Adoption and Impact of Human Resource Information Systems (HRIS)

Thompson S.H. Teo, Lim Ghee Soon & Sherin Ann Fedric

Abstract

As the result of an increased emphasis on a knowledge-based economy, many organizations are realizing that their people and information resources are critical to survival and success. Human Resource (HR) or manpower development is thus vital and many organizations are utilizing Information Technology (IT) in Human Resource Management (HRM), also known as Human Resource Information Systems (HRIS), to gain a competitive edge. This study attempts to identify the state of use of HRIS in organizations in resource-scarce Singapore as well as the impacts of HRIS adoption via a questionnaire survey of 500 firms, of which 110 usable responses (22.2%) were received. Results provide insights into HRIS practices and its impact.

1. INTRODUCTION

Dramatic advances in technology which necessitate the redesign of jobs and constant modifications in recruiting, selection, training and appraisal techniques, the globalization of businesses and the need to educate and train managers on dealing with the complexities of a global economy and the move towards a knowledge based economy, where value of the company depends on its employees' skills and knowledge, are just some of the challenges facing the HR departments in many organizations. With many functions to track and huge amounts of information to process frequently and accurately, HR executives have turned to information technology (IT) to help them meet their organization's information needs. This has led to the development and use of computer-based HRIS in organizations. A HRIS is used to acquire, store, manipulate, analyze, retrieve and distribute pertinent information regarding an organization's human resources (Kavanagh et al., 1990).

Management of HR is especially important in a knowledge-based economy, where ideas and expertise are greatly valued and a creative and innovative workforce is necessary to meet the challenges of this new economy. It is thus necessary for firms to have highly skilled human capital to provide them with a competitive edge. This is especially so in countries such as Singapore which faces a shortage of manpower.

Over the past two decades, there have been a number of studies on HRIS. These studies have focused on the type of applications that predominate in HRIS (DeSanctis, 1986; Broderick and Boudreau, 1992; Martinsons, 1994), the contexts necessary for the successful implementation of HRIS (Yeh, 1997) as well as the conditions that support successful HRIS (Haines and Petit, 1997).

In the earlier studies done, a model of IT use in HRM surfaced. Ein-Dor and Segev's (1978) suggestion that IT use in an organizational unit can be characterized by a two-factor model, which considers the degree to which tasks have been automated and the sophistication level of the resulting IS, was utilized. Using this model, DeSanctis (1986) and Martinsons (1994) reported that unsophisticated applications predominate in HRM and the typical focus of HRIS applications was improved efficiency rather than greater effectiveness. They attributed this situation to the perceived difficulties of building a HRIS as well as the commonly held view that HR activities are not strategic.

A later study done by Yeh (1997) highlighted the importance of contextual variables such as top management support, support of the information systems department, involvement of HR leaders, support of HR staff, level of computer knowledge of the HR staff and HRIS training. These factors have to be present if the HRIS is to be implemented successfully.

Another study done by Haines and Petit (1997) highlighted a number of individual/task, organizational and system conditions that support successful HRIS. The results of their study indicated that system conditions such as training, documentation, number of HR applications and ease of use were the most important antecedents of

success. Other organizational conditions like the availability of internal support for users also represented critical conditions for success.

2. OBJECTIVES OF STUDY

As competitive pressures for many organizations increase, the reliance on the strategic use of IT in HRM to manage the workforce is gaining increasing popularity. This can be attributed to the closer alignment of HR to business objectives which has demanded the use of IT. Many organizations are using HR and IT to harness its people and information resources, which are vital for success in the new economy (Richards-Carpenter, 1996). However, there has also been some evidence to suggest that HR has been a laggard in adopting IT. Information tools applied to employees pale in comparison with those used in other functional areas like Marketing, Finance, etc. (Dunivan, 1991; Boudreau, 1995). In addition, studies have reported that firms which have adopted HRIS have used it mainly for administrative purposes, rather than strategically (Martinsons, 1997; Groe et al., 1996). Hence, the first objective of this study is to gain a better insight into the state of use of HRIS in organizations in Singapore.

As yet, the impact of investments in HRIS is unclear (Martinsons, 1994). Hence, the second objective of this study is to examine the impact of HRIS adoption on organizations.

3. METHOD

This study is based on data gathered through a mail survey. The respondents were chosen randomly from companies listed in the Singapore Phone Book Business Listings (1999/ 2000). We compiled a list of 5000 companies from the phone book choosing those whose listings are in typefaced bold (which tend to be medium to large companies). From this list, we chose every 10th company to obtain a mailing list of 500 companies.

The questionnaire, a cover letter and a stamped, self-addressed envelope were sent to the Managing Directors and HR managers of 500 firms. Three weeks later, follow-up calls were made and another set of questionnaires were sent to those companies which had not responded. This resulted in 110 usable responses (22.2%).

The items used in the questionnaire were derived from past research. Specifically, the questionnaire examines:

1. number of employees in HR department;
2. age of HRIS;
3. source of HRIS software;
4. annual expenditure on hardware, software and training;
5. extent of HRIS adoption;
6. role of HRIS;
7. reasons for not adopting HRIS; and
8. impacts of HRIS adoption.

4. RESULTS

4.1 Sample Characteristics

Adopters of HRIS are defined as organizations which have dedicated computer hardware and software applications for their HRM activities. Of the 110 respondents, 63 (57.3%), are adopters of HRIS. The sample characteristics are shown in Table 1. About 41% of the organizations are from the manufacturing/construction sector and the logistics/transportation/shipping sector. The category others include advertising firms, newspaper publishing/printing firms, insurance companies and organizations dealing with international procurement. Slightly more than half of the organizations (53.6%) are medium to large in size, with more than 100 employees. The majority of the organizations (40%) had average annual revenue greater than S$10 million. Of the organizations surveyed, the majority are foreign-owned (49.1%), mostly from the United States.

Table 1
Sample characteristics

Characteristics	Percentage
Industry	
Architecture/Engineering	2.7
Banking/Finance	4.5
Computers/Communication	8.2
Education	0.9
Logistics/Transportation/Shipping	19.1
Manufacturing/Construction	21.8

Characteristics	Percentage
Retail/Wholesale/Trading	18.2
Service	4.5
Travel/Tourism/Hotel	1.8
Others	18.2
Size of organization	
<50 employees	28.2
50-99 employees	18.2
100-199 employees	13.6
200-499 employees	18.2
500-999 employees	9.1
> 1000 employees	12.7
Annual Revenue ($ million)	
<1	8.2
1-10	15.5
11-100	40.0
101-300	7.3
301-500	4.5
>500	13.6
Missing	10.9
Form of Ownership	
Government-linked company	15.5
Local ownership	30.9
Foreign ownership	49.1
Joint Venture	4.5

Number of employees in the HR department

Table 2 illustrates that more than half of the companies (62.7%) had between 0-3 people in their HR department. A Pearson chi-square test was done to see if there was a relationship between the number of employees in the HR department and the decision to adopt HRIS in organizations. The Pearson chi-square value is significant, indicating that there is a relationship between the number of employees in the HR department and the adoption of HRIS. It appears that non-adopters of HRIS have more employees in the HR department. One possible reason is that the use of IT helps to increase productivity among adopters which results in less staff needed for HR-related work.

Table 2
Number of employees in the HR department

Number of employees in the HR department	Adopters of HRIS	Non-adopters of HRIS	Total
Total	**47**	**63**	**110 (100%)**
Pearson Chi-square statistic = 21.08		**p=0.0000**	
0-3	41	28	69 (62.7%)
≥ 4	6	35	41 (37.3%)

4.2 Age of HRIS

Age of HRIS can be considered as the length of time an organization has been committed to IT in the HR department and it has been found to have a strong effect on the success of IT in an organization (Tye and Chau, 1995). As seen from Table 3, majority of organizations (30.2%) have been using HRIS for the past 4-6 years, while a substantial percentage (20.6%) of organizations have also been using it for the past 7-9 years. This shows that HRIS have been in use for quite a while.

Table 3
Age of HRIS

Age (years)	Percentage
<1	7.9
1-3	14.3
4-6	30.2
7-9	20.6
9-12	12.7

Age (years)	Percentage
>12	14.3

4.3 Source of HRIS software

The most common source of obtaining HRIS software is off-the shelf (54%), followed by external vendor development (27%) as can be seen from Table 4. This finding is consistent with previous studies (DeSanctis, 1986) and is expected as very reliable, affordable and customizable off-the-shelf solutions exist today (Berardine, 1997).

Table 4
Source of HRIS software

Source	Percentage
Supplied by head office	4.8
Developed in-house	12.7
Developed by vendor	27.0
Off the shelf	54.0
Customized software	14.3

4.4 Annual expenditure on hardware, software and training

Table 5 shows the annual expenditure of organizations on hardware, software and training for HRIS. The majority of organizations spend less than S$5000 annually on their hardware, software and training for HRIS. This result is consistent with past research, which has indicated that some mallagers view HRIS training as an unnecessary expense and hence are unwilling to pay for the cost of training in addition to the cost of the system (Sirageldin, 1990).

Table 5
Annual expenditure

Annual Expenditure	Hardware	Software	Training
< S$5,000	68.3	58.7	84.1
S$5001-10,000	17.5	22.2	11.1
S$10,001-25,000	6.3	11.1	4.8
S$25,001-50,000	0.0	1.6	0.0
S$50,001-100,000	4.8	3.2	0.0
> S$100,000	3.2	3.2	0.0

4.5 Extent 0f HRIS Adoption

The extent of HRIS adoption can be used to measure the contribution of HRIS to the organization (Tye and Chau, 1995). The first measure of the extent of HRIS adoption is the number of computer workstations dedicated for HRM usage. In our sample, the majority of the organizations (44.4%) have 1-3 computer workstations dedicated for HRM purposes (Table 6).

Table 6
Number of Workstations

Workstation (HRM)	Percentage
0	14.3
1-3	44.4
4-6	17.5
7-9	4.8
10-12	4.8
>12	14.3

The second measure of extent of HRIS adoption is the type of applications adopted in the organization. In this study, the uses of HRIS for ten HRM activities were identified. These were selected as they were the most common applications frequently mentioned in HRIS books and HR magazines. Respondents were asked to indicate the applications that were used in their organizations. Table 7 illustrates that the most common HRIS applications currently in use in organizations are employee record-keeping (96.8%), payroll (90.5%) and benefits management (57.1%). This comes as no surprise as many surveys and research on HRIS have found that HRIS is more commonly used for administrative purposes like employee record-keeping and payroll rather than for strategic purposes (Kovach and Cathcart, 1999; Groe et al., 1999) such as succession planning. These applications emphasize doing administrative tasks faster and with less manpower, which usually produce tangible dollar-valued benefits while strategic benefits may be less concrete.

Table 7
HRIS Applications

HRIS Applications	Currently in Use (%)	Future Use (%)
Employee record-keeping	96.8	43.1
Payroll	90.5	41.2
Benefits Management	57.1	41.3
Training & Development	41.3	72.5
Performance Appraisal	38.1	58.8
Compensation Management	38.1	45.1
Turnover tracking/analysis	29.0	49.0
Career Development	25.4	60.8
Recruitment/selection	11.1	49.0
Succession Planning	7.9	47.1

Of the 63 adopters of HRIS, 50 organizations (79.4%) indicated their intention to use HRIS extensively over the next 1-2 years. The most popular future uses of HRIS are for training and development (72.5%), career development (60.8%) and performance appraisal/management (58.8%). There appears to be a shift towards applications which are more strategic, probably because organizations realize that the HRIS can be used for more effective purposes rather than just administrative functions. Another possible reason could be that most of the organizations which are using HRIS at present are already using it for administrative functions like employee record-keeping and payroll and hence they may explore more strategic HR applications over the next few years.

4.6 Role of HRIS

Table 8 illustrates the role of URIS in organizations which have adopted HRIS. Three types of roles adapted from Johnston and Carrico's (1988) typology - traditional, evolving and integrated - were examined. Specifically, respondents were asked to choose the role of HRIS that most describes their organization, namely:

Traditional: HRIS supports operations but is not strategy related. It is used mainly for administrative purposes.

Evolving: HRIS is actively used to support the corporate strategy although the competitive potential of HRIS is not considered when defining and developing strategies.

Integrated: HRIS is integral to strategy and it is used to create new services, alter linkages with users and ultimately establish new standards of performance within the industry.

The results show that for a large percentage (60.3%) of the HRIS adopters, HRIS still plays a traditional role in the organization. A very small percentage (7.9%) regards HRIS as integral to their strategy. The findings indicate that although many articles on HRIS have advocated the use of HRIS for strategic purposes, in reality, the majority of HRIS adopters do not use the HRIS as a strategic tool in their organizations.

Table 8
Role of HRIS and number of workstations

Number of workstations used solely for HRM Activities (WKSTATN)	Role of HRIS in the organization		
	Traditional	Evolving/Integrated	Total
Total	**38 (60.3%)**	**25 (39.7%)**	**63 (100%)**
Pearson Chi-square statistic = 3.71		**p=0.054**	
0-3	26	11	37
≥4	12	14	26

A Pearson chi-square test was done to examine if there was a relationship between the role of HRIS in organizations and the number of workstations used solely for HRM activities and the total number of applications respectively. In order to ensure that the cell sizes are greater than 5, we combined the "evolving" and "integrated" groups into a single group. The chi-square statistic for Table 8 is insignificant (p > 0.05) indicating that there is no relationship between the role of HRIS in organizations and the number of computer workstations used for HRM purposes. One possible reason for the insignificant relationship is that firms usually tend to have a certain number of workstations for HRM activities regardless of the role of HRIS.

In contrast, the chi-square statistic for Table 9 is significant (p = 0.001). implying that there is a relationship between the role of HRIS in organizations and the total number of HRIS applications. This implies that while the number of workstations may not vary with the role of IS (Table 8), the number of different types of applications has a relationship with the role of IS. One possible reason is that firms with evolving or integrated role tend to have greater number of applications than traditional firms due to their more strategic role of HRIS.

Table 9
Role of HRIS and number of HRIS applications

Total number of HRIS applications (TOTAPP)	Role of HRIS in the organization		
	Traditional	Evolving/Integrated	Total
Total	**38 (60.3%)**	**25 (31.7%)**	**63 (100%)**
Pearson Chi-square statistic = 11.25		**p=0.001**	
1-4	27	7	34
≥5	11	18	29

4.7 Non-Adopters of HRIS

Non-adopters of HRIS are defined as those organizations which do not use computer hardware and software applications for their HRM activities. Of the 110 organizations surveyed, 47 (42.7%) are non-adopters of HRIS. Of these, 29 (61.7%) organizations indicated that they would not adopt HRIS in their organizations within the next one to two years. The reasons given by the non-adopters for not adopting HRIS in the future are shown in Table 10. The main reason given was that the company is too small. This is quite understandable since the HRIS functions as a database that maintains employee records and is used for HRM activities. Hence, the fewer the employees, the lesser the need for such a system.

Table 10
Reasons for non-adoption of HRIS

Reasons	Percentage
Company too small	62.1
Do not see the need	34.5
Too costly	17.2
Lack of HRIS knowledge	10.3
Lack top management support	10.3
Lack suitable HW/SW	10.3
Lack of HRIS expertise	6.9
No time to train staff	3.4
Others	3.4

Among the 47 non-adopters of HRIS, 18 (38.3%) said that they intended to adopt HRIS in their organizations within the next one to two years. Table 11 illustrates the applications that they intend to adopt. A great majority intend to use the HRIS for employee record-keeping (94.4%), training and development (83.3%), compensation management (83.3%) and performance appraisal/management (83.3%).

Table 11
Applications that non-adopters intend to adopt

Applications	Percentage
Employee record-keeping	94.4
Training & Development	83.3
Payroll	83.3
Compensation Management	83.3
Performance Appraisal	83.3
Turnover tracking/analysis	61.1
Career Development	55.6
Benefits management	55.6
Recruitment/selection	44.4
Succession Planning	44.4

4.8 Impact of HRIS adoption

Respondents who reported that their organization had adopted HRIS were asked to indicate their perceptions of the impacts of HRIS adoption on their organizations. This was done by measuring their views on statements about the impact of HRIS on a five point Likert scale ranging from (1) strongly disagree to (5) strongly agree. The perceived impacts on the organization were measured by items taken from previous research. The list of statements along with the corresponding means and standard deviations as well as the percentage of respondents who agreed or strongly agreed (i.e., score of 4 and 5 respectively) with the statements is provided in Table 12.

Table 12
Impact of HRIS adoption

	Variables	Mean	Standard Deviation	% 4's And 5's
More accurate HR information.	ORGIMP1	3.9048	0.7559	73.0

Variables	Mean	Standard Deviation	% 4's And 5's
More up-to-date HR information.	ORGIMP2	3.9206	0.7252	73.0
Better tracking of employee information.	ORGIMP3	4.0794	0.7252	81.0
Reduction in paperwork.	ORGIMP4	3.3492	0.8643	41.2
Work duplication is eliminated.	ORGIMP5	3.4603	0.8767	53.9
Simplifying work processes in the HR department.	ORGIMP6	3.4762	0.7590	44.4
HR administration is more streamlined.	ORGIMP7	3.6349	0.6038	57.1
Improves effectiveness of HR department by automating administrative tasks.	ORGIMP8	3.6984	0.6871	63.5
Lowers administrative headcount in the HR department.	ORGIMP9	2.8413	1.0193	31.8
Increase in profit.	ORGIMP10	2.0000	0.9333	3.2
Quicker hiring.	ORGIMP11	1.8730	0.9068	3.2
Less expensive recruitment.	ORGIMP12	1.7302	0.7664	0.0
More effective utilization of employees' skills.	ORGIMP13	2.5079	0.9311	12.7
Helps organization retain employees by good employee-to-job matching.	ORGIMP14	2.0317	0.9667	6.3
More timely management reporting.	ORGIMP15	3.5556	0.9119	54.0
Improves decision making.	ORGIMP16	2.9841	1.0850	31.7
Frees up HR personnel for more strategic staffing issues.	ORGIMP17	2.9365	1.0140	25.3
Emphasizes the role of HR as an active partner in achieving the organization's strategic business objectives.	ORGIMP18	2.6984	0.9442	19.0
Better co-ordination among the different functional areas in the organization.	ORGIMP19	2.7937	1.0800	23.8

A high percentage of respondents perceive that the HRIS provides them with better and more up-to-date HR information and improves the effectiveness of the HR department. However, organization-wide impacts are less observed. None of the respondents perceive the impact of the HRIS to be that of less expensive recruitment and only a small percentage of respondents (3.2%) feel that the HRIS results in increase in profit and quicker hiring.

Further analysis was conducted on the perceived impacts of HRIS adoption to determine if there was a relationship between the perceived impacts and the extent of adoption of HRIS. Table 13 illustrates the results of correlation analyses performed on the organization impact variables and the two measures for extent of adoption: number of workstations used mainly for HRM activities (WKSTATN) and total number of applications (TOTAPP).

As can be seen from Table 13, WKSTATN is only significantly correlated with improved decision making (ORGIMP16) and moderately correlated with more timely management reporting (ORGIMP15) and better co-ordination among the different functional areas (ORGIMP19). On the other hand, the total number of applications adopted in the organization (TOTAPP) is correlated with all of the organization impacts except for simplifying work processes in the HR department (ORGIMP6), improving effectiveness of the HR department (ORGIMP8), lowering the administrative headcount in the HR department (ORGIMP9) and quicker hiring (ORGIMP11). Thus, it can be concluded that there appears to be a relationship between the total number of HRIS applications adopted in organizations and the perceived impacts of HRIS adoption.

Table 13
Correlation analysis

		WKSTATN	TOTAPP
ORGIMP1	Pearson Correlation	0.0540	0.2995
	Sig (2-tailed)	0.6741	0.0171
ORGIMP2	Pearson Correlation	-0.0250	0.3366**
	Sig. (2-tailed)	0.8460	0.0070
ORGIMP3	Pearson Correlation	0.2476	0.5606
	Sig. (2-tailed)	0.0504	0.0000
ORGIMP4	Pearson Correlation	0.0174	0.2714*
	Sig. (2-tailed)	0.8922	0.0314
ORGIMP5	Pearson Correlation	0.0645	0.3163
	Sig (2-tailed)	0.6156	0.0116
ORGIMP6	Pearson Correlation	-0.0298	0.2134
	Sig. (2-tailed)	0.8169	0.0931
ORGIMP7	Pearson Correlation	-0.1111	0.3780**
	Sig (2-tailed)	0.3858	0.0023
ORGIMP8	Pearson Correlation	0.0291	0.1986

		WKSTATN	TOTAPP
	Sig. (2-tailed)	0.8207	0.1186
ORGIMP9	Pearson Correlation	-O.1642	0.0800
	Sig (2-tailed)	0.1984	0.5330
ORGIMP1O	Pearson Correlation	0.0865	0.2693
	Sig. (2-tailed)	0.5003	0.0328
ORGIMP11	Pearson Correlation	0.1750	0.2024
	Sig (2-tailed)	0.1700	0.1116
ORGIMP12	Pearson Correlation	0.1751	0.2822
	Sig. (2-tailed)	0.1698	0.0250
ORGIMP13	Pearson Correlation	-0.0100	0.3152*
	Sig (2-tailed)	0.9381	0.0119
ORGIMP14	Pearson Correlation	0.1703	0.2738*
	Sig. (2-tailed)	0.1820	0.0299
ORGIMP15	Pearson Correlation	0.2607*	0.4774**
	Sig (2-tailed)	0.0391	0.0001
ORGIMP16	Pearson Correlation	0.3519**	0.5424**
	Sig. (2-tailed)	0.0047	0.0000
ORGIMP17	Pearson Correlation	0.1728	0.4624**
	Sig (2-tailed)	0.1756	0.0001
ORGIMP18	Pearson Correlation	0.1601	0.4030**
	Sig. (2-tailed)	0.2099	0.0011
ORGIMP19	Pearson Correlation	0.3077*	0.4439**
	Sig (2-tailed)	0.0142	0.0003

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

6. Conclusions

The focus of this study was to gain an insight into the current status of HRIS adoption in organizations in Singapore. A vast majority of the survey respondents indicated that HRIS was used mainly for administrative purposes, that is, it played a traditional support role. This finding was further reiterated by the HRIS applications adopted in organizations. Most organizations surveyed adopted more administrative HRIS applications like payroll and employee record keeping, rather than strategic applications like succession planning. The results thus indicate a tremendous amount of unrealized HRIS potential as few respondents are using the HRIS strategically to directly improve their competitiveness.

Another supplementary objective was to find out the impact of the adoption of HRIS on organizations. A wide majority of the organizations perceived that the HRIS provided better HR information and improved the effectiveness of the HR department by automating administrative tasks. However, other widely acclaimed benefits of quicker hiring, increase in profit and better utilization of employee skills were not perceived by the organizations.

This study also asked respondents regarding their current and future use of HRIS applications. This result is useful to HRIS developers and vendors who are interested in information about the future demand for different types of HRIS applications so that they can actively develop and promote such applications.

There are some limitations that need to be recognized while interpreting the findings from this study. Firstly, although there are many different forms of HRIS such as Web-based HRIS, intranets, employee self-service and interactive voice response (IVR) kiosks, in this study, HRIS was simply viewed as the use of computer hardware and software applications to perform HRM activities. Since results may vary in the case of different types of HRIS, future research can perhaps examine the adoption of specific types of HRIS.

The key informant method (Phillips, 1981) was adopted in this study for data collection. The responses from key senior executives of the surveyed organization were utilized. Although these top executives are critical in influencing the adoption decision process, their perspectives may not adequately describe the organization's adoption behavior. The findings from this study can be extended by complementing the survey with personal interviews or by using the case-study approach to provide more in-depth data. This would also help to reduce the key informant bias by obtaining responses from multiple respondents within the same organization.

Future research can also incorporate alternative ways of measuring the impact of HRIS adoption. For example, system effectiveness as measured by user satisfaction and system usage or system efficiency as measured by cost efficiency can be used to measure the perceived impacts. Alternatively, financial measures such as profitability and return on investment can be used to evaluate the impact of the adoption of HRIS.

The findings in this study can be strengthened and expanded by replicating this study at a different point in time. A follow-up study can be done in a few years time to see if more organizations have adopted HRIS, if the extent of HRIS adoption is greater or if the HRIS is used for more strategic purposes. In addition, factors influencing the HRIS adoption decision can be examined. A longitudinal study is also recommended for research on the impact of HRIS on organizations as impacts are often time-dependent i.e. IT impacts can be assessed more appropriately after a certain amount of time has elapsed since its adoption and implementation (Shao, 1998).

REFERENCES

Berardine, T. (1997). Tips on buying off the shelf. *Computing Canada*, 23(13), 44.

Boudrean, J. (1995). Growing role for managing human resources. *The Age*, August 24.

Broderick, R. & Boudreau, J. W. (1992). Human resource management, information technology and the competitive edge. *Academy of Management Executive*, 6(2), 7-17

DeSanctis, G. (1986). Human Resource Information Systems: A current assessment. *MIS Quarterly*, 10(1), 15-26.

Dunivan, L. (1991). Implementing a user-driven human resource information system. *Journal of Systems Management*, 42(10), 13-15.

Ein-Dor, P. & Segev, E. (1978). Organizational context and the success of management information systems. *Management Science*, 24(10), 1064-1077.

Groe, G. M., Pyle, W. & Jamrog, J. J. (1996). Information technology and HR. *Human Resource Planning*, 19(1), 56-61.

Haines, V. Y. & Petit. A. (1997). Conditions for successful human resource information systems. *Human Resource Management*, 36(2), 261-275.

Johnston, H. R. & Carrico, S. R. (1988). Developing capabilities to use information strategically. *MIS Quarterly*, 12(1), 37-50.

Kavanagh, M. J., Gueutal, H. G. & Tannenbaum, S. I. (1990). *Human Resource Information Systems: Development and Application*. PWS-KENT Publishing Company, Boston, Massachusetts.

Kovach, K. A. & Cathcart, C. E. Jr. (1999). Human resource information systems (URIS): Providing business with rapid data access, information exchange and strategic advantage. *Public Personnel Management*, 28(2), 275-282.

Martinsons, M. G. (1994). Benchmarking human resource information systems in Canada and Hong Kong. *Information and Management*, 26, 305-316.

Martinsons, M. G. (1997). Human resource management applications of knowledge-based systems. *International Journal of Infonnation Management*, 17(1), 35-53.

Phillips, L. W. (1981). Assessing measurement error in key informant reports: A methodological note on organizational analysis in marketing. *Journal of Marketing Research*, 16, 395-415.

Richards-Carpenter, C. (1996). Make a difference by doing IT better. *People Management*, 2(12), 39.

Shao, Y. P. (1998). Perceived Impact and Diffusion of Expert Systems in Banking: An Exploratory Investigation. *International Journal of Information Management*, 18(2), 139-156.

Singapore Phone Book Business Listings (1999/2000).

Sirageldin, C. (1990). Training drives the HRIS. *HR Focus*, 67(5), 15-49.

Tye, E. M. W. & Chau, P. Y. K. (1995). A study of information technology adoption in Hong Kong. *Journal of Information Science*, 21(1), 11-19.

Yeh, C. Y. (1997). Human Resource Information Systems: Implementation in Taiwan. *Research & Practice In Human Resource Management*, 5(1), 57-72.