-Kecmanovic, 2014; Torraco, 2005), revisit the findings from the first step, and examine the extent to which current research helps organizations to build the required HRM capabilities previously derived and outlined in Table 3 above. In this section, we briefly introduce the concepts of e-HRM and IT value, describe the review's scope and process, and outline the findings by HRM function.

3.1   E-HRM

We use e-HRM to refer to IT-enabled HRM processes (e.g., Strohmeier, 2007). The related term of HR information system (HRIS) refers to the actual information system, which "is designed to support…activities of human resources management" (e.g., DeSanctis, 1986, p. 15). Therefore, this definition for e-HRM is boader and includes HRIS and the HRM process that HRIS supports. Aware of other terminological interpretations (e.g., by IS academics who agree with system theorists that HRIS includes people and practices (Kavanagh & Thite, 2009) or with HRIS users whose interpretations of HRIS is rather application focused even excluding the actual personnel data records (Mathieson, 1993)), we believe the rather simple definition we use to be most widely used and to be sufficient for the sake of this review. Consequently, we also do not follow the sometimes raised notion of HRIS only facing HR-internal actors and e-HRM including actors external to the HR department (e.g., Marler & Fisher, 2013).

Although HRM was one of the first areas in which organizations used IT to automate processes such as payroll in the 1960s (DeSanctis, 1986), e-HRM research became more common around the 1990s when the first HRM software packages became available (Dery et al., 2013). Besides this review, other e-HRM reviews that differ in scope, taxanomy, and focus exist (e.g., Marler & Fisher, 2013; Sareen & Subramanian, 2012; Strohmeier, 2007, 2009; Wirtky, Eckhardt, Laumer, Wild, & Weitzel, 2011). However, we still lack a broader e-HRM discussion (Parry & Strohmeier, 2014).

3.2   Business Value of IT

In this section, we do not review the long history of research on IT value (for such a review, please refer to Melville, Kraemer, & Gurbaxani, 2004) but introduce the concepts we use in this research. We refer to the business value of IT as "the organizational performance impact of information technology at both the intermediate process level and the organization-wide level, comprising both efficiency and competitive impacts" (Melville et al., 2004, p. 287). In other words, we do not refer to IT's value as IT's cost but as IT's economic impact on organizations (Kohli & Grover, 2008). Researchers initially struggled to measure and to substantiate IT's economic impact (Brynjolfsson, 1993; DeLone & McLean, 1992), but plenty of empirical support exists today (e.g., Brynjolfsson & Hitt, 1996; Kohli & Devaraj, 2003). In addition to the well-known IS success model (DeLone & McLean, 1992, 2003), further conceptualizations that explain how sustainable value is created from using IT assets exist (e.g., Nevo & Wade, 2010). All conceptualizations agree that an IT asset does only create value through alignment and interaction with business (Henderson & Venkatraman, 1993; Nevo & Wade, 2010; Powell & Dent-Micallef, 1997; Wagner et al., 2014). Therefore, as we indicate in Section 2, we discuss the ability to support business capabilities, which researchers sometimes refer to as the ensemble view on IT (Orlikowski & Iacono, 2001).

Examining the kind of IT value in greater detail, we draw on Kohli and Grover's (2008) four themes for IT value research, which we interpret as four different types of value creation. These four types extend Zuboff's (1988) well-established distinction between automating and informating as follows. The first type, IT-embeddedness, is similar to automating (Zuboff, 1988), and it is the most intuitive "default" type that refers to business value being created from processes that IT perform. One example is the IT-supported process of calculating the monthly payroll. The second type is information mindset, which refers to value being created from reusing information, which is sometimes also referred to as informating (Zuboff, 1988). An example of information mindset is the reuse of payroll information to informate the future compensation of new employees in the recruiting process. Third, IT-based value is also created from co-creation (e.g., an organization that electronically exchanges personnel demand and supply information with external recruiting agencies). Value co-creation's cross-organizational nature is the important difference compared to the other types of value creation (Kohli & Grover, 2008). Finally, value expansion refers to the rather intangible types of value creation. Coming back to the example of a payroll system, IT not only tangibly improves process efficiency but also intangibly creates value by freeing the workforce from repetitive and dull duties and by increasing employee satisfaction, motivation, and team morale. These four types of value creation "are not mutually exclusive, nor are they exhaustive; rather they are meant to initiate a discussion of how the IT community must rethink value propositions" (Kohli & Grover, 2008, p. 28). In our

literature review, we use these four types to discuss value creation of IT in the relevant literature and think of further IT opportunities for value creation that have gained little or no attention before.

3.3   Review Scope and Process

For our review, we included e-HRM research papers published between January, 1990 and September, 2013 in 76 peer-reviewed, reputable, and relevant academic journals, which published a total of more than 89,000 English research papers during that period of time. This scope covers the history of research on IT in HRM since the first HRM software packages were introduced in the beginning of the 1990s (Dery et al., 2013). Before the 1990s, little research was conducted on e-HRM and IT was mainly used to automate individual processes using largely outdated mainframe technology (DeSanctis, 1986). We selected the 76 academic journals based on selection criteria that not only focus on the organization, HR, and/or information systems (IS) but also strike a balance between academic rigor and relevance. The criteria include quantitative metrics-based rankings such as the Thomson Reuters ICI 2010 JCR 5-year impact factor and democratic rankings such as the Association for Information Systems' (AIS) Senior Scholars' basket of journals. We conducted full-text searches by using search terms that included not only specific terms such as human resources information system, HRIS, and e-HRM but also broad search terms such as payroll, e-learning, workforce planning, recruiting, and staffing to not be too selective (Rodgers & Hunter, 1994) and to find all kind of IT support relevant to HRM. Appendix A contains further details on our journal selection criteria, included journals, and search terms. We collectively opted to apply two restrictions with regards to content. First, we excluded papers on IT security (e.g., Puhakainen & Siponen, 2010; Son, 2011), on virtual teams (e.g., Au & Marks, 2012), and on employee monitoring that uses IT to control employees' behavior (e.g., Ariss, 2002; Bock & Swee Ling Ho, 2009; Nord, McCubbins, & Nord, 2006). These excluded topics are more related to an organization's IT capabilities than to its HRM capabilities. Second, with regards to the vast amount of e-learning research, we only included contributions with findings relevant to the workplace context because the academic context does differ in several aspects (Dick, Case, Ruhlman, Slyke, & Winston, 2006).

In terms of process, we approached the literature rather systematically by using HRM functions and their related HRM capabilities (see Table 3) as a frame. Such a systematic approach, where the review scope is defined upfront, could be a "risk to scholarship" because important literature might be missed if the scope is too narrowly defined (Boell & Cecez-Kecmanovic, 2014). However, systematically approaching the literature ensures not only that research is replicable (Torraco, 2005) but also that one "accumulate[s] a relatively complete census of relevant literature" (Webster & Watson, 2002). Our broad review scope further mitigates the risk of this review not representing the literature adequately. To refine the long-list of papers we obtained from full-text searches on the selected 76 journals, the first author manually pre-screened the papers and excluded those that obviously did not discuss IT in the context of HRM. He also provided a first suggestion to classify the papers into HRM functions. Next, especially in cases where the decision was less obvious, the first three authors reviewed and collectively decided on the remaining papers until we reached a consensus. The two scope restrictions that we outline before also resulted from this step in the process. Finally, we also collectively discussed the assignment of studies to HRM functions based on the papers' research context. We assigned those e-HRM papers of a more general nature (i.e., independent of any particular HRM function) to the category "IT in HRM in general", which we discuss separately. We all discussed classification differences until we reached a consensus. Following the advice of other researchers (e.g., Webster & Watson, 2002), we evaluated additional attributes such as research type, method, level, and country of origin. However, such findings are not our main focus, and, therefore, we only mention them when they contribute to the discussion. We refer readers particularly interested in findings of that nature to other e-HRM reviews (e.g., Strohmeier, 2007).
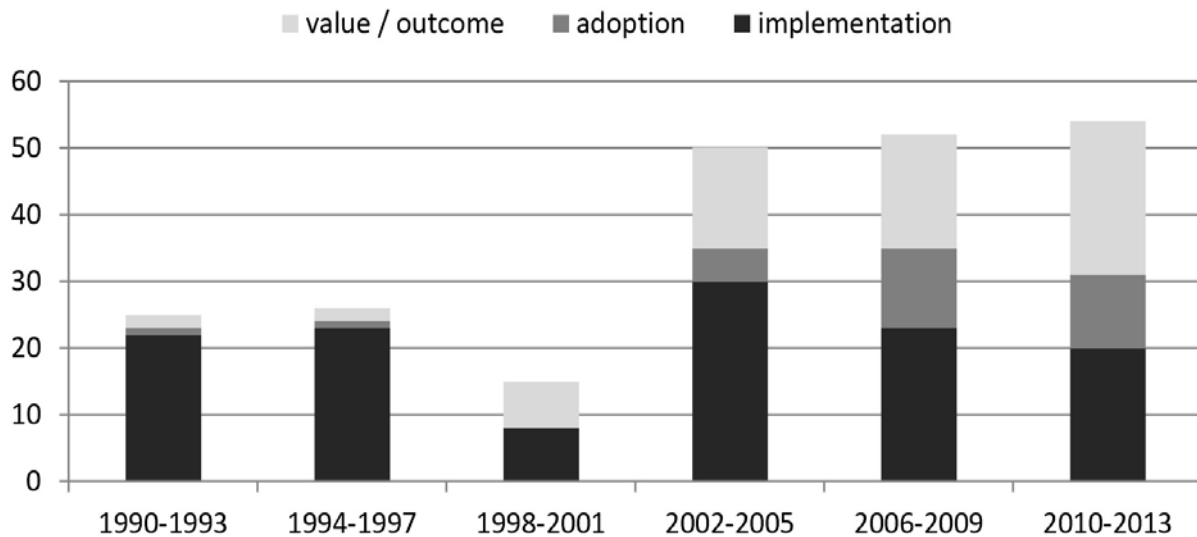
Figure 3. History of e-HRM Publications (Absolute Numbers by Research Focus)

The final list contains 250 papers. Figure 3 and Table 4 (see Appendix B for more details) summarize the papers. We explain the subcategories contained in Table 4 in Sections 3.4 to 3.10. Furthermore, keeping the attention on the most relevant findings, we do not discuss each of the 250 papers individually. Instead, we occasionally enrich the discussion with additional papers and books that we know of but that are outside the review's scope. We do not include these additional references when summarizing review findings (e.g., in Table 4) to provide an unbiased picture of the available literature. In Sections 3.4 to 3.10, we outline the review findings with regards to both the state of e-HRM research by HRM function and the extent to which current e-HRM research helps organizations to build the necessary HRM capabilities listed in Table 3.

Table 4. Overview of e-HRM Papers in Review Scope

HRM function		e-HRM papers
In general	IT implementation	16
	IT adoption	5
	IT consequences and value	35
	Subtotal	**56**
Planning	HR Demand	4
	HR Supply	3
	Demand and supply match	2
	Subtotal	**9**
Staffing	Objective match of facts	40
	Subjective match of people	1
	Subtotal	**41**
Recruiting	Recruiting in general	12
	Employer branding	38
	Candidate assessment	27
	Subtotal	**77**
Development	Performance management	9
	Mentoring	6
	Training	34
	Subtotal	**49**

Table 4. Overview of e-HRM Papers in Review Scope

Motivation	Workforce morale	2
	Performance incentives	3
	Subtotal	**5**
Administration	Administrative activities	3
	Employee portal to HRM	10
	Subtotal	**13**
Grand total		**250**

3.4   IT in HRM in General

General e-HRM studies usually focus on either IT implementation, IT adoption, or IT consequences and value.

3.4.1   Implementation of IT in HRM

In the scope of our literature review, 22 studies focus primarily on implementation (e.g., Benders, Schouteten, & Kadi, 2009; Hoch & Dulebohn, 2013) and sourcing (e.g., Farndale, Paauwe, & Hoeksema, 2009). They are based on the premise that IT can only create value if it is properly implemented. However, compared to our research, these studies are less concerned with the outcome of use or with the actual IT under discussion. Thus, we do not discuss their findings in greater detail (for details, we refer readers to other reviews such as Marler and Fisher (2013), Ngai and Wat (2006), Sareen and Subramanian (2012), and Strohmeier (2007)). For our purposes, we are content with the general notion from these publications that IT's potential in HR administration (e.g., record keeping and payroll) is largely realized, whereas the potential of IT in other HR functions (most notably HR planning and HR development) is less realized (Lin, 1997).

3.4.2   Adoption of IT in HRM

Research discussing IT adoption in HRM at this general level predominantly uses descriptive statistics (Florkowski & Olivas-Luján, 2006). Three of the five papers in scope of this review use descriptive statistics and indicate that about 70 percent of all organizations use IT in HRM administration such as payroll processes and employee record keeping (Kinnie & Arthurs, 1996; Strohmeier & Kabst, 2009). About 40 percent of organizations use IT in HR recruiting, 33 percent in HR development, and only about 20 percent in HR planning (Kinnie & Arthurs, 1996). Thus, IT is rather used for administrative than for analytical activities (Ball, 2001). Factors explaining e-HRM adoption are mostly organization-specific such as organizational size (Florkowski & Olivas-Luján, 2006; Strohmeier & Kabst, 2009). More relevant for the HRM transformation is the study published by Voermans and Veldhoven (2007). The authors examine managers' and employees' attitudes toward e-HRM by using Ulrich's new roles that HRM is expected to assume in the course of the transformation (Ulrich, 1997). They found that those managers and employees who believe HRM to assume a strategic role to have more favorable attitudes towards e-HRM and that others who believe HRM to assume the role of an employee champion have rather negative attitudes towards e-HRM. Unfortunately, Voermans and Veldhoven (2007) do not fully reveal how they measure "attitudes towards e-HRM".

3.4.3   Consequences and Value of IT in HRM

IT value research suggests that two stages of value creation exist (e.g., Nevo & Wade, 2010). At the first stage, value is created if IT improves a business activity's efficiency and/or effectiveness. At the second stage, sustainable strategic value is created if the improvement fulfills certain criteria such as organization-specificity. We review and discuss publications according to these two stages in the following.

Research publications at the first stage examine the general impact of IT in HRM. They classify different outcomes and consequences of IT use and note that the consequences are not always as intended and sometimes even negative (Strohmeier, 2009). For instance, even if IT in HRM is intended to increase effectiveness, it may result in inefficiency improvements (Bondarouk & Ruël, 2009). Even worse, using IT in HRM could also reduce social interaction and autonomy that employees desire (Stone, Stoneromero, &

Lukaszewski, 2006). Research at this stage has also found that IT in HRM often aims to improve efficiency but could create more value by informating decision processes (Liff, 2007; Shrivastava & Shaw, 2003). Martin and Reddington (2010) provide several suggestions for improving effectiveness based on using social technology in HRM such as Web mining in recruiting, building learning communities in HR development, and using HR portals in HR administration. Other researchers suggest a greater use of decision support systems such as knowledge-based systems and expert systems to create value by informating business processes (e.g., Dulebohn & Johnson, 2012; Lawler & Elliot, 1996; Martinsons, 1997). For instance, Martinsons (1997) believes in and discusses the potential of knowledge-based systems in a variety of HRM activities including planning, recruiting, development, and performance appraisals. We discuss these and other HRM function-specific ideas for value creation in greater detail in subsequent sections.

At the second stage, a large number of publications examine the general hypothesis that IT has the potential to create strategic value and to support the HRM transformation from a rather administrative to a more strategic function. Most of the published studies retain the hypothesis, while some reject the hypothesis (Bondarouk & Ruël, 2013; Dery et al., 2013; Liff, 2007; Marler & Fisher, 2013). The most popular explanation of why IT causes HRM to become more strategic is that IT frees HR employees from administrative tasks, which allows them to focus more on value-adding strategic activities (Bell et al., 2006; Gardner et al., 2003; Haines & Lafleur, 2008; Hussain et al., 2007; Parry & Tyson, 2011; Parry, 2011; Shrivastava & Shaw, 2003). Several researchers criticize this explanation (Barrett & Oborn, 2013; Bondarouk & Ruël, 2013; Hussain et al., 2007) since, among other reasons, personnel outside the HR department do not perceive IT to add greater strategic value (Hussain et al., 2007) and the concept "strategic value of IT" is differently or not sufficiently conceptualized (Barrett & Oborn, 2013). Another popular conclusion is that IT helps the HR function to become more strategic if business and IT are aligned (i.e., if IT is tailored to support the HR strategy) (Kossek, Young, Gash, & Nichol, 1994; Lengnick-Hall & Lengnick-Hall, 2006; Marler, Fisher, & Ke, 2009; Martin & Reddington, 2010; Schalk, Timmerman, & van den Heuvel, 2013). Other conclusions are less common. Schalk et al. (2013) argue that IT could support the HRM transformation through the mere disruption from introducing IT in HRM, which triggers desired organizational change that was not possible to do without the disruption. Similarly, Heikkilä (2013) found that introducing standardized Western HR software in China forced Chinese employees to stick to organization-wide HR processes. Thus, he argues that strategic value is created from process standardization that IT enforces.

Summing it up, multiple ways for IT to create value in HRM exist regardless of whether this value can be considered as strategic or not. Up to now, the discussed IT opportunities at the general level fall into two of Kohli and Grover's (2008) four types of value creation; namely, IT embeddedness and information mindset.

3.5   Planning

In this section, we review the IT support regarding the planning function in terms of the employee demand analysis, the employee supply analysis, and the matching of demand and supply. Specifically, in Section 3.5.4, we review the available research relevant to the planning-related transformative capability; that is, providing business-relevant insights.

3.5.1   Employee Demand

We found four publications targeting IT enablement of HR demand analysis. An analysis determining the required number of employees for an organization can be either performed bottom-up (e.g., based on data provided by individual departments and teams) or top-down (e.g., based on business forecasts or benchmarks). IT-enables organizations to use complex manpower-planning models combining both the top-down and the bottom-up approach (Niehaus, 1995; Sohoni, Johnson, & Bailey, 2004; Weigel & Wilcox, 1993). Huang, Lee, Song, and Thomaseck (2009) contribute a simulator that compares different models optimizing the accuracy of personnel planning models. Computerized models also enable organizations to flexibly adjust to changes such as downsizing decisions (Niehaus, 1995; Sohoni et al., 2004). Thus, using IT not only automates complex planning processes but also creates the intangible value of flexibility that only becomes tangible with the necessity to change. Unfortunately, the contexts of the discussed publications are limited to the U.S. military and the airline industry in which job descriptions and required skills are clearly defined and stable.

3.5.2   Employee Supply

Studying long-term employee supply includes both internal supply and external market supply. We found three publications in this regard. However, two were published in the early 1990s. Schumacher and Dolan (1995) discuss external supply, identify relevant Internet databases, and suggest their use. Focusing on the internal supply, Stein (1992) suggests using network analysis to identify knowledge in organizations. Taking a more contemporary approach to external employee supply, Aguinis and Lawal (2013) review research related to the sourcing of freelancers using electronic marketplaces. They conclude that these marketplaces are far from being integrated into HRM processes and that there is still a great need for further research.

3.5.3   Matching HR Demand and HR Supply

Some HRM activities take long-term actions to match demand and supply such as employer branding and competence management. Employer branding can be externally focused, in which case it is rather a recruiting activity, or it can be internally focused, in which case it is rather an employee motivation activity. We discuss both recruiting and motivation in Sections 3.7 and 3.9, respectively.

Competence management systems are typically used to match internal HR demand with internal HR supply and to identify eventual discrepancies. We found two publications on competence management systems. Both provide implementation design recommendations and principles (Lindgren, Henfridsson, & Schultze, 2004; Simon, 2010). Interestingly, Lindgren et al.'s (2004) solution also includes foreseeable changes in internal supply due to training and development efforts. Thus, they suggest gaining additional value from already-existing information in the learning system.

3.5.4   Transformative HRM Capability: 1) Providing Business-relevant Insights and Foresights

From the literature we review in Section 3.5, we can draw two conclusions about providing business-relevant insights. First, except for two publications (Aguinis & Lawal, 2013; Schumacher & Dolan, 1995), the research tends to focus on internally available data that stems from existing employees. Thus, we know little about HR planning that uses external market data that stems from prospective workers. Second, the literature primarily suggests IT support that automates HRM planning processes, which is best done in organizations with clearly defined and stable descriptions of jobs and skills (e.g., the military or airline organizations).

These two conclusions suggest not only that we need further research but also that further IT value could be created either through informating the planning process or through value co-creation. To informate the planning process, one could reuse information from the learning system (Lindgren et al., 2004) or information from other systems such as knowledge management systems in case they hold information on available experts and their competencies. One could further co-create value by integrating external platforms such as electronic marketplaces (Aguinis & Lawal, 2013) or external recruiting websites.

3.6   Internal Staffing

In this section, we focus on staffing's two sides, which are the objective match of facts and the subjective match of people. Sometimes internal staffing also requires employees to participate in organization-internal assessments centers, which we discuss in Section 3.7.3.

3.6.1   Staffing as an Objective Match of Facts

We refer to the objective match of facts as the match of a project or job vacancy with available people skills. Of the 41 identified publications about IT's supporting HR staffing, 36 (~90%) involve the implementation of sophisticated algorithms to calculate optimal tours schedules and working shifts of flight crews, nurses, postal service employees, and call center personnel (see Appendix C for the detailed list of references). In these kind of organizations, the use of deterministic computer algorithms is logical because both job profiles and skill profiles are clear and homogeneous. However, job requirements and human skills are rather heterogeneous in most organizations, which is why we discuss only four publications that are applicable to a greater variety of organizations.

First, while the authors of other publications on the objective match of facts use IT to pre-calculate work schedules, Petrakis, Hass, and Bichler (2012) discuss a solution to optimize work schedules for service

personnel by considering the real-time location of service personnel. Deviations from a pre-calculated plan usually cause overtime for personnel, but plans calculated in real-time may compensate for deviations. Thus, IT has an opportunity to create not only value in form of organizational efficiency improvements but also intangible value by increasing team spirit and improving employee satisfaction. Thinking further along the lines of Kohli and Grover's (2008) four themes for IT value research, IT also provides an opportunity for co-creating value in this scenario. If job profiles and skill profiles are homogenous and real-time information indicates that a job cannot be done with the given resources as planned, then cooperating with the competition could be less costly than incurring potential penalty fees, employee overtime, and reputational damage. In this scenario, IT enables co-opetition (i.e., cooperation with the competition), which seeks not only a short-term increase in profit but also a long-term favorable change of the industry an organization is competing in (Brandenburger & Nalebuff, 1998).

Two further publications discuss the link between job vacancies and prerequisite training. Bellone, Merlino, and Pesenti (1995) present a system that not only manages prerequisite trainings for a job but also suggests job vacancies to employees with a certain competence profile. Campbell (1999) provides a model for staffing of cross-trained workers. He shows that one can optimize the cross-utiziliation of workers in the staffing process by cross-training only to some extent. IT solutions on this basis could, therefore, not only optimize staffing but also calculate the value of training and informate HR development accordingly.

Finally, the literature also discusses cases where job profiles and skill profiles are not homogeneous (e.g., Palvia, Perkins, & Zeltmann, 1992), but we identified only one publication from the early 1990s that discusses this IT opportunity in greater detail (Liang & Wang, 1992). The authors suggest and describe the use of fuzzy logic in staffing algorithms.

3.6.2   Staffing as a Subjective Match of People

In addition to the match of facts, HR staffing is also a match of people. This subjective match is again twofold. First, it is a match of employees' desires with jobs' features, which is conceptually different from the previously discussed match of available skills and job vacancies (Edwards, 1991). In the recruiting process, agencies and headhunters typically advise on a match of a candidate's desires and a job's features. Some career websites use electronic surveys to digitize desires and provide their rough ideas of matching job categories (see Section 3.7). In the staffing process, human mediators such as HR professionals, mentors, and friends also provide advice, but IT seems to be rarely used because we found no related discussion in the literature.

In addition to the match of employees' desires with jobs' features, the subjective match of people in the staffing process is also a match of individual employees with teams. The measurement of team composition is multidimensional and includes a range of attitudes and characteristics (Werbel & Johnson, 2001). One relevant characteristic is gender composition because performance of male-only and female-only teams is inferior compared to mixed teams (Apesteguia, Azmat, & Iriberri, 2011). Thus, team staffing is also related to diversity management (see Section 3.9). Despite the complexities and interdependencies, research and development into IT support for team staffing is rare. Our review shows only one publication in this regard (Malinowski et al., 2008). Its authors make two major points. First, since HR professionals have already difficulties in articulating what exactly an optimal team composition entails, the multidimensionality of an optimal team composition is too complex to be measured in its entirety using traditional approaches. However, focusing on major dimensions such as trust among team members could provide a possible way forward. Second, for team staffing to be successful, it must center not on the individual but on skills and desires of all team members in their interplay. As a result, Malinowski et al. (2008) believe that we need innovative approaches for IT to support team staffing. As a solution, they suggest a recommender system for team staffing decisions that predicts a maximum level of trust among team members based on social network analysis.

3.6.3   Transformative HRM Capability: 2) Matching Desires and Characteristics of Individuals with Job Features and Team Characteristics

As we mention elsewhere, we did not find any publication about using IT to help match employees' desires with jobs' features. We found only one publication about matching employees with teams. These two subjective matches of people appear to be exclusively performed by human mediators such as HR professionals, colleagues, mentors, and friends. However, an optimal match requires mediators to know the desires and characteristics of all employees on the one hand and of all job features and team

characteristics on the other. In large or international organizations in particular, such knowledge is challenging to gain for individual human mediators. Using expert systems that deal with the large amount of knowledge is a viable solution in this context (e.g., Dulebohn & Johnson, 2013). The IT challenge is to meaningfully digitize differences in employees' desires, teams' characteristics, and jobs' features, which is an opportunity for researchers and practitioners to explore further. Malinowski et al. (2008) investigate this challenge and provide one solution (a recommender system) to one kinds of subjective matches (the match of employees with teams) by using one team composition dimension (trust) and one data source (past team assignments).

We can conceive many alternative solutions to Malinowski et al.'s (2008) one. Further existing data sources that one could leverage include curriculum vitae (CV) databases (Färber, Keim, & Weitzel, 2003), electronically available employee feedback such as performance appraisals, external social networks such as Facebook or LinkedIn (Kluemper & Rosen, 2009), or organization-internal social networks that are becoming increasingly popular. Regardless of the specific data source and IT solution used, using IT in this context has the potential not only to automate and to informate the staffing process itself (Kohli and Grover's (2008) first and second type of IT value creation) but also to improve organizational performance outside the HR department and to create intangible value for supervisors and employees (Kohli and Grover's (2008) forth type of IT value creation) because it can reduce mismatched team members, which improves employee work satisfaction and working atmosphere.

3.7 External Recruiting

IT-enabled recruiting or e-recruiting has become increasingly popular (Cappelli, 2001). Company websites, recruiting websites, and e-mail are now far more used and effective than traditional recruiting means such as print media (Laumer, Eckhardt, & Weitzel, 2009). Thus, the literature provides several papers on e-recruiting in general, which we review in this section. In addition, we discuss employer branding and candidate attraction (Section 3.7.2), candidate management, pre-selection, and interviewing (Section 3.7.3), and IT support in regards to the four recruiting-related transformative capabilities that Table 2 lists (Section 3.7.4 to 3.7.7).

3.7.1 E-recruiting in General

Most studies on general e-recruiting are case studies that describe the introduction of e-recruiting systems into an organization, their benefits, and lessons learned (e.g., Eckhardt et al., 2014). While these are interesting cases to learn from, many findings appear not specific to e-HRM. These findings include employees' being resistant to change, the importance of top-management support, the needed awareness of cultural differences, and the need to listen to and to involve a variety of people to overcome differences. The findings unique to e-HRM primarily stem from regional differences in education, assessment, and legal system (e.g., the presence of worker unions) (Cronin, Morath, Curtin, & Heil, 2006; Ryan, Wiechmann, & Hemingway, 2003; Wiechmann, Ryan, & Hemingway, 2003). Buckley, Minette, Joy, and Michaels' (2004) case study differs in that it compares the differences between the traditional recruiting approach and the new e-recruiting approach (including its financial implications) in greater detail. Similar to other studies (e.g., Münstermann et al., 2010), Buckley et al. (2004) found that IT creates value in recruiting—especially by automating processes.

Lee (2007, 2011) provides a conceptual insight into e-recruiting. In his earlier publication, he describes the architecture of a holistic e-recruiting system that supports the entire recruiting process. He concludes that an organization should not implement the holistic system but analyze its individual needs instead in order to maximize the value from e-recruiting (Lee, 2007). In his later publication, he stresses the need for an e-recruiting system to be integrated into the system landscape and develops a conceptual model that shows the cost advantage of an integrated system compared with isolated systems in case the number of recruits increases (Lee, 2011). Similar to the case studies previously discussed, Lee's conceptual studies describe IT's value creation in the form of process cost savings from automation. Another papers suggests extending Lee's architecture to also include employer branding, which we discuss next (Eckhardt et al., 2008).

3.7.2 Employer Branding, Candidate Attraction, and Job Advertisement

Employer branding entails creating a certain image of an organization as an employer with the goal to attract candidates. It also includes advertising job vacancies. In this section, we discuss the related IT

support that comprises three major categories: 1) company websites, 2) external recruiting websites, and 3) other technologies such as social media.

Research on IT's supporting candidate attraction predominantly focuses on organizations' recruiting websites and the impact they have on attracting applicants (i.e., their intention to pursue employment with the organization). In summary, website-related variables do impact candidates' intention to apply (Allen, Mahto, & Otondo, 2007; Cober, Brown, Keeping, & Levy, 2004; Kashi & Zheng, 2013; Lyons & Marler, 2011; Williamson, King, Lepak, & Sarma, 2010; Williamson, Lepak, & King, 2003). Researchers have often found organizational attitude to mediate this link (Allen et al., 2007; Goldberg & Allen, 2008; Lyons & Marler, 2011) and firm reputation (Allen et al., 2007) and technology expertise of candidates (Sinar, Reynolds, & Paquet, 2003) to moderate it. Thus, organizations who properly use IT to support their recruiting websites adds to the organization's value by attracting candidates.

Further research sheds light on other aspects of recruiting websites such as fairness perceptions, content, ethnicity, and pre-selection. Fairness perceptions matter in the recruiting process (Konradt, Warszta, & Ellwart, 2013). In particular, organizations should transparently and consistently communicate selection criteria, and prospective employees should be able to provide additional information not explicitly requested by the website's application form (Dineen, Noe, & Wang, 2004). The kind of information presented also matters (Williamson et al., 2003). For instance, Young and Foot (2006) found that organizations tend to glorify themselves. They argue that not meeting newly hired employees' high expectations could lead to their dissatisfaction, which is worse than the benefit organizations gain from glorification. Ethnicity also matters because minorities seek diversity in organizations based on the websites (McKay & Avery, 2006), which explains why diversity statements have a positive impact on attracting African American candidates (Goldberg & Allen, 2008). In addition, using a person-organization fit questionnaire on the recruiting website could enable organizations to influence the attractiveness that applicants perceive (Dineen, Ash, & Noe, 2002) and, if desired, dissuade low-fitting candidates from applying (Dineen, Ling, Ash, & DelVecchio, 2007).

Researchers have criticized studies (especially the early ones) on firm recruiting websites as trivial and atheoretical (Anderson, 2003). Calls for more research on the impact of e-recruiting on organizations (e.g., Anderson, 2003; Viswesvaran, 2003) seem largely unanswered. Our review shows only one contribution that examines the impact of e-recruiting at organizational level. Selden and Orenstein (2011) compare state government recruiting websites and examine applications received and new hire turnover. They found that higher content quality on the website leads to less applications and lower voluntary turnover rate of new hires. Thus, higher content quality seems to lead to improved self-selection and, therefore, improved recruiting effectiveness (Selden & Orenstein, 2011).

External recruiting websites such as CareerBuilder.com and Monster.com offer an alternative to organizations' own websites on which they publish company-related information and job vacancies. Despite the growing popularity of recruiting websites (Marschall, 2006), research publications regarding job advertisements on these websites are limited. Publications began appearing in 2000 (McCourt-Mooney, 2000a, 2000b, 2000c). Later publications compare tools and services of different recruiting websites (Tong & Sivanand, 2005) and explain job seekers' experiences (Feldman & Klaas, 2002). Recruiting websites have evolved and changed substantially since then. Therefore, we do not discuss the findings of these publications in greater detail. Unfortunately, research on external recruiting websites has become rare. The most recent study in scope of our review examines the adoption of CV databases that these external recruiting websites provide to hiring organizations (Eckhardt, Laumer, & Weitzel, 2009). However, Eckhardt et al. (2009) focus on technology adoption and the impact of social influence. Their only comment related to business value of these CV databases is that, overall, organizational usage seems low (Laumer, Eckhardt, & Weitzel, 2008), which implies that many organizations do not yet capitalize on the databases' potential, which is surprising given their increasing popularity among job seekers (Marschall, 2006).

Finally, apart from company websites, external recruiting websites, and social media websites such as Facebook or LinkedIn (Klein, Rosenberger, Schumann, 2012), customer relationship management (CRM) systems (Strohmeier, 2013) provide further opportunities to support employer branding using IT. Practitioners show great interest in using social networks in recruiting (Ollington, Gibb, & Harcourt, 2013), and research on social media in recruiting seems to be picking up (e.g., Brecht & Eckhardt, 2012; Garg & Telang, 2012). Using CRM technology in HRM is least discussed in the literature. Strohmeier (2013) refers to the fusion of CRM and HRM as employee relationship management (ERM), which fundamentally entails using concepts from the well-established customer management field in managing employees.

However, "the concept (of ERM) is still in its 'embryonic' phase—especially if compared with the advanced state of CRM" (Strohmeier, 2013, p. 101).

3.7.3 Candidate Management, Pre-selection, and Assessment

One commonly cited drawback of online recruiting is the increasing number of applications per job vacancy, which needs to be managed, assessed, and decided on (Cappelli, 2001). Thus, using IT to manage, pre-select, and assess candidates appears valuable (Eckhardt, von Stetten, & Laumer, 2009). These processes have similarities with staffing (see Section 3.6) in that vacancies need to be matched with applicants' profiles. However, opposed to the staffing process, the selection process in recruiting deals with candidates unknown to the organization, which necessitates further assessments. An organization can assess a candidate in three dimensions including biography, personal characteristics, and behavior, which IT can all support (Laumer, von Stetten, & Eckhardt, 2009).

Assessing candidates' biographical data is usually the first assessment step and is also referred to as application screening in the literature. Research on IT's supporting the application screening process is again limited despite the widely known issue of higher numbers of applications in the e-recruiting process compared to traditional recruiting process. In fact, we found only two studies that focus on IT-supported pre-screening. Mohamed, Orife, and Wibowo (2002) critically discuss the common practice of automated keyword searches on applications to identify relevant applications. Their concern is two-fold. First, they have doubts whether HR professionals in organization always use the right keywords that are actually indicative for future job performance. Second, they suspect that some applicants knowing about this practice could modify their application accordingly and gain an advantage. The authors conclude with suggestions to avoid these pitfalls. Hedricks, Robie, and Oswald (2013) recommend an innovative Web-based support for reference checking. Their results indicate not only an equal validity compared to traditional reference checking but also efficiency gains as references responded quicker.

Once a candidate passes the initial biographical data assessment, personal characteristics are commonly assessed next. We discuss one form of personal characteristics assessment in Section 3.7.2 when we discuss using a person-organization fit questionnaire on the recruiting website (Dineen et al., 2002, 2007). In addition, we found three types of further publications that discuss the IT-enabled personal characteristics assessment. The first type encompasses studies that develop and prove the validity of computerized testing in contexts such as secretarial assessments (Schmitt, Gilliland, Landis, & Devine, 2006) and military assessments (Burke et al., 1995). The second type encompasses studies that compare different formats, and, despite some concerns regarding human-computer interaction (Booth, 1998; Jäger, Krieger, & Dlugosch, 1995), they generally found no difference between computerized and pen-and-paper testing if the test is untimed (Jones, Brasher, & Huff, 2002; Potosky & Bobko, 2004; Salgado & Moscoso, 2003). However, we need to consider differences in the context such as the possibility to cheat in unsupervised Web-based testing scenarios. Initial research in this regard found no impact of cheating on personality tests such as the "big five" (Arthur, Glaze, Villado, & Taylor, 2010). The third type encompasses studies that examine innovative approaches such as social networks. Kluemper and Rosen (2009) found that one can derive IQ, work performance indicators, and the big five personality traits from social network profiles. They provided some training to 63 students on the big five personality traits, IQ testing, and performance indicators and asked the students to evaluate six other students based only on their social network profile. The authors also tested the six evaluated students using standard tests and compared the results. Surprisingly, they found that the 63 students not only had a high level of intra-class correlation but also were able to accurately distinguish candidates by the seven evaluation dimensions. Thus, an opportunity to use IT in assessing candidates based on their social network profile exists. In case social network profiles are part of the recruiting decision, users need to be careful about what kind of information they publish and about their own privacy. Research indicates that conscientiousness, agreeableness, extraversion, age, and emotional stability are significant indicators that reduce a person's risk to publish problematic information (Karl, Peluchette, & Schlaegel, 2010; Roulin, 2014). It further indicates cultural differences (e.g., U.S. students are more prone to publish problematic information than German students) (Karl et al., 2010). With regards to privacy, Harris, Hoye, and Lievens (2003) found that applicants with more exposure to technology were less concerned about privacy. Research on computerized assessment of personal characteristics previously discussed primarily demonstrates efficiency improvements over traditional assessments, but we know little about potential effectiveness improvements.

The third and last dimension assesses a candidate's behavioral aspects, which is commonly done in behavioral interviews and simulations. We identified four publications that focus on IT support of behavioral interviews. Two publications compare the interview formats face-to-face with video conferencing. Chapman and Rowe (2001) report no difference, while Straus, Miles, and Levesque (2001) report more positive evaluations in video interviews—especially if the applicant is female and the interview is not structured. The third publication examines perceptions of fairness and notes no difference between different media in this regard (Bauer, Truxillo, Paronto, Weekley, & Campion, 2004). The forth relevant publication examines the impact of previous recruiting test scores on interviewers (Dalessio & Silverhart, 1994). Findings include a quality decrease of the interviewers' assessment if they know the applicant's previous test score. This finding suggests that IT does facilitate the assessment and access to result scores, but it should not be communicated to the interviewer prior to the interview. The literature also discusses IT support of simulations in recruiting and generally finds that IT has great potential to not only increase efficiency but also effectiveness (Aguinis, Henle, & Beaty, 2001; Bartram, 2000; Laumer, Eckhardt, & Weitzel, 2012; Laumer, von Stetten, Eckhardt, & Weitzel, 2009; Lievens, van Dam, & Anderson, 2002). Ree and Carretta (1998) report on computer simulations used to recruit U.S. air force pilots, and Fluckinger, Dudley, and Seeds (2014) experimentally demonstrate that interactive multimedia simulation in addition to the traditional assessment of biographical data does significantly improve results.

Summing up, considerable research on IT providing value to the employee selection process exists, but "more research is needed before we can claim evidence that technology improves the decision-making process in selection" (Viswesvaran, 2003, p. 110).

3.7.4   Transformative HRM Capability: 3) Active Searching and Approaching of Candidates

We found no research on IT's supporting active sourcing in recruiting. However, once recruiters are trained accordingly (Eckhardt et al., 2011), using social networks is already common practice in recruiting with some networks such as Xing and LinkedIn providing special access for recruiters, which facilitate active searching. Thus, a gap appears to exist between researchers and practitioners with regards to using social networks (Roth, Bobko, Van Iddekinge, & Thatcher, 2013). The lack of publications and the research gap limit an objective assessment of IT's further value potential. In our understanding, IT value is co-created as organizations exchange information with external information providers such as social networks. However, it seems that the interface between a seeking organization and information providers is not integrated (i.e., IT-enabled) yet. Despite the lack of literature in this regard, we can reasonably assume that IT has at least the potential to provide further value by integrating seeking organizations with external information providers and automating the active candidate search (i.e., first type of IT value creation) (Kohli & Grover, 2008).

3.7.5   Transformative HRM Capability: 4) Providing a "Signature Experience" to Candidates

Sections 3.7.1 to 3.7.3 indicate that IT in recruiting primarily creates value from automation (e.g., Buckley et al., 2004). No publication suggests or reports on organizations that use IT to purposefully create a special experience for potential candidates in recruiting let alone differentiation and sustained competitive advantage. While organizations can tailor IT to appear especially innovative, approachable, or social if they chose to do so, the literature does not provide any clues for IT's potential to provide a "signature experience" in recruiting.

3.7.6   Transformative HRM Capability: 5) Assessing of Soft Skills and Cultural Fit of Candidates

The increasing number of applications in e-recruiting processes (e.g., Cappelli, 2001) requires new ways of assessing candidates' soft skills and cultural fit that go beyond the traditional, costly behavioral interviews. We show previously that IT has the potential to support HRM in this regard by tapping all of Kohli and Grover's (2008) types of IT value creation except for IT value co-creation. Person-organization fit questionnaires (Dineen et al., 2002, 2007) and social media profile evaluations (Kluemper & Rosen, 2009) are examples for IT-embeddedness. Information gathered in this process can informate the team-staffing process (see Section 3.6.3). Organizational fit also creates intangible value by contributing to work effectiveness and employee satisfaction. However, since cultural fit is organization dependent and cannot be outsourced (e.g., to recruiting websites), it has no potential for value co-creation.

3.7.7   Transformative HRM Capability: 6) Targeting Market Potentials Labor such as Women, Foreigners, and Mature Candidates

We found few studies that target recruiting in general (Breaugh, 2008) let alone recruiting with IT support. However, two types of IT value creation appear reasonable. First, in spirit of information mindset (Kohli & Grover, 2008), IT has the potential to create value by applying data analysis techniques known from direct marketing to targeted recruiting. An increasing number of applications in e-recruiting (e.g., Cappelli, 2001) enables one to meaningfully analyze job advertisements tailored to women, foreigners, and mature candidates, which could deliver more findings like those provided by two publications on ethnic differences in this review (Goldberg & Allen, 2008; McKay & Avery, 2006). Second, organizations can co-create value by cooperating with external recruiting websites with a large number of applications and a targeted e-recruiting experience. Such cooperation to analyze data is at the core of the "big data" trend, which is even said to have the potential to revolutionize management (McAfee & Brynjolfsson, 2012).

3.8   Development

As we describe in Section 2.2.4, employee development includes performance management, informal development (i.e., mentoring), and formal development (i.e., training). In this section, we review the IT support not only of these three aspects but also of the three development-related transformative capabilities.

3.8.1   Performance Management

Developing employees starts with repeatedly assessing their strength and weaknesses. In this section, we review research regarding IT's supporting HR performance management, which falls into two categories: 1) impact on user and 2) impact on organization.

Two publications discuss the impact of electronic performance management on the user. Comparing online and traditional performance appraisal systems, the first publication reports no difference in user satisfaction, perceived utility, and perceived security (Payne, Horner, Boswell, Schroeder, & Stine-Cheyne, 2009). Examining antecedents of user satisfaction in greater detail, Cook and Crossman (2004) found that perceived fairness of the system matters and that the actual and expected performance scores biased users' satisfaction impression.

The remaining papers on electronic performance management examine the impact on organizations. This impact not only includes operational efficiency but also effectiveness because electronic performance monitoring provides more accurate performance indicators (Wu & Hou, 2010) and because it allows more frequent appraisals, which lead to increases in organizational citizenship behavior (Bhave, 2014). Furthermore, Aral, Brynjolfsson, and Wu (2012) found employee performance software to create disproportionally more value when it complements organizational practices. The authors not only found evidence for a three-way interaction effect among the adopted software, the practice of performance pay, and the practice of HR analytics but also substantiated that additional value was created from the three-way interaction among IT and the two organizational practices, which could not be created from either pairwise interaction. However, the intuitive hypothesis of electronic performance monitoring systems leading to more objectivity in performance evaluations has to be rejected because subjective visual performance measures seem to dominate the evaluation process (Kulik & Ambrose, 1993).

3.8.2   Mentoring

Coaching and mentoring are sometimes said to differ in that mentoring is more voluntary and holistic while coaching is commonly provided by the employer and targeted to improve a certain skill. Instead of finding a hard distinction between the two, we rather consider coaching to be one special form of mentoring (e.g., Ensher, Heun, & Blanchard, 2003) since, in particular, the IT support that we discuss in this paper seems fairly similar. Both require the means to match an advisor with a mentee and the means to communicate. Moreover, neither is restricted to an organization's boundaries. IT-enabled mentoring and coaching is also referred to as e-mentoring (Ensher et al., 2003). In this section, we briefly outline the findings of five e-mentoring-related studies that we identified during the literature review.

The overall goal for e-mentoring is to support a mentee in setting and reaching aspirations. To do so, one study reports that the frequency of interaction between mentor and mentee needs to be high, which, in turn, is dependent on the mentee's self-efficacy before entering the mentoring relationship (DiRenzo,

Linnehan, Shao, & Rosenberg, 2010). In addition, DiRenzo et al. (2010) surprisingly found that having been in a mentoring relationship before had no impact on the mentoring outcome. Similarly, DiRenzo, Weer, and Linnehan (2013) found that a mentee's career aspirations can be increased through increasing both their general and their career-based self-efficacy.

Looking at the e-mentoring relationship from a mentor's point of view, Panopoulos and Sarri (2013) examined mentors' antecedents of e-mentoring adoption. They found that the relative advantage compared to traditional means of mentoring need to be clear, mentors need to be open to try innovative approaches, they need to be confident using computers, and they tend to require pressure from their mentees to continue using the system. Similarly, Headlamwells, Gosland, and Craig (2006) found that a majority of mentors used other communication means than offered by the e-mentoring system although they were generally satisfied with that system. Comparing mentoring via electronic chat with face-to-face mentoring, Smith-Jentsch, Scielzo, Yarbrough, and Rosopa (2008, p. 193) report that male mentors use more condensed language in electronic chats leading to "less psychosocial support, career support, and post-mentoring protégé self-efficacy than face-to-face".

In summary, e-mentoring research findings indicate some user reluctance to use e-mentoring systems. If used, these systems have the potential to increase efficiency, but their potential to increase effectiveness and to create further value is unclear and requires further research (Ensher et al., 2003).

3.8.3   Training

Using IT in training and education (i.e., e-learning) has great potential and is expected to grow strongly over the next few years in both the academic educational and the workplace training context (Anderson, 2012). Both contexts are similar in that they use IT to support human learning. However, the contexts differ with regards to the beneficiary of the value created. In the academic educational context, learning has first priority and the users of e-learning (i.e., the students are also the customers). The expected value created from using academic e-learning is, therefore, geared toward the learning students. In the workplace training context, learning does not have first priority and e-learning users are employees, not customers. Opposed to the academic context, the expected value created from using e-learning is rather geared towards the investing organization (Dick et al., 2006). Thus, differences in motivation and value creation are often overlooked in the workplace context (Noe, 1986), which could cause e-learning to fail even in cases where its design meets high pedagogical standards (Tai, 2008). We broadly categorize and summarize workplace e-learning research into two categories: 1) understanding workplace e-learner motivation and 2) improving on workplace e-learning implementation. For more details, we refer readers to other reviews dedicated to workplace e-learning (e.g., Burgess & Russell, 2003; DeRouin, Fritzsche, & Sales, 2005; Huynh, Umesh, & Valacich, 2003).

During the course of this literature review, we found several studies that draw on technology adoption theories to better understand workplace e-learning motivation (Cheng, 2011; Chiu, Chiu, & Chang, 2007; Chiu & Wang, 2008; Ong, Lai, & Wang, 2004). Some case studies and conceptual studies investigate learner motivation (Brown & Charlier, 2013; Chan & Ngai, 2007). Most studies find that, besides perceptions of utility and usability, social components (i.e., subjective norms) are critical in workplace e-learning motivation (Chan & Ngai, 2007; Cheng, 2011), the interactivity of learning (Cheng, 2011), and personal privacy concerns (Ong et al., 2004). Since workplace e-learning use is often not a single event, research has also examined factors relevant for the decision to continuously use e-learning and found that prior satisfaction and perceptions of fairness, utility and outcome expectations have a significant impact on the continuance intention (Chiu et al., 2007; Chiu & Wang, 2008). Common suggestions for future research include differentiating the learning context in greater depth and breadth (Alavi & Leidner, 2001) and focusing more on non-adopters to better understand their decision not to participate (Chan & Ngai, 2007). Going beyond technology adoption, some studies on gamification and self-regulated learning in the workplace context exist. Research on gamification aims to increase intrinsic motivation and enjoyment while learning. Merely relabeling work into play is found to have a positive impact (Webster & Martocchio, 1993). Further research suggests combining games with intelligent tutoring (Siemer & Angelides, 1997) and describes a positive impact of games in military education (Chatham, 2007). Our review scope includes two studies examining self-regulated learning that is necessary for the effectiveness of autonomous learning independent of time and place (Santhanam, Sasidharan, & Webster, 2008; Wan, Compeau, & Haggerty, 2012). These studies found, opposed to popular belief that self-regulated learning needs to be triggered, that self-regulated learning strategies can be differentiated, and that the choice of strategy depends on not only the desired outcome but also individual factors. Personalized e-learning

adapts to individual factors. However, research on e-learning personalization appears to be primarily conducted in the academic context because we found no results in a workplace context. Similarly, other reviews focusing exclusively on workplace e-learning hardly mention research on personalization (e.g., DeRouin et al., 2005).

Considering findings from e-learning motivation and other fields, a range of studies derive and further justify best practices in e-learning implementation (e.g., DeRouin, Fritzsche, & Sales, 2004). This kind of research starts with differentiating e-learning contexts along dimensions such as format (e.g., traditional versus virtual), synchronicity (e.g., asynchronous versus synchronous), instructional method (e.g., objectivist versus constructivist), choice of media (e.g., text, graphics, video), and choice of technology (e.g., video conferencing, hypertext, web 2.0) (e.g., Benbunan-Fich, 2002; Gupta & Bostrom, 2009; Piccoli, Ahmad, & Ives, 2001). Unfortunately, we note that studies often neglect external dimensions such as subjective norms, level of voluntariness, and other external factors impacting motivation to learn despite the fact that the workplace training context primarily differs from the academic education contexts in terms of learner motivation (see discussion in the beginning of this section). There seems to be common agreement that the potential of workplace e-learning especially asynchronous e-learning is not yet fully realized (DeRouin et al., 2004). The commonly stated potential benefits for the organization include savings in training costs, training standardization across geographies, and flexible content updates. The potential benefits for the learner include collaborative learning, time and place independent learning, and increased control over the learning in terms of pace, content, and instruction (i.e., learner control). However, learners are poor assessors of their own learning needs (Carrier, 1984), which entails that guidance and support remain important in IT-enabled learning (DeRouin et al., 2004). Without guidance, technology-enabled benefits such as learner control could actually lead to decreased learning effectiveness (DeRouin et al., 2004).

Further workplace e-learning research on the use of social technology, on e-learning interconnectivity with other enterprise systems, and on e-learning's alignment with business processes discusses additional potential for e-learning to create value. Using social technology seems promising because social factors are important in learning as previously mentioned and because they can enable collaborative learning independent of time and place (Bruckman, 2002), which, in turn, can also create new knowledge (London & Hall, 2011). Thus, the value potential goes beyond the training context, which Kohli and Grover (2008) call value expansion. Another opportunity to create further value from using IT resides in the interconnection of the learning management system (LMS) with other enterprise systems such as the competence management system (CMS). Since training specifically targets the building of certain competencies, an interconnection has the potential to facilitate the management of both LMS and CMS (Haland & Tjora, 2006). Building on the interconnection of LMS and CMS, Wang, Vogel, and Ran (2011) further discuss the idea of performance-oriented e-learning and develop KPIs that help organizations to monitor competency development. Finally, what's true for IT in general is also true for e-learning in particular. Alignment of IT and organizational processes is critical for IT to create value (Henderson & Venkatraman, 1993; Nevo & Wade, 2010; Powell & Dent-Micallef, 1997). Thus, if employees stick with traditional learning processes after e-learning's introduction, IT value creation declines (Chu & Robey, 2008).

3.8.4   Transformative HRM Capability: 7) Training of Soft Skills

We found no publication on using IT to train soft skills in the workplace. A large national survey conducted in Germany revealed that about 80 percent of the organizations did not believe in the trainability of soft skills through workplace training efforts (von Stetten et al., 2014). Soft skills are generally said to be difficult to transfer and to be better attained on-the-job (Laker & Powell, 2011). Thus, it appears to be a common belief that the potential for IT value creation in training soft skills is limited. We require further research on the effectiveness of soft skills training in general and on IT-simulation-based soft skills training in particular to disprove this common belief.

3.8.5   Transformative HRM Capability: 8) Moving Focus from Organizational Needs toward Employees' Desires

Focusing on employees' desires in HR development could have implications on IT's supporting performance management, mentoring, and training.

With regards to employees' desires in performance management, IT's potential to provide further value is limited. As our previous discussion indicates, embedding IT in performance management does not

increase desirable review objectivity (Kulik & Ambrose, 1993). It does increase the frequency of performance reviews and enable employee monitoring (Bhave, 2014), which employees, however, do not always desire (for a review, see Stanton, 2000). On the one hand, increasing review frequency could reduce the perceptions of autonomy and, consequently, lead to dissatisfaction, which is an example of extrinsic motivation undermining intrinsic motivation as posited by the self-determination theory (Deci & Ryan, 2002; Lepper & Greene, 1975). On the other hand, it is reasonable to motivate and to develop employees by providing adequate feedback more than once a year (e.g., Dychtwald et al., 2006). However, increasing the feedback frequency to more than once a year could also be achieved without using IT.

Employee mentoring is by definition focused on employees' desires. Despite cost savings, IT-enabled mentoring is expected to facilitate communication due to reduced hierarchical perceptions between mentor and mentee (Ensher et al., 2003). However, our review reveals that this and other propositions are still unexamined and require further research.

In the training context, focusing on employees' desires is necessary to motivate employees to participate. Because most researchers have conducted e-learning research at the user level, most workplace e-learning publications allow one to derive implications with regards to employees' desires. Our review reveals that learners prefer e-learning to be useful, social, enjoyable, and easy to use and that IT has the potential to create value with respect to all employee preferences. Regarding usefulness, we found that IT has the opportunity to create further value from the interconnection of the learning management systems with other enterprise systems, which is essentially re-using available information. We found that using social networks meets employees' desire for learning to be social. It also creates further value through collaboration and knowledge creation. Gamification increases not only perceived enjoyment but also learning effectiveness. Furthermore, IT has the potential to increase perceived ease of use by providing learner control and enabling self-regulated learning independent of time and place.

3.8.6   Transformative HRM Capability: 9) Training Employees of all Generations

Training employees of all generations has two aspects: 1) teaching different content to different generations and 2) teaching the same content to different generations. As for the first aspect, the literature does discuss generation-specific development concepts such as reverse mentoring for mature employees. However, our review indicates IT to have little potential to create further value in this regard. The second aspect requires adapting and personalizing training to employees of different generations. One major advantage of using IT in training is that it helps instructors personalize their instruction (Goldstein, 1974). However, despite a relatively long history on personalized instruction, little empirical support for the hypothesis that personalized instruction really leads to a greater learning outcome exists (Cronbach & Snow, 1977). Researchers have long suspected that IT has untapped value potential in personalized e-learning endures, but research appears to focus exclusively on the academic context (e.g., Chen, 2010; Klašnja-Milićević, Vesin, Ivanović, & Budimac, 2011; Lo, Chan, & Yeh, 2012; Thomas & McKay, 2010). We found no publication on personalized workplace training. As such, we need more research on learner-focused workplace e-learning (DeRouin et al., 2005).

3.9   Motivation

Motivation activities primarily encompass workforce morale improvements (e.g., diversity management, employee satisfaction) and incentives for performance (e.g., talent management, compensation, and benefits). In addition to these two aspects, in this section, we also review the IT support regarding two motivation-related transformative capabilities listed in Table 2.

3.9.1   Workforce Morale Improvements

Managing diversity and monitoring employees' satisfaction are HRM activities performed to prevent employees' dissatisfaction. Diversity management primarily deals with ensuring equal opportunities for all employees regardless of personal characteristics such as gender, ethnicity, religion, and age. However, organizations increasingly aim to further capitalize on diversity. One example is a certain diversity-friendly employer image that attracts capable employees regardless of personal characteristics (see also Section 3.7.2). Another example is team staffing based on research such as the finding that mixed teams perform better than same-sex teams (Apesteguia et al., 2011) (see also Section 3.6.2). We found no IT-related publications on diversity management. However, initial investigations into the use of technology exist, such as a report that a subsidiary of software company SAP sponsored that concludes that technology's

role in diversity management is generally unclear (Helgesen, 2014), which means IT's value potential in diversity management is unclear.

Monitoring employee satisfaction usually entails a frequently scheduled employee satisfaction survey to identify and act on employees' dissatisfaction and to prevent negative consequences such as high rates of unwanted turnover. With regards to employee satisfaction surveys, IT provides a lot more opportunities to create value than merely administering the survey electronically. For example, Sexton, McMurtrey, Michalopoulos, and Smith (2005) suggest and demonstrate using a neural network to predict which employee is most likely to leave the organization next based on data such as salary, position, age, and ethnicity. Another study found that work-related events such as the introduction of an HRIS impacts turnover intention (Maier, Laumer, Eckhardt, & Weitzel, 2013).

3.9.2 Performance Incentives

Improving workforce morale as previously discussed is a subtle approach to improve employees' motivation. A more explicit and more common approach is setting employee-performance incentives. These incentives not only include monetary compensation and benefits but also opportunities for personal advancement (i.e., talent management). In this section, we discuss IT's supporting both kinds of incentives.

We found only two academic publications that discuss IT opportunities with regards to compensation and benefits in the scope of our review. Garcia-Diaz, Flores, and Noce (1996) provide guidelines for compensation development in terms of both percentage increase and scheduling using external and internal consistency constraints. Sturman, Hannon, and Milkovich (1996) focus their attention on flexible benefits. They maintain that allowing employees to individually decide on the kind of benefits themselves improves employee satisfaction but confronts them with a complex decision due to a potentially great number of combinatorial choices. They suggest using an expert system that facilitate this complex decision and recommends a combination of benefits based on personal parameters such as family status and age.

Talent management includes HRM activities such as career management, rotation program management, and succession planning. Publications about IT's supporting talent management are scarce despite the fact that it is readily available as part of standard solutions offered by software vendors such as Oracle and SAP. We found only one case study discussing talent management systems (TMS) in the scope of our review (Burbach & Royle, 2010). It discusses lessons learnt from a global rollout of TMS and reports that regional differences in education and academic degrees increase complexity of technical requirements. However, really inhibiting truly global talent management is not technical complexity but the regionally different use of the same IT (Burbach & Royle, 2010).

3.9.3 Transformative HRM Capability: 10) Providing Flexibility in terms of Work Modes and Benefits

IT is already contributing to flexibility in both work modes and benefits. IT support for flexible work modes includes all kind of remote workplace and communication technology, which is outside the scope of our review because these technologies do not directly support HRM processes (see Section 3). It also includes flexibility in administrative functionalities such as shift scheduling and vacation planning, which is usually part of HR portals that we discuss in Section 3.10.2.

We found one publication that discusses flexibility in benefits, which we discuss in Section X. This paper (Sturman et al., 1996) suggests an expert system that facilitates decision making based on personal characters and data on past decisions. Thus, according to Kohli and Grover's (2008) four themes of IT value, IT has the potential to create value not only through process embeddedness but also through re-using information and process informating. Furthermore, in accordance with the big data trend (e.g., McAfee & Brynjolfsson, 2012), Campbell et al.'s (2012) findings suggest one should include other data such as the individual's situation regarding mobility and market evaluations of general skills to find an optimal level of compensation and benefits that satisfies both the employee and the organization. However, we require further research to operationalize findings such as those of Campbell et al. (2012) in the HRM context.

3.9.4   Transformative HRM Capability: 11) Managing Talent not only with Leadership Potential, but also with any other Key Skill, Knowledge, or Relationships

We found that publications regarding IT in talent management are scarce despite TMS already being part of standard software packages. However, talent management was traditionally focused primarily on leadership potential and ignored other key skills, knowledge, and valuable relationships (Tansley, 2011). Using data analytic approaches such as those Kluemper and Rosen (2009) or Malinowski et al. (2008) provide, IT could be embedded and create value in identifying employees with key skills, knowledge, or relationships. We need further research corroborating this value potential.

3.10   Administration

In this section, we first review and discuss the IT support of administrative HRM activities before turning our attention to the HRM portals providing access to administrative HRM activities. We conclude by briefly discussing IT's supporting one administration-related transformative capability: the optimization of processes and costs.

3.10.1   Administrative HRM Activities

We found only three publications that are related to IT support of administrative HRM activities in the scope of our review. Ioannidis, Kokkotos, and Spyropoulos (1993) describe "eccentricities of the Greek public sector payroll information system" and suggest improvements in form of a framework for retroactive and delayed payments. In this case, IT enables one to administer an unusually complex salary policy where payments need to be made in advance and adjusted in retrospect. Moving on from payroll activities to HR controlling, Walker and MacDonald (2001) suggest using IT to implement an HR scorecard and its key performance indicators (KPIs). IT allows managers to calculate KPIs in a timely and traceable manner, which enables them to identify root causes for observed changes in individual KPIs. The third publication suggests and describes a group decision support system to expedite the collective bargaining process between work union and organization management (Hsieh & Menefee, 1991). Their suggested model considers multiple quantitative and qualitative objectives of the bargaining parties. The value of using IT is considerable as it mitigates the risk of work stoppage.

3.10.2   Employee Access to HRM Activities

Among the HR administration papers we found, most (about 75%) focuss on HR portals also refer to as business-to-employee (B2E) portals, which enable employees to perform administrative HRM activities themselves. In this section, we discuss two case studies on implementing such portals and several studies examining acceptance, satisfaction, and effectiveness of HR portals.

The two case studies found using change management practices that modify organizational processes to be a key success factor in implementing HR portals (Klein & Krcmar, 2005; Ruta, 2005). Thus, aligning business and IT is again crucial for IT to generate value. Findings specific to the context of e-HRM are rare. However, referring to the HRM transformation, one case does suggest that value is created by freeing HR employees from administrative tasks and allowing them to perform more strategic tasks (Ruta, 2005).

Research on HR portal acceptance, satisfaction, and effectiveness unsurprisingly indicates that quality of service (i.e., usefulness) is always significant (Marler et al., 2009; Ruël, Bondarouk, & van der Velde, 2007; Yang, Stafford, & Gillenson, 2011). More surprising is the finding of a weak correlation between satisfaction and use (Wickramasinghe, 2010). Taking a closer look, in one case, the HR portals' usefulness and employee's satisfaction seemed somewhat independent from use because employees tended to stick with traditional means and continued "to make phone calls to the HR" because they simply favored personal interaction (Huang & Martin-Taylor, 2013). This finding also explains why change management (Klein & Krcmar, 2005; Ruta, 2005) and managerial pressure (Marler et al., 2009) are important for HR portal adoption and value creation.

The main value of HR portals resides in automating administrative tasks and in moving some of the workload for tasks such as record keeping to the individual employee (Ruta, 2005). Interestingly, employees do not perceive it as a shift in workload (Wickramasinghe, 2010).

3.10.3 Transformative HRM Capability: 12) Optimizing Processes and Costs

Provided that IT is more often used for administrative than for analytical HRM activities (Ball, 2001), the low number of academic publications in the area of HRM administration is somewhat suspicious. However, defying the need for further research is the fact that standard HRM software solutions offered by vendors such as Oracle and SAP include support for administrative HRM activities for years, and the administrative activities themselves have hardly changed. Thus, research focuses on HR portals, where IT provides the potential to optimize HRM processes and to reduce costs. The available literature does not indicate any value potential in terms of Kohli and Grover's (2008) informating, co-creation, or value expansion.

Table 5. Transformative HRM Capabilities and IT Value Potential by Themes (Kohli & Grover, 2008)

HRM function	Transformative HRM capability	IT value potential				e-HRM papers
		EM	IN	CO	EX	
Planning	1) Providing business-relevant insights and foresights	-	x	x	-	3
Staffing	2) Matching individuals' desires and characteristics with job features and team characteristics	x	x	-	x	1
Recruiting	3) Actively searching and approaching candidates	x	-	-	-	0
	4) Providing a "signature experience" to candidates	-	-	-	-	0
	5) Assessing of soft skills and cultural fit of candidates	x	x	-	x	3
	6) Targeting labor market potentials such as women, foreigners, and mature candidates	-	x	x	-	2
Development	7) Training soft skills	-	-	-	-	0
	8) Shifting focus from organizational needs to employees' desires	x	x	-	x	40
	9) Training employees of all generations	x	-	-	-	0
Motivation	10) Providing flexibility in terms of work modes and benefits	x	x	-	-	2
	11) Managing talent not only with leadership potential but also with any other key skill, knowledge, or relationships	x	-	-	-	2
Administration	12) Optimizing processes and costs	x	-	-	-	13
EM: IT embeddedness IN: information mindset CO: value co-creation EX: value expansion x: value potential exists -: value potential does not exist						

4 Discussing the Value Potential of IT in HRM

When relating the "to-be" situation in Section 2 with the "as-is" situation outlined in in Section 2, we are able to not only explain the value potential of IT in HRM but also highlight fruitful avenues for future research and practice attempting to tap the value potential.

4.1 Explaining the State and Potential of IT in HRM

Based on Section 2, we expected a shift in technology type used in HRM organizations, which leads to four implications for IT in HRM. In this section, we discuss the state and potential of IT in HRM based on those implications.

Overall, the suggested shift in technology type (i.e., from mediating towards intense technology) is not reflected in e-HRM research. We identified 250 e-HRM papers in the scope of our review (see Table 4) and found that IT can support 10 of 12 required HRM capabilities (see Table 5). However, as Table 5 also indicates, few of the 250 e-HRM papers actually address these capabilities. If the shift in technology type towards intense technology had been recognized, more e-HRM papers would address the associated HRM capabilities. We believe ambiguity in the HRM transformation literature to be one reason for e-HRM research not reflecting the shift in technology type. As we mention in Section 2, discussions on newly required HRM capabilities are not specific enough to form a basis for subsequent research. As such, we develop our own list of capabilities in Section 2.2. We hope that the set of more specific HRM capabilities listed in Table 3 inspires further discussions on specific goals of the HRM transformation.

While unaware of what the HRM transformation entails in terms of technology, e-HRM research is well aware of the transformation itself. Around the turn of the millennium, the HRM transformation literature suggested to extend the focus including not only HR process efficiency but also business value creation across all HRM functions (Barney & Wright, 1998; Ulrich, 1997). At the same time and in sync with practitioners, e-HRM researchers extended their focus accordingly as Figure 3 above clearly illustrates. Therefore, we are also led to believe that practice has not outpaced research in e-HRM. Unfortunately, this notion occurs repeatedly in the literature with regards to various HRM functions such as development (DeRouin et al., 2005), recruiting (García-Izquierdo, Aguinis, & Ramos-Villagrasa, 2010; Searle, 2006), selection (Roth et al., 2013), and diversity management (Kulik, 2014). Since non-HRM practitioners also indicate that the HRM transformation has not arrived yet in practice (Hussain et al., 2007), and we believe that the HRM transformation opened many questions that neither practice nor research has answered yet.

The first implication of the shift in technology type for IT in HRM is a need for greater integration and information exchange across functional and organizational boundaries (see Section 2.3). Unfortunately, e-HRM research appears "patchy" and seldom spans HRM functions (Stone & Dulebohn, 2013; Strohmeier, 2007). We found, for instance, only three publications discussing the information exchange between HR development and HR staffing (Bellone et al., 1995; Campbell, 1999; Lindgren et al., 2004) and even fewer publications discussing the exchange across other HRM functions. However, we did find indications of a growing value potential from informating capabilities (i.e., "information mindset") (Kohli & Grover, 2008; Zuboff, 1988). Since value from "information mindset" can only be realized by a capability if another capability has IT already embedded and serves as information provider (Kohli & Grover, 2008), one would expect opportunities to create value from "IT embeddedness" to occur more frequently than opportunities to create value from "Information mindset". Surprisingly, Table 5 indicates that "information mindset" and "IT embeddedness" occur equally often in absolute terms, which indicates a relatively larger IT value potential from informating (i.e., "information mindset"). This finding is also in line with similar statements in publications on e-HRM (e.g., Liff, 2007; Shrivastava & Shaw, 2003) and on strategic HRM (Barney & Wright, 1998; Wright & McMahan, 1992).

The second implication of the expected shift in technology is a greater need to consider employee differences outlined in Section 2.3. The e-HRM literature appears promising in this regard. We found considerable research on recruiting websites and candidate attraction. Most e-learning research was conducted at the user level. To accommodate for employees' individual differences, Strohmeier even suggests applying customer relationship management (CRM) practices to HRM (Strohmeier, 2013).

The third implication is that the shift in technology type calls for greater specialization of individual HRM capabilities. Since it seldom addresses HRM capabilities (see Table 5), e-HRM research is seldom specialized in the sense of Thompson (1967). In fact, we notice two extremes in the e-HRM literature. Either "[t]he respective technological applications are…considered on a very general level" (Strohmeier, 2007), or research tends to focus on specific technological possibilities such as how social networks can be used in HRM. To focus on individual HRM capabilities, research should rather address relevant business needs such as how IT can help HRM to respond to talent shortages or what needs that users have that social software can address.

Finally, the use of more intense technology also entails increasing IT costs (see Section 2.3). Our review indicates that this aspect is entirely neglected by e-HRM research up to now. Costs are only discussed in contexts of automation, optimization, and cost reduction. However, our examination of external labor market challenges, the resulting transformative HRM capabilities, and Thompson's (1967) theory suggests discussing cost increases for an HRM transformation to be successful. Thus, there is ample room for future research. Subsequently, we highlight more specific research avenues that stem from our review findings.

4.2 Highlighting Avenues for Future Research

As evident from previous sections of this review and from earlier e-HRM reviews (e.g., Marler & Fisher, 2013; Sareen & Subramanian, 2012; Strohmeier, 2007, 2009; Wirtky et al., 2011), ample opportunities exist for further e-HRM research (Stone & Dulebohn, 2013). With regards to methodology, theory, level or research, and other research attributes, our findings are similar to those of earlier reviews, which is why we do not discuss them in greater detail. That is to say that we agree with most earlier calls for further research including more theoretical, more cross-level, and more longitudinal research (e.g., Marler & Fisher, 2013; Strohmeier, 2007). However, primarily based on the discussion of the previous section, we conclude current e-HRM research to be not quite spot on in terms of relevance. As such, we contribute by summarizing the major research opportunities that we came across during this review for each HRM function (see Table 6 for overview).

Table 6. Overview of Major e-HRM Research Opportunities

HRM function	e-HRM research opportunity
In general	*Business needs* (e.g., transformative HRM capabilities that address the HRM transformation's goals)
Planning	*System integration* (e.g., re-using available information to improve labor demand and supply predictions)
Internal staffing	*Subjective match of people* (e.g., using IT to detect individual preferences and optimal team compositions and to support staffing decisions)
External recruiting	*Targeted recruiting* (e.g., using IT for segmentation and to pro-actively recruit approach)
Development	*E-learning personalization* (e.g., individual learner differences that matter in terms of workplace e-learning outcome)
Motivation	*Talent management* (e.g., using IT to objectively identify talents in an organization)
Administration	*No major opportunity*

4.2.1 IT in HRM in General

Overall, our findings suggest that future e-HRM research on enabling the HRM transformation should address transformative capabilities (see Table 3) and consider the four general implications that the HRM transformation has on IT (see Section 2.3).

Addressing a transformative HRM capability has two major benefits. First, due to the low number of studies currently addressing transformative HRM capabilities (see Table 5), potential for IT to create value in HRM and the opportunities for further relevant e-HRM research contributions are considerable. The actual potential is likely even greater than we indicate in this review. Since we do not consider the impact of local, political, and legal labor market challenges in this study, the list of transformative HRM capabilities (Table 3) is not exhaustive and likely to be even longer. Second, by addressing transformative HRM capabilities, we implicitly address the currently neglected shift in technology type and its four implications (see Section 4.1).

However, we suggest that future e-HRM research should explicitly consider the four implications we discuss above. If future e-HRM studies consider greater integration and information exchange, greater personalization, greater specialization, and increased costs in e-HRM, they will likely be relevant because all of the opportunities we identify and synthesize in this paper contain at least one of these four elements.

4.2.2 Planning

HR planning appears to be widely open for further research. This review suggests that considerable potential exists in providing organizations with personnel insights and foresights mitigating problems before they become eminent, such as understaffing and overstaffing. Thus, HR planning will become similar to financial planning. However, IT in HR planning is generally underappreciated as is the role of HR planning in general. Despite the great impact that HR planning can have on company performance, organizations tend to focus more on other more operative HRM functions (Huselid et al., 1997). We found that less than four percent of the e-HRM research (9 of 250) deal with HR planning. All studies were either

case studies, experiments, or simulations at the organizational level. None of these studies examined value or outcome of e-HRM in planning.

Thus, we need basic research to examine why a discrepancy between potential and how it is addressed exist and what the important factors for organizations are to tap this potential. E-HRM research has focused on integration and information exchange as mentioned before. We need to investigate what information needs exist, how organization specific such analyses need to be, to what degree we can standardize these analyses, and what HR planning's impact on organizational and/or individual impact is.

4.2.3   Internal Staffing

Since existing research focuses on the objective match of facts (particularly in the contexts of military, airline industry, and hospitals), future research should focus on other industries and the subjective match of people. All identified staffing studies focused on implementation using simulations and experiments. With one exception, they were all conducted at organizational level.

We require future e-HRM research on the subjective match of people in particular. A range of open questions exists, such as what criteria to use in the matching process, what technology (e.g., recommender, fuzzy logic, etc.) fits which kind of match and why, and how to measure "matching success" at the individual, group, and organizational levels.

4.2.4   External Recruiting

Because one third of all organizations do not receive the right applications to fill vacant positions (Weitzel et al., 2015), identifying and addressing labor market potentials and actively approaching individual candidates becomes vital. A lack of research exists on targeted recruiting in general (Breaugh, 2008), and we found no e-HRM research in this regard.

Interesting findings from future e-HRM research could include barriers to pro-active recruiting, approaches to identify potential candidates, and reasons why organizations are reluctant to use external CV databases despite their increasing popularity among applicants.

4.2.5   Development

Our review suggests workplace e-learning personalization to be an area with great research opportunities. Most of the considerable amount of e-learning research stems from the academic environment and aims to improve efficiency. However, using IT to personalize learning could actually improve learning effectiveness, too (Goldstein, 1974). We found no research on e-learning personalization in the workplace context. Despite e-learning being an ideal opportunity for interdisciplinary research that blends theories regarding organization, motivation, adoption, management, and learning, workplace e-learning research lacks theories that guide practitioners (DeRouin et al., 2004). In addition, most e-learning research was conducted at the individual level, and we found few studies examining the organizational impact of e-learning (Alavi & Leidner, 2001)

Future e-HRM research may examine relevant individual differences that impact learning outcome because there is a "dearth of research that has examined potential individual difference, instructional design, and situational moderators of effective e-learning outcomes" (Welsh, Wanberg, Brown, & Simmering, 2003). Furthermore, we need research on how to personalize according to these factors and on how to manage increasing e-learning personalization cost relative to gains in learning outcome.

4.2.6   Motivation

E-HRM research in the area of talent management is the most fruitful. Since talent management has evolved to include not only employees with leadership potential but also all kind of employees with valuable skills, knowledge, and relationships, we believe that we need to reconsider existing talent management functionality in existing software packages. A great business challenge and IT opportunity is to identify talent—especially in large and international organizations.

Future e-HRM research could examine means and barriers of talent identification across cultures, the individual and organizational impact of talent management, and whether using IT increases objectivity when promoting talents.

4.2.7 Administration

E-HRM has its origin in automating administrative HR processes such as payroll (DeSanctis, 1986). Standard software solutions have long automated most administrative processes, which have not changed much over time. The greatest novelty are HR portals granting employees direct access to employee data and obsoleting many HR administrators. In the light of the great research opportunities in other HRM functions in particular, we see little need for further e-HRM research in HR administration.

5 Limitations

This review, like every review, has boundaries that may limit its findings. In this section, be briefly outline the review's three major boundaries and their implications on our findings. First, in terms of journal selection, the final list of 76 journals does not contain many practitioner journals. As we mention in Section 3.3, we stroke a balance between relevance and academic rigor. In the area of HRM in particular, researchers have found that practitioner journals lack academic rigor because many papers in them appear to be unaware of long-known research findings (Rynes, Giluk, & Brown, 2007). As such, we only risk our findings if we have inaccurately described the research contexts of the 250 papers drawn from 76 rather academic journals. However, we are well aware of other sources outside the academic literature, and reputable editorial boards peer-review all of the 250 included papers.

Second, we did not include books and conference proceedings to keep the scope manageable. As for books, neither many e-HRM books (e.g., Gueutal & Stone, 2005; Kavanagh & Thite, 2009) nor a dedicated e-HRM book review (Strohmeier, 2012) contradict our findings. In fact, the e-HRM book review supports our main conclusion that e-HRM research does not see the bigger picture and not consider the impact of the greater HRM transformation. Instead, Strohmeier (2012, p. 293) conclude that it is still "not easy to get the 'big picture' of e-HRM" and that, "[l]ike pieces of a big mosaic, the respective book chapters present smaller pieces of insights". We are also certain that our findings are compatible with many if not most conference proceedings. A study reviewing 23 years of publication history of eight major IS conferences on e-HRM has also found that most e-HRM research focuses on process efficiency rather than effectiveness and that existing e-HRM research does not adequately consider certain HRM functions that are gaining in importance such as HR planning (Wirtky et al., 2011).

Finally, with our rather "systematic" review approach, we did not consider all academic papers on e-HRM. The smaller the review scope of a systematic approach, the bigger the risk of missing important contributions. Researchers suggest alternative "iterative" review approaches for this reason (e.g., Boell & Cecez-Kecmanovic, 2014). However, these iterative approaches have other disadvantage such as limitations in repeatability, limitations in quantitative literature summaries (e.g., Table 4 or Figure 3), and limitations in objectivity (Rodgers & Hunter, 1994). Combining the best of both approaches and mitigating the risk of missing important contributions, we opted for a systematic review with a broad review scope and an enrichment of discussion with further papers not in our actual scope (see Section 3.3).

6 Conclusion

Given the importance of HRM in the war for talent (Chambers et al., 1998), the pending transformation in HRM, and the strongly possible untapped IT value potential in HRM, we examine IT's potential to enable the HRM transformation. We achieve this goal in three steps. First, we outline a "to-be" situation by examining transformative HRM capabilities (Table 2) and their expected impact on IT in HRM using Thompson's (1967) theory of organizations in action. We then examine the "as-is" situation of IT support in HRM by reviewing more than 20 years of publication history of 76 peer-reviewed, reputable, and relevant journals. Finally, we relate the "to-be" and the "as-is" situations to understand the potential of IT in HRM, to identify gaps, and to provide guidance for future e-HRM research. We found a considerable amount of e-HRM research, which, however seldom, enables the HRM transformation because it seldom targets transformative HRM capabilities leaving ample opportunities for future e-HRM research.

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Appendix A: Review Scope

We focused on papers published between January, 1990 and September, 2013 in the journals listed in Table A1. We selected these journals based on either of the following criteria.

- Quantitative ranking Thomson Reuters ICI 2010 JCR 5-year impact factor: top 10 in either the business, management, or information science category.

- Qualitative ranking German national VHB-Jourqual 2.1 (VHB-Jourqual, 2011): top 10 in business, top 20 in information systems, top 30 in organization and personnel objectives, and all C-ranked journals that explicitly focus on HR according to the journals' descriptive information.

- Qualitative ranking international Association for Information Systems (AIS): all AIS Senior Scholars' basket of journals and other AIS or AIS-affiliated journals if they are also ranked by the VHB-Jourqual 2.1; that is, *CAIS, BISE, EJIS, ISJ, ISR, JAIS, JIT, JMIS, JSIS, MISQ*, and *MISQ Executive.*

- Qualitative ranking German guidance for information systems (Heinzl, Schoder, & Frank, 2008): all A-ranked journals.

We had to exclude some journals matching these criteria from the review because we had no means to evaluate their contents at the time of the review: *IEEE Software*, IEEE transactions journals, *Organizational Behaviour and Human Performance*, *Research in Personnel and Human Resources Management*, and *Research in the Sociology of Organizations*.

We conducted full-text searches where possible using the following search terms (which a previous review (Wirtky et al., 2011) has previously tested and proven to be valuable): HRM, HRIS, learning, recruiting, recruitment, employee performance, employee training, employee workplace, human resources management, human resources information system, payroll, personnel development, talent management, workforce planning.

Table A1. List of Reviewed Journals

Journal	Availability[1]	Total papers	e-HRM papers
International Journal of Human Resource Management	2000-2010	2467	16
Academy of Management Journal		1620	0
Academy of Management Review		1499	0
ACM Transactions on Database Systems		587	0
ACM Transactions on Information Systems		464	0
Administrative Science Quarterly		607	0
Business and Information Systems Engineering	> 2006	1055	2
Communications of the ACM		6458	8
Communications of the Association for Information Systems		1021	2
Computers and Operations Research		3969	20
Database	1993-1999	1455	3
Decision Support Systems		2656	9
Electronic Markets	> 1991	671	0
Employee Relations		873	4
European Journal of Information Systems	> 2005	999	4
Human Relations		1788	2
Human Resource Management[2]	> 1996	1119	19
Human Resource Management Journal		665	2
Human Resource Management Review[2]	> 1991	654	14
Human-Computer Interaction		372	0

Table A1. List of Reviewed Journals

Information and Management		1511	7
Information and Organization	2001-2002	172	0
Information Systems	> 1995	1172	0
Information Systems Journal[2]	> 1997	564	4
Information Systems Research	1990-2010	604	2
INFORMS Journal on Computing	1989-2009	748	0
International Journal of Electronic Commerce	2000-2010	381	0
International Journal of Human Resource Management[2]		2467	16
International Journal of Information Management	1986-2002	1690	4
International Journal of Management Reviews	> 1999	303	0
International Journal of Selection and Assessment[2]	> 1995	782	37
Journal of Applied Behavioral Science		741	0
Journal of Applied Psychology		2266	4
Journal of Behavioral Decision Making	> 1996	754	0
Journal of Computer Mediated Communication	> 1995	653	2
Journal of Economic Behavior and Organization		3030	0
Journal of Economics and Management Strategy	> 1992	668	0
Journal of Human Resources		879	0
Journal of Industrial Economics		714	0
Journal of Information Technology[2]	1986-2003	366	5
Journal of Institutional and Theoretical Economics		1175	0
Journal of International Business Studies	< 2002	902	0
Journal of Labor Economics	< 2012	660	0
Journal of Law, Economics, and Organization		639	0
Journal of Management		1203	5
Journal of Management Information Systems		979	3
Journal of Management Studies		1331	0
Journal of Managerial Psychology[2]		904	8
Journal of Marketing		1170	0
Journal of Occupational and Organizational Psychology		867	1
Journal of Operations Management	< 2002	1209	1
Journal of Organizational Behavior		1545	0
Journal of Risk and Uncertainty	< 2011	614	0
Journal of Strategic Information Systems[2]	> 1991	703	5
Journal of Supply Chain Management	> 1997	546	0
Journal of the ACM		986	0
Journal of the American Medical Informatics Association	1994-2012	1711	0
Journal of the Association of Information Systems	> 2000	274	1
Journal of Vocational Behavior		1657	7
Leadership Quarterly		1281	0
Management Science		2620	9
Mathematical Programming		604	1
MIS Quarterly		1041	3

Table A1. List of Reviewed Journals

MIS Quarterly Executive	> 2002	227	0
Omega. The International Journal of Management Science[2]		1729	12
Organization		1051	0
Organization Science		1415	0
Organization Studies		2264	0
Organizational Behavior and Human Decision Processes		1601	1
Organizational Research Methods	> 1998	547	0
Personnel Psychology		2231	8
Personnel Review[2]	> 1994	947	15
Research in Organizational Behavior	> 2000	125	0
SIAM Journal on Computing	1997-2011	1444	0
Strategic Management Journal	> 1996	1836	0
Strategic Organization	> 2003	235	0
Total (76 journals)		**89450**	**250**
[1] We reviewed papers from January, 1990 to September, 2013; availability might be limited due to journal age or access restrictions [2] Top-10 e-HRM journal regarding share of e-HRM papers on total papers			

Appendix B: Results of the Literature Review

IT in HRM in general

Ball, K. S. (2001). The use of human resource information systems: A survey. *Personnel Review*, *30*(6), 677-693.

Barrett, M., & Oborn, E. (2013). Envisioning e-HRM and strategic HR: Taking seriously identity, innovative practice, and service. *The Journal of Strategic Information Systems*, *22*(3), 252-256.

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