

# Do Current HRIS Meet the Requirements of HRM?: An Empirical Evaluation using Logistic Regression and Neural Network Analysis

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**Abstract.** Our paper examines the question whether major features of current HRIS actually meet requirements of HRM. To do so, we initially identify major features of current HRIS, discuss why these features may or may not meet requirements of HRM and derive corresponding hypotheses. Subsequently, we employ an international large-scale survey to test these hypotheses by combining logistic regression and neural network analysis. Our results draw a rather positive picture of HRIS: If equipped with the right functionality and delivery features current HRIS are able to meet requirements of HRM.

## 1 Introduction

The usage of Information Technology (IT) in Human Resource Management (HRM) dates back to at least the 1950s [47]. Since that time, numerous innovations have considerably changed the features of the respective Human Resource Information Systems (HRIS) [1, 4, 9, 18, 23, 34, 35]. At present, conceptions like *virtual* or *electronic HRM* denote the latest phase of HRIS usage [31, 39, 43].

However, describing current HRIS is a rather complex task. Likely, current HRIS are best understood as *configurations of different interacting systems that aim at the generation and delivery of HR functionality in order to automate and informate HRM*. The configurational aspect emphasises that current HRIS usually comprise of several different interacting systems. Roughly categorized, back-end systems aim at the generation of HR functionality, while corresponding front-end systems undertake the delivery of these functionalities to different categories of end-users [43].

In the interim, numerous *back-end systems* for HRM are offered by a bulk of specialised vendor organisations. With solitary HR applications, integrated HR applications (that provide a broader range of HR functionalities) and/or enterprise wide ap-

plications (that integrates HR functionalities additionally with other organisational functions such as production, sales or finance) there are three general varieties of back-end systems [1, 11, 43].

*Front-end systems* then have to deliver the generated functionality of the back end-systems to different categories of end-users. For this purpose increasingly web-browsers can be used as general user interfaces of HR back-end systems [23, 30]. Combined with the delivery potentials of web-browsers, portal-technology additionally enables a simple, unified and personalized access to all the heterogeneous back-end systems and services any user group may need [44]. As a consequence, by combining different back-end and front-end systems a multitude of different HRIS configurations is imaginable. Each of these configurations then will offer a different set of specific features that may (or may not) support HRM.

Abstracting from specific features, there evidently are some main features of current HRIS that refer to functionality and delivery. Regarding the *functionality* provided by back-end systems, in contrast to mere operational systems of the past functionality now can be considerably expanded into managerial areas and integrated with other business functions [23, 43]. Regarding the *delivery* provided by web-based front-end systems, new HRIS user groups such as managers, employees and applicants can be opened up thereby offering completely new ways of organising HRM [31, 43].

Acknowledging that these features represent major innovations with far reaching implications for HRM, and additionally acknowledging that innovativeness of a technology does by no means imply its appropriateness, our paper explores *to what extent these features actually meet genuine requirements of HRM*. Does the automation and support of complex managerial HR functions such as selection and performance management really meet a requirement of HRM? Is the self-service based handing over of HR functions to managers and employees (and hence to layman) really desirable and required by HRM? Previous empirical research has described major features of HRIS [3, 13, 15, 16, 20, 21, 22, 24, 25, 32, 33, 37, 46], however, has barely considered the current developments in functionality and delivery, and especially, has not evaluated these features against actual requirements of HRM.

We hence try to fill this gap and provide some answers. To do so, we firstly analyse the HRIS features under debate, discuss why these features may or may not meet requirements of HRM and derive corresponding hypotheses. Subsequently, we employ an international large-scale survey to test these hypotheses by combining logistic regression and neural network analysis. After presenting and discussing our results, we finally attempt to derive some conclusions for future work.

## **2 Features of HRIS and Requirements of HRM**

### **2.1 Functionality**

That it is functionality of a HRIS that centrally matters to HRM seems to be a truism. However, according to previous empirical research the functionality of HRIS was rather restricted. For a long time operational functions - repeatedly mentioned are

payroll processing, employee record keeping and attendance administration - constituted the main functional focus of HRIS [3, 13, 21, 25, 32, 33] while there is only few evidence of non-operational HRIS in the recent past [3, 24, 46]. Owing to the ongoing technological development, meanwhile the offered functionality of packaged HRIS components has considerably expanded. Besides operational functions more and more managerial applications, comprising also “softer” and hence harder programmable functions are offered. At present, there are extensive systems for all core HR areas, such as recruiting and selection [e.g. 10], compensation and benefits [e.g. 14], training and development [e.g. 48], performance management [e.g. 36] and HR planning [e.g. 23]. For some time past, there is no function in HRM, which cannot be supported by corresponding systems [9, 23]. This gradually occurring transition to a comprehensive managerial functionality constitutes a first alteration that - at least optionally - characterises a main newer feature of HRIS.

Concerning the requirements of HRM, the identified previous concentration on operational functions is consistently perceived as insufficient. Research manifested a dichotomy of “unsophisticated vs. sophisticated” [33], “administrative vs. strategic” [46], “administrative vs. analytical” [27], “transaction orientated vs. decision support orientated” [7] or “non-strategic vs. strategic” [24] functionalities of HRIS. Though slightly different in terminology and in main focus, these set of opposing pairs accordingly refer to the gap between actually offered operational functions and desirable, but - at least until a shorter time ago - not available managerial functions of HRIS. The emphasis on managerial HRIS functions is directly derived from core ideas of HRM: Rather than merely administering existing workforce, HRM crucially aims at the proactive management of employees so as to actively contribute to business strategy and organisational performance [19]. Hence managerial functions, in particular recruitment and selection, training and development, compensation and benefits, performance management and HR planning, are core activities of HRM [6]. As a consequence, managerial functions of HRIS are considered as particularly important. HRIS increasingly are seen as measures to support organisational strategy and to contribute to organisational performance by not only automating managerial HR functions, but in particular by creating relevant information. This information shall enable comprehension and appropriate decisions leading to improved HR results [7, 11, 23, 24, 27, 28, 30, 40]. Hence:

*H1a: The implementation of managerial HR functions in HRIS will meet the requirements of HRM.*

Given this, the offering of operational functions constitutes an ordinary and by no means innovative feature of HRIS. However, it would be precipitate to deem operational functions as obsolete. Though the contribution of operational HR functions to organisational performance may be minor, they are nevertheless operationally necessary. Payroll processing constitutes a plain example: Justifiably employees expect their salaries and being lastingly incapable to ensure a correct and timely pay is a worst case scenario to HRM. So as to avoid the harm as well as the costs of a manual payroll, HRM of course needs operational payroll functionalities. Quite similar, operational functionalities are frequently necessary to ensure compliance with national legislation. For instance, a number of European countries require the online delivery

of income-tax relevant employee data for their revenue authorities, what is usually accomplished again by payroll systems.

Hence, in comparison to managerial functions operational functions may be less valued. However, HRM would badly miss operational functionalities if they were not implemented. Hence:

*H1b: The implementation of operational HR functions in HRIS will meet the requirements of HRM.*

As a further feature, current HRIS may be integrated with other organisational systems. This vision of an integrated Management Information System (MIS) is as old as the organisational usage of IT. However, the complexities of its realisation have caused numerous setbacks. Hence, rather than being integrated into the functions of a general MIS, HRIS of the past tended to be isolated. In the interim however, there are two major working approaches to actually integrate the functions of HRIS into a general MIS [29]. Firstly, for more than a decade Enterprise Resource Planning Systems (ERP) offer possibilities. Based on a common integrated database usually numerous modules for areas such as HRM, finance, production, sales and accounting, with predefined interfaces are offered by a single ERP-vendor. HR systems, then, are integrated into a general business concept of the corresponding system, which allows cross functional data integration, business processes etc. [1, 11, 29, 40]. Additionally, even if there are heterogeneous, apriori non-compatible systems, Enterprise Application Integration (EAI) offers a second approach for integration. Based on inter-application “middleware”, EAI applications serve as an integrative bridge between the heterogeneous back-end systems of HR, other organisational systems and the front-ends [29]. Besides specific EAI applications, portal systems increasingly dispose of comprehensive EAI features as well [44]. Hence, external integration of functions is a further, gradually obtainable feature offered by current HRIS.

This external integration directly corresponds with another core idea of HRM, i.e. the coordination with other managerial functions in order to achieve a “fit” with central organisational developments [2]. Integration features of HRIS allow the systematic coordination of operational as well as managerial HR functions with other organisational functions. Concerning operational integration, e.g. HR cost data as results of monthly payroll processing can directly be transferred to respective accounting systems. Concerning managerial integration, e.g. the production schedules of production systems can be integrated with work scheduling in the HR.IS. The functional integration of the HRIS into a general MIS therefore offers a decisive measure for achieving the often postulated “external fit” of HRM [2]. Hence:

*H1c: The integration of HRIS functions with functions of a general MIS will meet HRM requirements.*

## **2.2 Delivery**

Besides the mere functions especially novel kinds of web-based delivery of functions have gained much attention [43]. Previously, functionalities were delivered to the

end-users via graphical or textual user interfaces. Since the advent of the World Wide Web over a decade ago, HRIS can increasingly be accessed via web. Technically, web servers enable HR back-end systems to deliver their functionality in terms of HTML-sites that can be accessed by web-browsers as front-end systems. As a consequence, web-browsers are increasingly used as the main user interface of HRIS [30].

Web-based delivery of functions is often associated with several advantages. Firstly, browsers are common practice and end-users are accustomed to it. Browsers offer graphical interfaces that are self-explanatory and easy to use. As its main advantage however, access to back-end systems becomes ubiquitously possible. Functionality can be delivered worldwide to any desired site of the organisation, but also to any home office thereby enabling new possibilities of HR telecommuting. If combined with portal technology, numerous and heterogeneous back-end systems and services can simultaneously be accessed using a single sign on, based on a unified interface and presenting personalised access. Users can easily switch between back-end systems without knowing the corresponding system, its navigation features etc. This releases users from the burden of conventionally using numerous different systems simultaneously and should lead to cost and time savings [23, 43]. These general delivery advantages as compared to conventional user interfaces should be valued by HRIS users as well. Hence:

*H2a: The delivery of implemented HR functions to HR professionals via World Wide Web will meet the requirements of HRM.*

However, really striking changes due to web-based delivery arise from the opening up of new user groups, mainly line managers, employees and applicants. Clearly, based on an elaborated user and rights administration, these groups could have gained access to conventional HRIS as well. However, besides security considerations especially the handling of the systems proves to be uncomfortable for occasional users. Hence, the user-friendly, ubiquitous delivery via web constituted the technological breakthrough for inaugurating new actor groups to HRM.

Concerning the requirements of HRM, especially the connection of line managers to HRIS corresponds with a conceptual characteristic of HRM: Denominated as “decentralization of HRM”, the participation of line management in HRM is discussed since the 1990s. Such decentralization can be well supported by so called “manager self-service”-features that enable managers to perform operational and managerial HR functions related to their subordinated employees. Though initially not an explicit demand of HRM, likewise employees themselves can be provided with web-based access to HRIS. Besides rather operational tasks such as data maintenance or travel authorizations requests also the composing of compensation options, choice of (web-based) training measures etc. can be assigned to employees (“employee self-service”). Restricted to recruiting and selection “applicant self-service” concepts are feasible too.

Taken together, such delivery features have introduced novel ways of organising HRM. HR functions can be assigned to a network of spatially segregated and heterogeneous actors that are supported and coordinated by IT [31, 43]. Especially this kind of delivery has led to mentioned general notations like electronic or virtual HRM [34]. These possibilities of organising HRM should comprise opportunities, but pos-

sibly also threats for HRM. This transfer of HR functions to external actors may save time and costs, avoid redundant work and enhance cooperation between HR stakeholder groups. Therefore, HRM may be “liberated” [40] for more important activities that support business strategy and organisational performance. However, this also puts pressure on HRM to truly act strategic and truly support to performance. Otherwise e-HRM may result in an unwanted downsizing of the HR department so as to at least realise the promised rationalisations. Though comprehensive e-HRM conceptions may entail challenges to HRM, the positive aspects should prevail. Hence:

*H2b: The delivery of implemented HR functions to line managers, employees and applicants via World Wide Web (“e-HRM-features”) will meet the requirements of HRM.*

### 3 Method

#### 3.1 Sample

The data employed in our study stem from the repeating Cranet Survey, which contains data on HRM issues of private and public organisations in over 30 countries. Data are ascertained by research partners in each of the countries. Information is gathered from the senior HR person in the organisation via a postal survey using a comprehensive address list. The data is broadly representative with respect to the industrial sector (using European Union’s NACE categorization) in each country. In the 2004 survey over 40,000 questionnaires were sent out worldwide. With a response rate of approximately 17% more than 7,000 organisations participated [see for details 8].

We restricted our analysis to European countries (5,771 organisations in 22 countries). Given this subset we additionally sorted out the organisations that did not dispose of an internal HRIS (1,054 organisations/18.2%). This resulted in a sample of 4,717 organisations. As described below, we used a combination of logistic regression and neural network analysis to analyse the data. To assess performance, neural network analysis (and optionally logistic regression analysis too) requires a *holdout* or *test sample* of usually 20% of the total sample [42]. We followed this convention and randomly selected a test sample of 957, while using the remaining set of 3,760 organisations for logistic regression and neural network analysis.

#### 3.2 Measures

As the dependent variable, *suitability* of the HRIS was measured using a 4-point Likert scale which referred to the extent that the HRIS actually met the requirements of HRM. HRIS that met the requirements entirely or to a large extent were coded as 1, HRIS that met the requirements only to a small extent or not at all received a 0.

The provision of *operational and managerial functions* was measured by the number of implemented functions. In accordance with previous research [e.g. 3, 46] “pay-

roll processing”, “time and attendance administration”, “employee record keeping” as well as “health and safety” were taken as operational functions. Managerial functions referred to the “major four” HR functions (“recruitment and selection”, “compensation and benefits”, “training and development” and “performance management”) that were completed with two HR planning functions (“career and succession planning” and “work scheduling”). To ascertain *cross-functional integration* it was asked, whether or not the HRIS was integrated into a general MIS.

*Delivery* was measured corresponding to the respective user groups. Concerning the HR professionals it was asked whether the HRIS offered web-based access or not. Concerning the novel user groups of e-HRM, the extent of web-based delivery was measured on a 6-point Likert scale (from 0 for HRIS without any web-based delivery to 5 for HRIS that allow highly complex web-based transactions).

### 3.3 Data Analysis

The kind of actual relationships between HRIS features and the requirements of HRM are unknown at present. In order to map also more complex relationships such as interaction- and threshold-effects, we decided to follow suggestions of the literature and use a combination of the established logistic regression and the rather novel neural network analysis [5, p. 259].

Besides some further advantages, neural nets can identify and map highly complex, non-linear (but also trivial and linear) relationships between independent and dependent variables. For this general strength neural nets are increasingly used as statistical tools in multivariate research [5, 17]. Neural nets are best understood as a computational structure, which connects independent variables with dependent variable(s). To accomplish this, neural nets arrange the independent variables in an input layer and the dependent variable(s) in an output layer. Subsequently one or more intermediate layers with several processing elements (“neurons”) are constituted to mathematically map the probably highly complex, non linear connections between independent and dependent variables as good as possible [see for a detailed description e.g. 5, 17, 38, 45].

As the most common approach, we used the multi layer perceptron (MLP) [5, 17, 41, 42]. Previously, the task of determining the adequate number of layers and computational elements (“network topology”) and the adequate computational characteristics of the elements were left to trial-and-error approaches of researchers [17, 5]. Meanwhile, this can be delegated to algorithms that systematically test different network topologies and computational rules and select the individually most suitable configuration [41]. The MLP that provided the best results showed a 5-2-2 topology (5 input elements, 2 intermediate layers with 2 elements each).

To determine the relative influence of input variables on the output variable(s) of a neural net *sensitivity analysis* is suggested. Sensitivity analysis systematically varies the input values and measures the averaged variation of output values [41]. Sensitivity values, however do not allow determining direction and strength of the effects. Hence, the supposed combination with regression may help to interpret findings.

The most meaningful measure of network performance is the *accuracy of its classification* and hence the generalizability of results. The accuracy of prediction is de-





firmed. Delivery features showed mixed results. Web-based HRIS access for HR professionals does obviously not constitute an essential requirement of HRM. Hence, hypothesis 2a has to be rejected based on logistic regression. Conversely, web-based delivery to new actor categories was an obvious predictor of suitability, therewith substantiating the role of e-HRM.

Table 3 shows the results of the MLP.

**Table 2.** Results of Logistic Regression.

	B	Fit Statistic
1. Managerial Functions	-.414**	
2. Operational Functions	-.331**	
3. Cross-functional Integration	-.296**	
4. Web Delivery (HRM)	-.074	
5. Web Delivery (e-HRM)	-.183**	
-2 Log Likelihood		1248.68**
$\chi^2$		674.42**
Cox and Snell		.133
Nagelkerke		.182
McFadden		.108
** p < .01		n = 3,760

**Table 3.** Results of the Multi Layer Perceptron.

Predictor	Sensitivity	Rank
1. Managerial Functions	0.443	(1)
2. Operational Functions	0.279	(2)
3. Cross-functional Integration	0.064	(5)
4. Web Delivery (HRM)	0.097	(4)
5. Web Delivery (e-HRM)	0.160	(3)
Estimated Accuracy: 70.36%		n = 3,760

Interestingly, neural network analysis shows similar as well as variant results. First, the importance of managerial functions could be affirmed. Managerial functions showed the greatest influence for the classification results of the MLP found. Also, operational functions definitively influenced the classification result. While being a significant predictor in logistic regression, cross-functional integration of these functions exerted only minor influence for the classification results of the MLP and was actually the least important predictor of suitability. Given this, hypotheses 1c is de-

batable from an MLP perspective. Concerning delivery features, the MLP concurred with logistic regression, since e-HRM features proved to have a perceptible influence on suitability, while the influence of the web-based access for HR was rather unimportant.

Table 4 compares the classification accuracy of both methods based on the test data.

**Table 4.** Comparison of Classification Results.

	Neural Net	Logistic Regression
Overall Correct Classified	71.16%	70.64%
Suitability Correct Classified	82.23%	84.27%
Unsuitability Correct Classified	49.22%	43.61%

n = 957

The comparison shows that neural net analysis was only marginally better in generally classifying suitable and unsuitable HRIS. While the MLP showed some advantages in classifying unsuitable HRIS, logistic regression showed some advantages in classifying suitable HRIS. Taken together, concerning the results commonalities between both methods prevail, while the documented advantages of neural nets due to their ability to map highly complex relationships [see the overview of comparative studies in 16, p. 8ff] could not be exploited in our study.

## 5 Discussion

Our study aimed at the question whether main features of current HRIS actually correspond with HRM requirements. The results generally underscore that offered features are valued and mainly do meet the requirements of HRM.

At first, the long demanded transition from operational to managerial HRIS can be confirmed: Managerial functions are actually valued by organisations. However, though our study generally underlines the trend towards managerial HRIS the main focus of current systems is operational now as before. Given the confirmed relevance of managerial functions on the one hand and the only gradually growing usage of managerial HRIS on the other hand, this seems to indicate a latent usage paradox: Particularly the functions that are the best predictors of suitability are only hesitantly utilized. Hence, concerning the numerous organisations with sheer or rather operational HRIS there is a simple message: Since managerial systems are both available and, according to our results, suitable for meeting the requirements, it should be validated if and to what extent a transition to managerial HRIS will improve service delivery and decision quality in the respective activities.

Additionally, as hypothesised organisations attach importance to operational functions as well. Therefore operational functions of HRIS are by no means obsolete. In particular the time-consuming character of operational tasks is an ongoing driver

towards automation. Operational HRIS functions are thus the most important “liberators” of HRM.

Taken together, viewing operational HRIS functions as “hygiene factors” and managerial HRIS functions as “motivators” may provide an appropriate understanding of the respective importance and the mutual interactions of both areas. Ordinary operational functions of HRIS now as before are necessary and will cause substantial dissatisfaction if they are missing. However, managerial functions will increasingly constitute the more important and more interesting field of upcoming technological support for HRM. This dichotomy gives also a glimpse of future competition on markets for integrated HRIS software. Coming competitive advantages will rather be based on the offered managerial functions, while viable operational functionalities will be seen as a matter of course. Hence offering extensive operational functions will organisations not motivate to purchase software, but not offering them, may lead to the refusal of a solution.

Concerning the integration of HRIS functions into a general MIS, there was mixed evidence. This brings about some debate. Since the MLP showed at least few contributions to satisfy the requirements too, possible effects of cross-functional integration of HRIS should not be precipitately rejected but further examined. A possible explanation of only minor contributions - should this be a lasting result - may refer to level inadequacies [26]. The advantages of a fully integrated MIS may not, or at least not mainly, refer to the departmental level and hence to HR and other departments, but to the general organisational level. It hence may be simply not adequate to ask whether this feature meets departmental requirements. In any case, the suitability effects of cross-functional integration of HRIS need further investigation.

Referring to delivery features, web-based access for HR end-users obviously were plainly overrated by hypothesis 2a. Given that in the interim usually all HRIS tend to be graphically orientated, easy to use and self-explaining, the additional delivery advantage that provides ubiquitous access does obviously not correspond with the requirements of HRM.

Conversely and interestingly, e-HRM obviously satisfies a meanwhile frequent requirement of HRM. This pivotally substantiates the status that e-HRM has achieved in the interim. Concerning HRM requirements, e-HRM seems to represent an interesting case: e-HRM seems to only partially arise from preceding requirements. Especially manager self-service may be seen as an answer to the preceding HRM discussion and practical claims concerning a decentralisation. An empowerment of employees and applicants, however, to rather independently perform HR tasks and make decisions for themselves was not broadly discussed and claimed before. Hence, larger parts of e-HRM seem to be rather a “technology push”- than a “demand pull”- phenomenon. This by no means devalues such a requirement, since a lot of technological innovations, ranging from cars to television, were not broadly required prior to their invention. Taken together, e-HRM features of HRIS evidently are the second major innovation besides the managerial functions. Hence again, organisations without or without elaborated e-HRM should evaluate, if the further utilisation and expansion of e-HRM may result in improvements of their work. In the same way, HRIS software vendors that have paved the way for e-HRM can be assured to have initiated a trend that actually appeals to practical HRM and is of lasting importance.

## 6 Conclusions

This paper aimed at an evaluation of major features of current HRIS against the actual requirements of HRM. Based on conceptual work, a large scale-survey and the parallel application of two methodical approaches two major findings could be revealed: First, managerial functions of HRIS (if based on adequate operational functions) are especially valued by HRM. Second, in addition web-based delivery possibilities to new user groups were particularly appreciated. Taken together, our study generally draws a rather positive picture of contemporary HRIS. If equipped with the right features HRIS are able to actually meet requirements of HRM.

Our study, however, also shows limitations. Firstly, our study is limited to five major HRIS features, while there are numerous other detail features. A refinement and enrichment of examined HRIS features hence would provide a deeper understanding and probably explain more “variance”. *Secondly*, our study implies a universalistic perspective [12] by suggesting that all organisations show more or less the same requirements concerning HRIS. On the very general level of examined features this seems to be admissible. However, at least when refining the analysis, contingencies are to be expected. If for instance not functional categories but single HR functions are examined, the suitability of HRIS will necessarily depend on whether or not the corresponding function is actually performed. Hence a contingent perspective seems to be a necessary future improvement. *Thirdly*, we used a perceptual summary measure of suitability. Future studies hence may analytically distinguish several requirements and - given the common criticism - should use objective measures wherever possible. *Fourthly*, our additional application of neural net analysis did not provide significantly better results and additionally yielded a deadlock situation concerning cross-functional integration. However, accepting that each multivariate method shows specific strengths as well as weaknesses a methodical enhancement of traditional methods with neural nets now as before makes sense if complex, non-linear relationships are to be expected. After all, commonalities of both methods prevailed and hence stand for methodical robust findings concerning the other features.

Despite of these considerations the technologisation of HRM forges ahead and research is well advised to keenly keep up with it.

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