PERFORMANCE ANALYSIS OF HUMAN RESOURCE INFORMATION SYSTEM USING A FACTOR ANALYSIS METHOD

Wahyu Sardjono and Devyana

Information Systems, Management Department, BINUS Graduate Program – Master of Information
Systems Management
Bina Nusantara University
JL. K. H. Syahdan No. 9, Kemanggisan, Palmerah, Jakarta 11480, Indonesia
{ wahyu.s; devyana }@binus.ac.id

ABSTRACT. *The implementation of the Industrial Revolution 4.0 affects business processes within companies, and companies compete with each other to survive in business continuity, and hope to excel in competition. Therefore, it is necessary to develop the implementation of information systems in the company to be able to facilitate the business processes that are running well and become more effective and efficient. One strategic application in a company is a human resource information system, but its implementation is often constrained, so the expected targets are very difficult to meet; therefore, it is necessary to look for factors that cause gaps between the targets set and the realization that occurs in human resources information system. The research method used is the method of collecting data by observing, studying the literature, and distributing questionnaires to respondents using the application, to analyze the results of the questionnaire data using the factor analysis method. The results achieved in this study are the existence of employee capital management factors, capital business process factors, and Human Resource Monitoring factors that affect the target gap and implementation performance realization. The conclusion that is obtained from these three new factors can be built a performance solution model of the implementation of human resource information systems.*
Keywords: Human resource information system, Employee capital management, Capital Business Processes, Human resource supervision

1. **Introduction.** A company in Indonesia engaged in financial services to the public, is in the process of developing to be able to compete with other competitors, while the problem faced by the company is the work process that occurs in the personnel section that is still constrained by the system used manually, so the process business in this section has not been running optimally and still needs to be improved in order to be more effective and efficient. With so many business competitors who have jumped into the financial sector, it clearly affects the performance of the company, so it requires a breakthrough innovation to reduce unnecessary administrative processes. Therefore, Human Capital Management (HCM) of the company is trying to work to optimize the performance of the Human Resources Information System (HRIS). HRIS is a website-based application that is used in HCM covering all work processes carried out at HCM starting from the operational part (recruitment, payroll, training, and personnel), to future business process strategies. The aim of HRIS can be a worksheet on HCM and all employees of company related to employee administration. HRIS itself is a system developed by vendors and customizable according to the work processes that take place on HCM. HRIS began to be implemented in HCM around the end of 2017, but when further implementation was
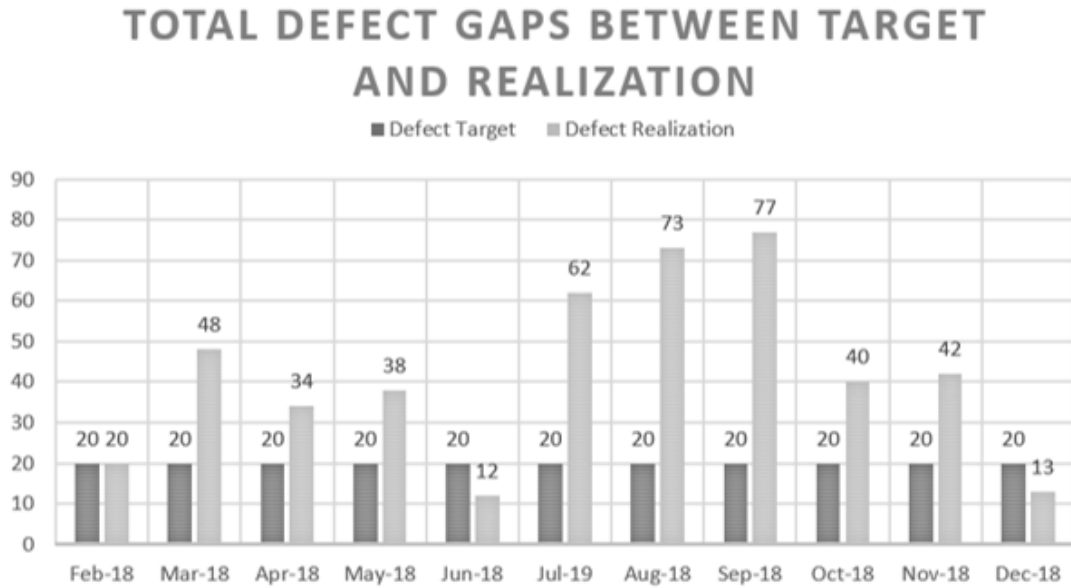
FIGURE 1. Graph of defect gaps between targets and realization of month

carried out in 2018. There were many defects on production servers that disrupted the work processes that were running, as shown in Figure 1.

The high defect in HRIS makes the work process that is going on be hampered, so that a lot of work is delayed. With many defects in the HRM section, the HCM is taking steps to plan enhancements for long-term development and to carry out maintenance for short-term development which is done twice a month. The results of the analysis obtained can be used as consideration for the company related to the development of HRIS going forward.

2. Literature Review.

2.1. Human resource.
Human resource management has seven important functions [1], and it can be shown as follows:

1) Strategic HR management
2) Equal employment opportunity
3) Staffing
4) Talent management
5) Total rewards
6) Risk management and worker protection
7) Employee and labor relations

The important role of human resources is to be able to bring change and the situation to be more innovative for the future so as to improve company performance for competitive advantage. In addition to providing human resource changes in the company should be able to encourage employees who work so as to produce characteristic namely: motivation, commitment, determination, cooperation and work that can produce change towards better. Having a good human resource can help the company in the decision making process [2]. To obtain a good performance of human resource organizations/companies have an important role. Many are of the view that key human resources are a factor of success in the company and also become a pillar of the company [3].

2.2. Human capital management.
There are three important concepts of human capital [4]:

1) Intellectual capital: Human capital is often associated with the idea of a thorough intellectual capital. This can be interpreted as the flow of knowledge available on the organization or company.
2) Social capital: This element is part of intellectual capital. It consists of knowledge derived from relationships inside and outside the organization.
3) Organizational capital: Institutionalized knowledge possessed by organizations or companies is stored in databases, manuals and so on.

2.3. **Business process lifecycle.** Based on Weske's opinion (2012, p.11), business process lifecycle consists of stages that are connected with each other. The stages are arranged according to structure, to show logical abilities. Many design and development activities are carried out during each of these stages, and incremental and evolutionary approaches involve concurrent activities in various unusual stages. Business process is a complete, dynamically coordinated set of activities or logically related tasks that must be performed to deliver value to customers or to fulfil other strategic goals [5]. The business process lifecycle has five important stages as shown below [6] in Figure 2.
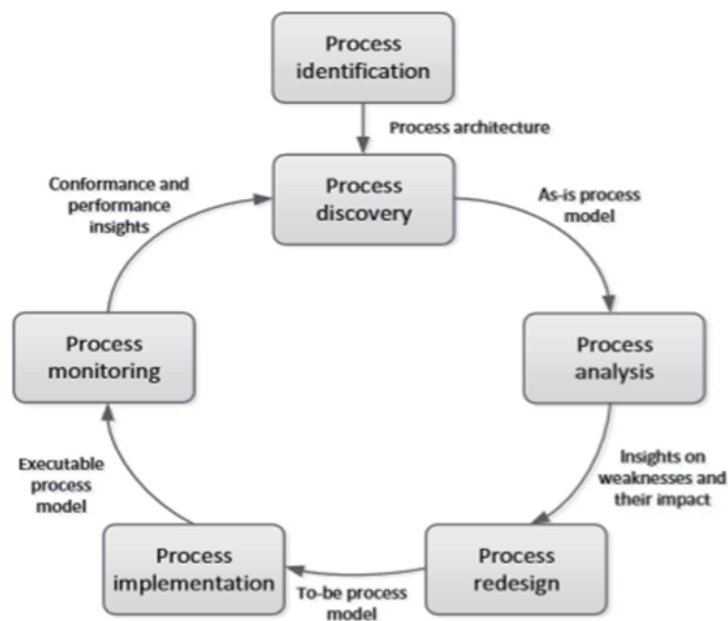

FIGURE 2. Business process lifecycle

3. **Methodology.**

3.1. **Conceptual framework.** From the chart of conceptual framework in Figure 3, in compiling this research, the mindset used is to answer the question of how the company's strategy in implementing information systems and information technology, whether it is effective for the company or it is in line with company objectives or not. Based on the explanation above, the research in this case study will use factors that have been determined and derived from literature studies as a way to evaluate system performance from the perspective of internal users. Then by analyzing the factors on these factors will be sought out what are the indicators that are formed so that the appropriate factors and the right model are obtained to evaluate the performance of the system at the company.

3.2. **Research methods.** The steps in data processing are carried out with the following stages: Make a reliability test based on the results of the questionnaire using Statistical Package for the Social Sciences (SPSS) software to find out whether or not the questionnaire is tested. Arrange a correlation matrix between each variable to determine the value
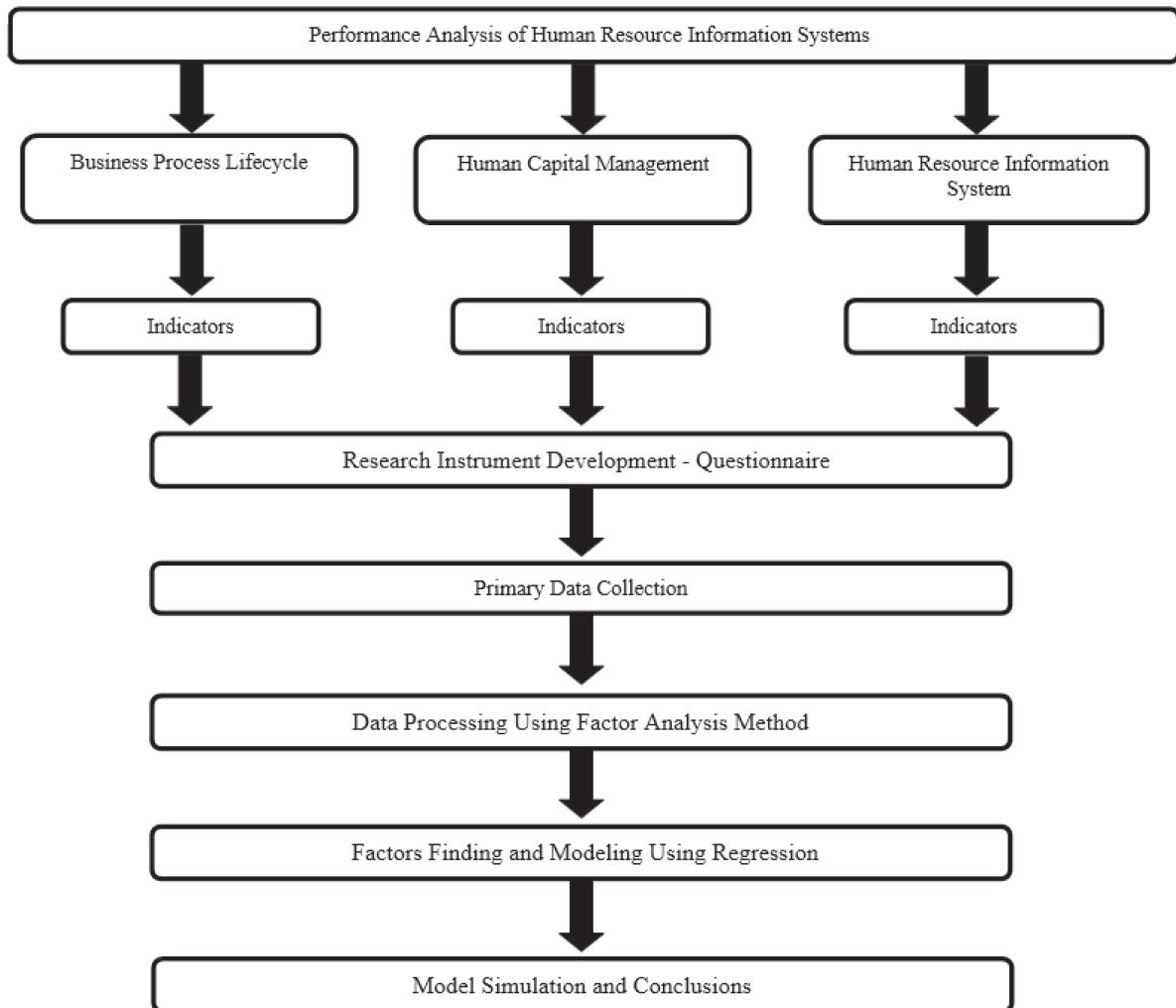
FIGURE 3. Conceptual framework

of Bartlett's Test of Sphericity which is used to determine the correlation that occurs significantly between variables, and test the Measure of Sampling Adequacy using Kaiser Meyers Olkin (KMO). Extract factors from a collection of existing variables to form one or more factors. Perform a factor rotation to convert a factor matrix into a simple matrix so that it is easy to interpret using varimax rotation. Name new factors that have been formed based on variables that have been determined. Make a factor score for the needs of further analysis needed in research. The results of this factor analysis will be used as an evaluation of the readiness of the implementation of the human resource management system as shown in Table 1.

4. **Result and Discussion.**

4.1. **Reliability test.** Reliability testing can be done using reliability analysis through Cronbach's Alpha with the help of SPSS 23. In this study reliability testing was carried out on 90 respondents. Decision making based on Cronbach's Alpha values > 0.70 is said to be acceptable, Cronbach's Alpha values > 0.80 are said to be good, and Cronbach's Alpha > 0.90 is said to be very good [37]. After reliability testing the Cronbach's Alpha value obtained from 30 indicators is 0.952. This shows that the instrument variables used in this study are reliable as shown in Table 2.

4.2. **KMO & Bartlett's Test.** In analyzing the factors, variables that were analyzed are feasible to be factored if the value of KMO-MSA > 0.5 and significant value (sig) or

TABLE 1. Research instrument development

Factor	Indicator	Statement	Reference
Business Process Life Cycle	Process Discovery	The current Human Resource (HR) system is in accordance with the regulations that apply to companies.	[7,8]
	Process Analysis	The design of the HR system must be analyzed in depth (in detail) in terms of business processes and procedures.	[9,10]
	Process Redesign	Current business process analysis carried out in detail and in full is a basic reference in the design of new business processes.	[11,12]
	Process Monitoring	System monitoring is an appropriate tool in seeing user interaction with the system.	[13,14]
	Process Implementation	The development of sustainable business processes can support companies to improve services and good governance.	[15,16]
Concept of Human Capital	Intellectual Capital (IC)	Increasing employee knowledge/competency in accordance with their work will have a positive impact on organizational performance.	[17,18]
	Social Capital	Work culture has an important role in the organization to be able to develop and adjust to the company's business processes.	[19,20]
	Organizational Capital	The company views employees as important assets of the company; therefore, HR provides facilities for employees to be able to develop expertise in work optimally.	[21,22]
Human Resource Functions	Strategic HRM	HR can be a bridge between the company and employees in order to support the company's strategic goals.	[23,24]
	Equal Employment Opportunity	Policies made by HR must be obeyed by all employees, and if the policy is not obeyed, there are sanctions that are based on applicable regulations.	[25,26]
	Equal Employment Opportunity	The relationship between HR and good stakeholders will optimize the implementation of the strategy to be carried out.	[27,28]
	Talent Management and Development	Companies need to map employees who have high potential and performance.	[29,30]
	Total Rewards	Satisfaction with financial compensation has a positive impact on employee contributions.	[31,32]
	Risk Management and Worker Protection	The application of knowledge management (storage, delivery, development of knowledge) has an important role in the sustainability of the organization/company.	[33,34]
	Employee and Labor Relation	By maintaining a good relationship between the company and employees can have a positive impact on the level of employee loyalty.	[35,36]

TABLE 2. Reliability statistics

Cronbach's Alpha	N of items
.952	30

TABLE 3. KMO and Bartlett's Test

Kaiser-Meyer-Olkin measure of sampling adequacy.		.831
Bartlett's Test of sphericity	Approx. Chi-Square	2097.894
	df	435
	Sig.	.000

probability $(p) < 0.05$. Based on the results of data processing, the KMO-MSA value of 0.831 was obtained in this study also known Bartlett's Test score of 0.000. This indicates that the data has been collected deserved to be factored as shown in Table 3.

4.3. **Result of factor analysis.** In the process of factor analysis there is a reduction in the data where the process is a process of filtering components that are suitable to be used as indicators that affect the gap between the target and the realization of HRIS. The results obtained in this study after the factor analysis process were carried out with the help of IBM SPSS software version 23. The following new factors and indicators are formed from the results of factor analysis from this study.

1) The first factor is Management of Employee Capital

   In Figure 4 the first factor formed through the factor analysis process is Management of Employee Capital. In this factor there are 9 indicators namely "Organizational Capital, Social Capital, Strategic Human Resource Management (HRM), Equal Employment Opportunity, Staffing, Talent Management and Development, Total Rewards, Risk Management and Worker Protection, Employees and Labor Relations".
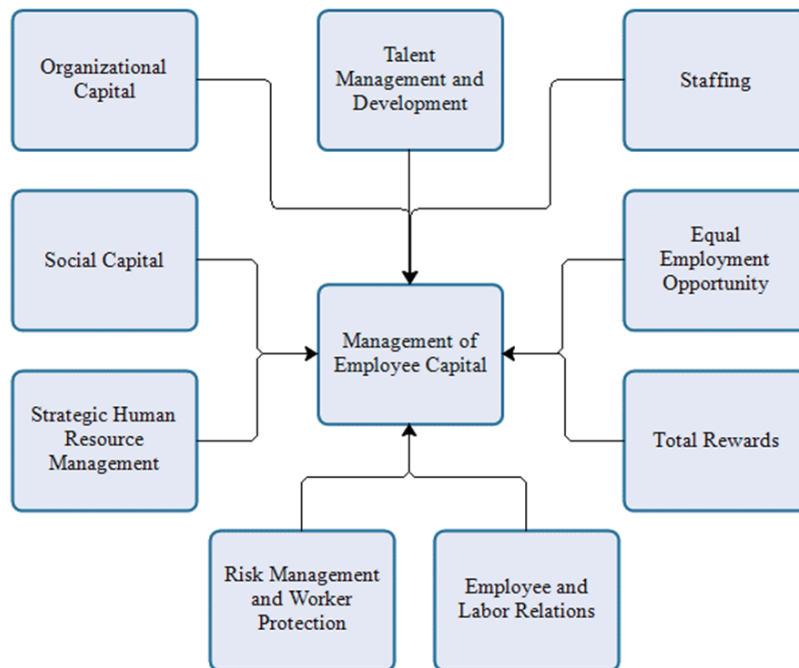

FIGURE 4. Indicators of Management of Employee Capital factors

2) The second factor is Capital Business Process

   In Figure 5 the second factor formed through the factor analysis process is the Capital Business Process. In this factor there are 6 indicators namely "Intellectual Capital, Social Capital, Process Discovery, Process Analysis, Process Implementation, Process Monitoring".

3) The third factor is Human Resource Monitoring

   In Figure 6 the third factor formed through the factor analysis process is Human Resource Monitoring. In this factor there are 5 indicators namely "Process Monitoring,
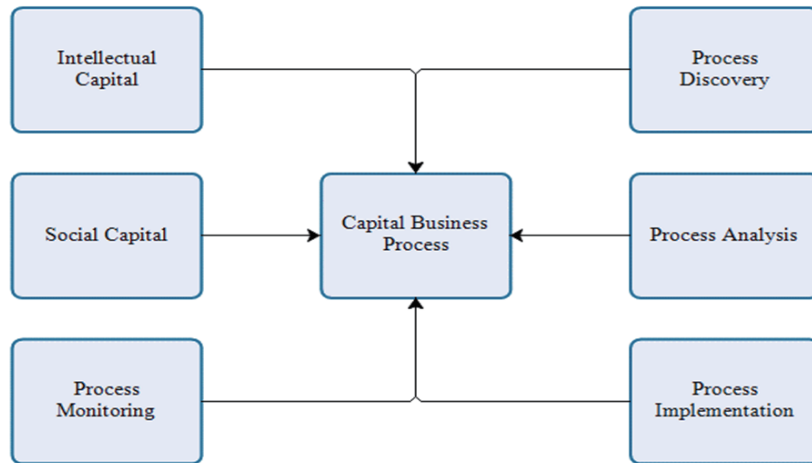
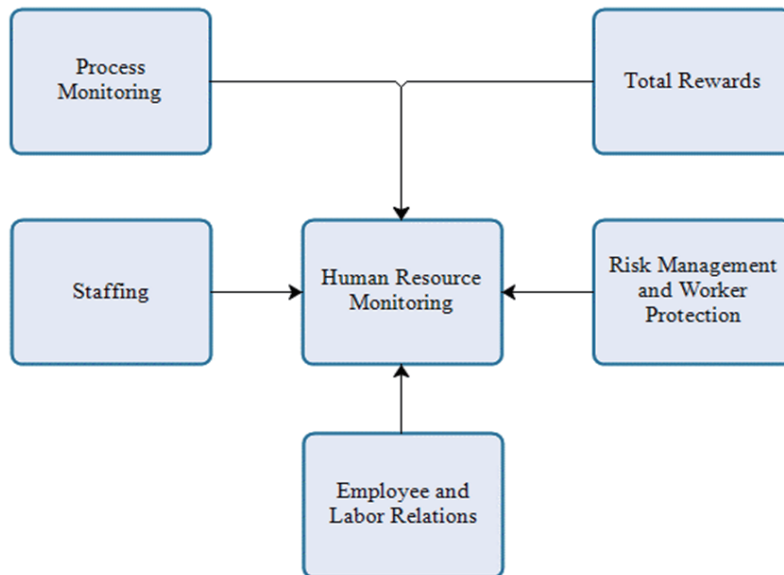FIGURE 5. Indicators of the Capital Business Process factor

FIGURE 6. Indicators of Human Resource Monitoring factor

Staffing, Total Rewards, Risk Management and Worker Protection, Employees and Labor Relations".

The following is explanation of the results of the distribution of questionnaires. Respondents as research samples totaled 90 respondents from 120 questionnaires distributed using online form survey media.

From Table 4, there were 120 questionnaires distributed, distributing questionnaires to all employees of the Human Capital Management (HCM) group, Information Technology (IT), and all employees of company who are in Jabodetabek with certain qualifications. "Questionnaire that did not return" were 17 questionnaires. Then the questionnaire that is not in accordance with the filling is a total of 13 questionnaires. Then the questionnaire that was declared is worthy of 90 questionnaires. In this study 90 questionnaires will be used and data processing will be carried out according to the needs of the author.

From the results of this analysis, we found an equation that can be used as a formula that describes the gap between the target and the realization of HRIS.

$$\mathbf{Y = 3.578 - 0.020X_1 + 0.419X_2 + 0.063X_3}$$

TABLE 4. Number of questionnaires distribution

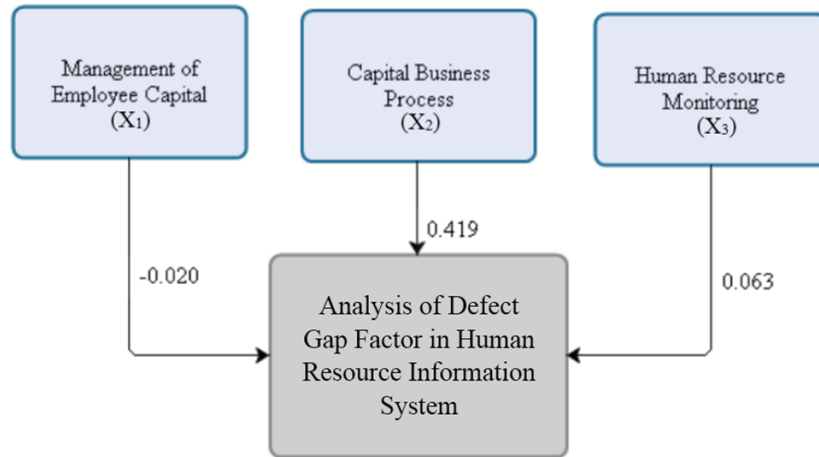| No	Remark	Amount
1	Questionnaire distributed	120
2	Questionnaire that did not return	17
3	Questionnaire that is not appropriate	13
4	Questionnaire that can be processed	90

FIGURE 7. Factor values for the frequency of use of respondents

Based on the above model, the relationship model that can be used to analyze the gap between the target and the realization set in the human resource information system is shown in Figure 7.

From the resulting model, it can be seen that the first factor, namely Management of Employee Capital, has a negative value of 0.020, which indicates that there are quality limitations in the first factor which is a representation of a number of variables (Figure 4) that can affect -0.020 on the lack of good management between organizational units each other in making new procedures so as to make changes to the procedure continuously. The second factor, Capital Business Process, has a positive value of 0.419, which shows that improving quality with the indicators contained in the second factor (Figure 5) can improve business process performance well. This factor has the greatest value compared to the other two factors. The third factor, which is Human Resource Monitoring, has a positive value of 0.063, which indicates that improving the quality of the third factor, which is a representation of a number of variables (Figure 6), will affect the improvement of human resource information performance in daily use.

The results of data processing from the distribution of questionnaires that have been made obtained an average value of 3.578 where the value is in a position between Fair and Frequent. Then from the formed model a simulation can be made to see the value that can be expected as an increase and the value is not expected and should be avoided by the company.

Based on Table 5 of the simulation results it shows several conditions that can be used as decision making for the implementation of human resource information systems in the future. Explanations related to these conditions are:

1) *Normal* means the conditions, the value of the analysis of the use of HRIS under normal conditions at this time is 3.578 and these values can be said in the category of "Enough". In this condition there is no addition or subtraction of the value of the new factor found because it can be considered not done research. From these data it shows the level of use of HRIS when used as worksheets in running business processes.

TABLE 5. Simulation result

Variable Condition	X_1	X_2	X_3	Y
Normal	0	0	0	3.578
Un-expected	1.705	-3.165	-3.179	2.017
Expected	-3.156	2.347	3.216	4.827

2) *Un-expected* means the conditions are not expected, this condition is considered as a condition that is in ignorance of the system resulting in a decrease in overall system performance. Making trial analysis by lowering the value of the factor that is positive at the lowest value and increasing the value of the factor that is negative at the highest value, then the value of the analysis is 2.017 where the value is included in the category of "Rarely". By decreasing the level of usage it can be interpreted that as long as HRIS is running the system is rarely used in the HR work process of the organization.

3) *Expected* means the ideal conditions, where all new factors found can be optimized to achieve high performance so that the gap between the realization target and its achievement can be minimized. For new factors with a positive coefficient, it can be increased to reach the maximum value, and for new factors with a negative coefficient, reduction can be done to reach the minimum value. After testing the ideal conditions in the analysis of the use of HRIS obtain a value of 4.827 which shows conditions that are far better than normal conditions. This value of 4.827 falls into the "Frequent" category so that if HRIS development is carried out in accordance with the decreasing defect, HRIS can be used as the main worksheet in the HR business process of the organization.

5. **Conclusion.** The results of respondent data processing from a number of employees working at the company above and carried out by the factor analysis method, found that there were 3 new factors, namely: Employee Capital Management, Capital Business Processes, Monitoring of Human Resources. From these three factors, the relationship model between the three factors can be built, so that a relationship between variables is found that the employee capital management factor is negative. This factor has a negative impact on the management of the organization that is running, so that a flaw appears in the system used. On the other hand, it is necessary to maintain coordination and trust relationships with partners, the easy and flexible transfer of resources between exploration and exploitative projects, and the application of business process management software or platforms [38]. Companies must improve organizational performance in the implementation of human resource information systems and make regulations or procedures for implementation that are better and that will have an impact on other factors. In addition to improving organizational performance, an understanding of unexpected conditions, or in these conditions is considered a condition that does not know the system resulting in a decrease in overall system performance must also be considered. The results of simulations with trial analysis by lowering the value of positive factors at the lowest value and increasing the value of negative factors at the highest value, obtained a value of 2.017 where the value is included in the category of "Rarely" should be aware of. By reducing the level of usage it can be interpreted that as long as HRIS is running, the system is rarely used in HR work processes. The organization must also strengthen communication between organizations to avoid miscommunication with each other who have interrelated business processes. With good management and communication it will greatly help the company in making decisions. Furthermore, in the future this research can be developed at the industry level and government level so that the system can be well integrated at a broader level and scope.

REFERENCES

[1] M. Weske, *Business Process Management*, 2nd Edition, Springer, London, 2012.

[2] A. J. Karim, The significance of management information system for enhancing strategic and tactical planning, *Journal of Information Systems and Technology Management*, vol.8, no.2, pp.459-470, 2011.

[3] M. S. Zare, R. Tahmasebi and H. R. Yazdani, Maturity assessment of HRM processes based on HR process survey tool: A case study, *Business Process Management Journal*, vol.24, no.3, pp.610-634, 2018.

[4] M. Armstrong, *Armstrong's Essential Human Resource Management Practice: A Guide to People Management*, Kogan Page Limited, London, 2010.

[5] A. Trigo, F. Belfo and R. P. Estebanez, Accounting information system: Evolving toward a business process oriented accounting, *Procedia Computer Science*, vol.100, pp.987-994, 2016.

[6] M. Dumas, M. L. Rosa, J. Mendling and H. A. Reijers, *Fundamentals of Business Process Management*, 2nd Edition, Springer, Berlin, 2018.

[7] J. W. Osborne, *Best Practices in Exploratory Factor Analysis*, CreateSpace Independent, Scotts Valley, 2014.

[8] L. R. Fabrigar and D. T. Wegener, *Exploratory Factor Analysis Understanding Statistics*, Oxford University Press, New York, 2012.

[9] M. L. Bernardi, M. Cimitile, C. D. Francescomarino and F. M. Maggi, Do activity lifecycles affect the validity of a business rule in a business process?, *Information Systems*, vol.62, pp.42-59, 2016.

[10] M. Malinova and J. Mendling, Identifying do's and don'ts using the integrated business process management framework, *Business Process Management Journal*, vol.24, no.4, pp.882-899, 2018.

[11] P. Soto-Acosta, E. Placer-Maruri and D. Perez-Gonzalez, A case analysis of a product lifecycle information management framework for SMEs, *International Journal of Information Management*, vol.36, no.2, pp.240-244, 2016.

[12] F. Ferreira, J. Faria, A. Azevedo and A. Marques, Product lifecycle management in knowledge intensive collaborative environments: An application to automotive industry, *International Journal of Information Management*, vol.37, no.1, pp.1474-1487, 2017.

[13] M. Cho, M. Song, M. Comuzzi and S. Yoo, Evaluating the effect of best practices for business process redesign: An evidence-based approach based on process mining techniques, *Decision Support Systems*, vol.104, pp.92-103, 2017.

[14] J. Mendeling, S. Dustdar, A. Gal, L. Garcia-Banuelos, R. Hull and M. Dumas, Blockchains for business process management – Challenges and opportunities, *ACM Trans. Management Information Systems*, vol.9, no.1, pp.1-16, 2018.

[15] L. T. Ly, F. M. Maggi, M. Montali, S. Rinderle-Ma and W. M. van der Aalst, Compliance monitoring in business processes: Functionalities, application, and tool-support, *Information Systems*, vol.54, pp.209-234, 2015.

[16] A. Metzger, P. Leitner, D. Ivanović, E. Schmieders, R. Franklin, M. Carro, S. Dustdar and K. Pohl, Comparing and combining predictive business process monitoring techniques, *IEEE Trans. Systems, Man, and Cybernetics: Systems*, vol.45, no.2, pp.276-290, 2015.

[17] Y. Zhang, S. Ren, Y. Liu and S. Si, A big data analytics architecture for cleaner manufacturing and maintenance processes of complex products, *Journal of Cleaner Production*, vol.142, pp.626-641, 2017.

[18] P.-L. Sun, C.-Y. Ku and D.-H. Shih, An implementation framework for e-government 2.0, *Telematics and Informatics*, vol.32, no.3, pp.504-520, 2015.

[19] L. M. Gogan, A. Artene, I. Sarca and A. Draghici, The impact of intellectual capital on organizational performance, *Procedia – Social and Behavioral Sciences*, vol.221, pp.194-202, 2016.

[20] V. Dženopoljac, S. Janoševic and N. Bontis, Intellectual capital and financial performance in the Serbian ICT industry, *Journal of Intellectual Capital*, vol.17, no.2, pp.373-396, 2016.

[21] S. Estrin, T. Mickiewicz and U. Stephan, Human capital in social and commercial entrepreneurship, *Journal of Business Venturing*, vol.31, no.4, pp.449-467, 2016.

[22] K. V. Lins, H. Servaes and A. Tamayo, Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis, *The Journal of Finance*, vol.72, no.4, pp.1785-1824, 2017.

[23] M. Pasban and S. H. Nojedeh, A review of the role of human capital in the organization, *Procedia – Social and Behavioral Sciences*, vol.230, pp.249-253, 2016.

[24] M. R. Marvel, J. L. Davis and C. R. Sproul, Human capital and entrepreneurship research: A critical review and future directions, *Entrepreneurship Theory and Practice*, vol.40, no.3, pp.599-626, 2014.

[25] J. H. Marler and E. Parry, Human resource management, strategic involvement and E-HRM technology, *The International Journal of Human Resource Management*, vol.27, no.19, pp.2233-2253, 2015.

[26] C. Boon, R. Eckardt, D. P. Lepak and P. Boselie, Integrating strategic human capital and strategic human resource management, *The International Journal of Human Resource Management*, vol.29, no.1, pp.34-67, 2017.

[27] E. Mun, Negative compliance as an organizational response to legal pressures: The case of Japanese equal employment opportunity law, *Social Forces*, vol.94, no.4, pp.1409-1437, 2015.

[28] N. Pedriana and R. Stryker, From legal doctrine to social transformation? Comparing U.S. voting rights, equal employment opportunity, and fair housing legislation, *American Journal of Sociology*, vol.123, no.1, pp.86-135, 2017.

[29] C. R. Greer, J. C. Carr and L. Hipp, Strategic staffing and small-firm performance, *Human Resource Management*, vol.55, no.4, pp.741-764, 2015.

[30] M. R. Watson and R. Abzug, Effective human resource management, *Handbook of Nonprofit Leadership and Management*, pp.597-638, 2016.

[31] W. Cascio and J. Boudreau, The search for global competence: From international HR to talent management, *Journal of World Business*, vol.51, no.1, pp.103-114, 2016.

[32] D. G. Collings, H. Scullion and V. Vaiman, Talent management: Progress and prospects, *Human Resource Management Review*, vol.25, no.3, pp.233-235, 2015.

[33] S. D. Gieter and J. Hofmans, How reward satisfaction affects employee's turnover intentions and performance: An individual differences approach, *Human Resource Management Journal*, vol.25, no.2, pp.200-216, 2015.

[34] W. Smit, K. Stanz and M. Bussin, Retention preferences and the relationship between total rewards, perceived organisational support and perceived supervisor support, *SA Journal of Human Resource Management*, vol.13, no.1, 2015.

[35] N. P. Pronk, D. L. McLellan, M. P. McGrail, S. M. Olson, Z. J. McKinney, J. N. Katz, G. R. Wagner and G. Sorensen, Measurement tools for integrated worker health protection and promotion, *Journal of Occupational and Environmental Medicine*, vol.58, no.7, pp.651-658, 2016.

[36] P. A. Schulte, A. Bhattacharya, C. R. Butler, H. K. Chun, B. Jacklitsch, T. Jacobs, M. Kiefer, J. M. Lincoln, S. Pendergrass, J. Shire, J. R. Watson and G. R. Wagner, Advancing the framework for considering the effects of climate change on worker safety and health, *Journal of Occupational and Environmental Hygiene*, vol.13, no.11, pp.847-865, 2016.

[37] M. Xi, Q. Xu, X. Y. Wang and S. M. Zhao, Partnership practices, labor relations climate, and employee attitudes: Evidence from China, *ILR Review*, vol.70, no.5, pp.1196-1218, 2016.

[38] A. Wilkinson and M. Barry, Voices from across the divide: An industrial relations perspective on employee voice, *Journal of Human Resource Management: Zeitschrift Für Personalforschung*, vol.30, nos.3-4, pp.338-344, 2016.