



## Implementation of Human Resources Scorecard-Based Human Resources Work System Design at PT. Suryasukses Abadi Prima

Aulia Nurwinda Septiani<sup>1</sup>, Pompong B. Setiadi<sup>2</sup>  
<sup>12</sup>Sekolah Tinggi Ilmu Ekonomi Mahardika, Indonesia  
Correspondent: [auliaseptiani1988@gmail.com](mailto:auliaseptiani1988@gmail.com)<sup>1</sup>

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**ABSTRACT:** PT. Surya Sukses Group is one of the largest plastic manufacturers in Indonesia. This company has been established since 1989 whose products have been used by many industries. This study aims to determine the stages of implementing the Human Resource Scorecard and measuring human resource performance based on the Human Resource Scorecard at PT. Surya Success Group. The Human Resource Scorecard is a way to measure and show the performance of a company's human resources in a comprehensive manner that is directly aligned with the company's vision, mission and goals. This study uses a four-perspective approach, namely the Financial Perspective; Customer Perspective; Internal Business Process Perspective; Learning and Growth Perspective. Data collection was obtained from research related to four perspectives from PT. Surya Success Group. So the total score of PT. Surya Sukses Abadi Prima in 2019 was 2,506 which was classified as a bad company performance and in 2020 it was 3,139 which was classified as a medium company performance.

**Keywords:** Human Resource, Human Resource Scorecard, Work System



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## INTRODUCTION

Companies in carrying out business operations certainly need various resources, including capital, materials, markets and machines. In addition to these aspects, companies also need human resources which are an important aspect of the company, because human resources have different responsibilities, roles and tasks in each position ([Chen et al., 2022](#)). Human resources in question are employees. The company certainly wants optimal employee performance so that it is in accordance with the goals set by the company ([Guix & Font, 2020](#))([Vidal Flores & Domenge Muñoz, 2017](#)).

PT. Surya Sukses Group is one of the largest plastic manufacturers in Indonesia. This company has been established since 1989 whose products have been used by many industries such as the food and beverage industry, health care, personal care, agriculture and housing. PT. Surya Sukses

Group has also obtained ISO 9001 and FSSC 22000 certification. The success and achievement of the vision and mission that this company can achieve cannot be separated from competent human resources (SAP, 2022).

Human resources itself in a company has an important position. Good human resources will of course bring benefits and support the achievement of targets for the company. Even with current technological advances or the availability of large funds for a company, the good position of human resources cannot be replaced because human resources is an asset or capital within a company ([Maheswari et al., 2020](#)). There are various ways to measure good human resource performance, one of which is using the Human Resource Scorecard (HRSC). The Human Resource Scorecard is a tool used to measure the effectiveness and efficiency of the human resource function in shaping employee behavior needed to achieve the company's strategic goals ([Dessler, 2020](#)).

Things that need to be prepared are identifying the main contributions of the human resources division which have a direct impact on company performance, identifying parties who are human resource customers, defining the activities of the human resources division which can make a significant contribution, such as high talent staffing or initiatives that can be used for employee retention programs, finally conducting a cost-benefit analysis for human resource activities that have a significant impact on the company ([Elbanna et al., 2015](#)). The process of compiling the Human Resource Scorecard, namely determining business strategy, outlines activities and strategy maps to advance the company and develop employee insights, identify required outputs, identify employee competencies and behaviors that are currently needed by the company, identify human resource policies and activities that are needed in the company, making Human Resource Scorecard steps, monitoring and evaluating ([Kang et al., 2015](#)).

Aspects that can be developed through the Human Resource Scorecard are human resource costs, recruitment, turnover and alignment of company goals. Human resource costs that are measured and reported through the Human Resource Scorecard include budget compliance, staff recruitment costs, utilization costs such as group health insurance. Tracking costs through the Human Resource Scorecard is used by managers to plan human resource goals and expenditures as well as control costs and set budgets in a realistic way ([Türüdüoğlu et al., 2014](#)). Recruitment has the aim of filling vacant positions. Time to fill a position is a recruiting indicator that is tracked in the Human Resource Scorecard. This information can be used by managers to determine the quality of human resources that can meet the company's needs for new personnel and benefit from additional resources to improve recruiting practices ([Jardali et al., 2015](#)). Turnover is the degree to which a company gains or loses employees. It is generally compared to the industry turnover rate. High employee turnover indicates employees are not comfortable with the work being done because of problems that exist in the company such as the work environment, lack of career opportunities, management or compensation conflicts. Alignment with corporate goals is a Human Resource Scorecard practice involving financial and non-financial aspects such as measuring actual costs and performance management data ([Kádárová et al., 2014](#)). The Human Resource Scorecard must measure the elements of the company that are

in the company's goals and strategy to become an alignment tool. For example, if a company's primary goal is to improve customer service in the coming year, customer service and customer service staff training should be part of the Human Resource Scorecard. Therefore special attention is needed to assess customer service and service to existing staff in the company ([Dincer et al., 2017](#)).

The existence of the Human Resource Scorecard concept is important, vital and strategic because an organization really needs the performance of all human resources elements. Companies without the role of human resources, it is certain that the company will not have any value ([Guix & Font, 2020](#)). However, without measuring the performance of human resources, it will be difficult to know the quality both individually and as a group. It will be difficult for the company to see and ensure the achievement of its strategy, vision and mission ([Maradita, 2020](#)). This will bring a company that does not develop and progress. The benefits of implementing the Human Resource Scorecard are strengthening the objectives between Human Resources Doables and Human Resources Deliverables, enabling to control costs and creating value, measuring key indicators, assessing the contribution of Human Resources to strategy implementation, enabling Human Resources professionals to manage their strategy effectively and responsibility (Brian et al., 2001). Research conducted by Rusindiyanto (2009) where in this study only mentioned respondents, namely employees of PT. Arto Metal Internasional Sidoarjo without mentioning in detail the employee who is the key informant for filling out the Key Performance Indicator determination questionnaire and the weighting questionnaire with the Analytical Hierarchy Process ([Erwin et al., 2021](#)). The results of research conducted by Queen (2019) also stop at the results of weighting using the Analytical Hierarchy Process and not continuing to use a scoring system so that it can be known more objectively and in detail the performance of the organization being studied. Based on the background, this study aims to determine the stages of implementing the Human Resource Scorecard and measuring human resource performance based on the Human Resource Scorecard at PT. Surya Sukses Group.

## **METHOD**

This study uses a four-perspective approach, namely Financial Perspective; Customer Perspective; Internal Business Process Perspective; Learning and Growth Perspective. Data collection was obtained from research related to four perspectives from PT. Surya Sukses Group. Data processing and analysis to find out the results of performance measurement using the Human Resources Scorecard method with weighting using the Analytic Hierarchy Process (AHP). There are 4 (four) perspectives in Human. The Resource Scorecard includes:

1. Financial perspective, which is a perspective that provides guidelines for the strategy implemented whether it can contribute to profitability or increase company profits or not. The main measures consist of operating profit, economic value added, Return on Capital Employed (ROCE) ([Agarwal et al., 2022](#)).
2. Customer perspective, namely the perspective that is used as a benchmark that employees are assets, users, or output from the implementation of HR strategies that will have an

- impact on customers. The main measurement from this perspective consists of the level of customer satisfaction, customer profitability, new customer acquisition ([Shen et al., 2016](#)).
3. Internal Business Process Perspective, which is a perspective that provides a benchmark that the company's internal processes will have an impact on achieving goals financially and customer satisfaction. The main measurement from this perspective, among others, is how to balance business strategy with HR strategy within the company ([Kancherla et al., 2019](#)).
  4. Learning and Growth Perspective, which is a perspective that focuses on strategies for developing human resources within the company. The measures in this perspective include: the level of employee satisfaction, high employee involvement, and the output produced by employees ([Fatima & Elbanna, 2020](#)).

## RESULT AND DISCUSSION

The Human Resources Scorecard is like the Balanced Scorecard, the scorecard is derived from the company's strategy with regard to the human resource system ([Masruroh, 2013](#)). Companies use the scorecard for their performance management and make strategy the central key to process and system management (Kaplan and Norton, 2000). The strategy map helps organizations see their strategy in a cohesive, integrated and systematic way, because it connects cause – effect relationships that show intangible assets transformed into tangible (financial) outcomes ([Torgautov et al., 2022](#)).

AHP is a form of decision-making model that basically tries to cover all the shortcomings of the previous models. The main equipment of this model is a functional hierarchy with the main input of human perception ([S.Pratama & & Ismail, 2018](#)). The advantage of the AHP model compared to other decision models lies in the ability to solve multi-objective and multi-criteria problems ([Lee et al., 2021](#)). Most existing models use a single objective and multicriteria. The advantages of the AHP model are more due to its higher flexibility, especially in making hierarchies. This flexible nature allows the AHP model to capture several goals and several criteria at once into a model or hierarchy. Even the model can also solve problems that have conflicting goals in a model ([Esther Akinbowale et al., 2022](#)).

The results of calculating the weighted score for each perspective of the company's human resource performance as a whole from 2019 and 2020, are as shown in Table 1.

Table 1. Summary of Weighted Score Calculation Results for each perspective

<b><i>Human Resources Scorecard</i></b>	<b>2019</b>	<b>2020</b>
Financial perspective	0.564	0.923
Customer perspective	0.916	0.980
Internal Business Process Perspective	0.467	0.584
Learning and Growth Perspective	0.559	0.652

To measure performance with the Human Resources Scorecard comprehensively by adding up the weighted scores from each perspective, the results are shown in Table 2.

Table 2 Comprehensive HRS Performance Measurement

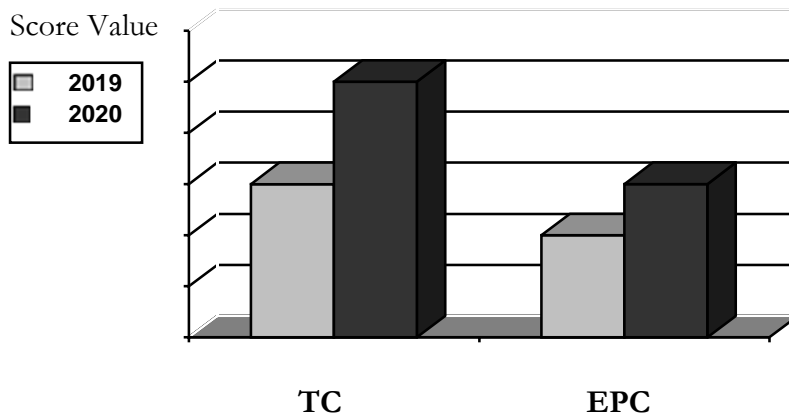
<b>HRSC</b>	<b>2019</b>	<b>2020</b>
Financial	0.564	0.923
Customer	0.916	0.980
IPB	0.467	0.584
L & G	0.559	0.652
<b>Total</b>	<b>2.506</b>	<b>3.139</b>

So the total score of PT. Surya Sukses Abadi Prima in 2019 was 2.506 which could be classified as poor company performance and in 2020 was 3.139 which could be classified as medium company performance.

### **Analysis of Human Resources Scorecard Performance Measurement Results**

The Human Resources Scorecard measures four perspectives, namely a financial perspective, a customer perspective, an internal business process perspective, and a comprehensive learning and growth perspective (Pgri et al., 2015). From a financial perspective, the TC KPI experienced a significant increase in 2019 to 2020 from 30% to 50%. Then for the EPC KPI in 2019 it was 30% and in 2020 it has decreased by 20%. From a customer perspective, the employee satisfaction index KPI in 2019 and 2020 has a point of 36.86 points. Then for the employee absentee level in 2019 it was 2.42% while in 2020 it decreased to 1.63%. The KPI for ETO in 2019 is 2.87% and has increased in 2020 by 3.79%. From the perspective of internal business processes, the benchmark for the average coordination between superiors and subordinates is that in a year, coordination has been carried out for 61 hours, while for 2020 it has been carried out for 71 hours. Then for benchmarks the average time for spending health benefits for employees during the process in 2019 is 4 days and in 2020 is only 3 days. The perspective of the learning and growth process on the benchmark of the number of employees who have information system skills is 6.15% in 2019 and then increases to 8.44% in 2020. Meanwhile, the number of trainings held by the company for employees is 3 times training in 2019 and 4 times of training in 2020. From Table 2 it can be seen the total score of the performance measurement results of PT. Surya Sukses Abadi Prima in 2019 was 2,506 which could be classified as poor company performance, and in 2020 there were 3,139 which could be classified as medium company performance.

Graph 1. Financial Perspective Comparison Graph



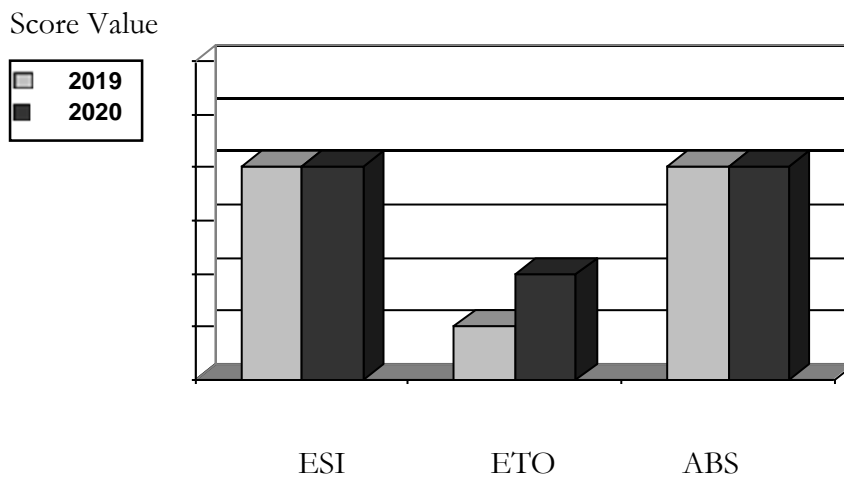
Information:

TC : Training Cost

EPC : Employee Procurement Cost

The financial perspective score for the TC KPI from 2019 has a score of 3 (moderate) then in 2020 it has increased to 5 (very good). For the EPC KPI from 2019 it had a score of 2 (less) then in 2020 it increased to 3 (moderate).

Graph 2. Graph of Customer Perspective Comparison



Information:

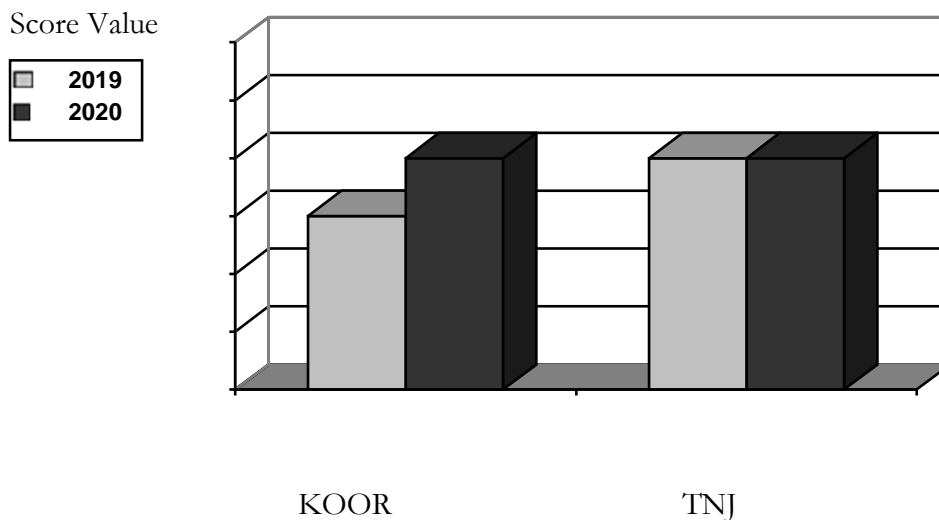
ESI : Employee Satisfaction Index

ETO : Employee Turn Over

ABS : Absenteeism

The customer perspective for the KPI of employee satisfaction at work has the same score in 2019 and 2020, which is 4 (good). The employee absence rate has increased from 2019 to 2020, from a score of 1 (very poor) to 2 (less). Meanwhile, the ETO KPI (employee turnover rate) has the same score in 2019 and 2020, which is 4 (good).

Graph 3. Internal Business Perspective Comparison Chart



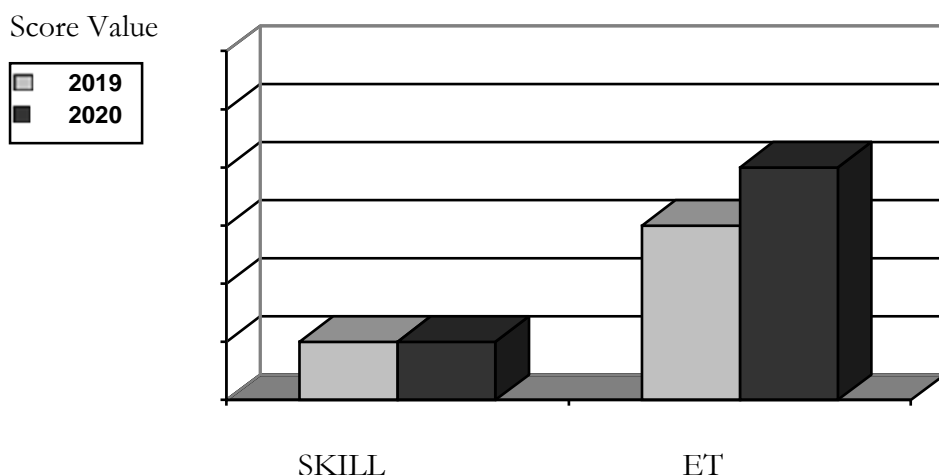
Information:

COORD : Coordination of superiors and staff

TUNJ : Time for health benefits

For an internal business process perspective, the average KPI for supervisor and staff coordination time in 2019 was at a score of 3 (moderate) then experienced an increase in 2020, namely at a score of 4 (good). This is also no different for the KPI when the average disbursement of health benefits for employees in 2019 and 2020 has the same score value of 4 (good).

Graph 4. Internal Business Perspective Comparison Chart



Information:

SKILL : Number of employees with skills in the field of information systems

ET : Number of employee training (Employee Training)

In the perspective of learning and growth processes, the percentage of employees with information systems skills in 2019 and 2020 has the same score, namely 1 (very poor). As for the KPI, the number of trainings the company has held for its employees, in 2019 was at a score of 3 (moderate) then in 2020 it has increased to a score of 4 (good) ([Lohana et al., 2021](#))

The method for measuring the achievement of HR system performance uses a scoring system with the Objectives Matrix (OMAX) method. After scoring with the help of hypothetical data, it was found that the performance achievement of all strategy objectives is in the green category, which means the target has been achieved. Besides, it also shows that the perspective of learning and growth, internal business processes, and customers have successfully supported the performance of the financial perspective ([Jones & Doberstein, 2022](#)). The success of achieving the overall performance of this financial perspective ultimately leads the institution to a condition where the institution can achieve the targets that have been set previously. Where the intended target institution is customer satisfaction-oriented services, increasing profitability, minimizing risk, and becoming an institution that employees like ([Wang et al., 2022](#)).

The achievement of targets from performance indicators as a whole means that the goals of the institution are achieved and it can be concluded that the institution can achieve its vision. Using the Human Resources Scorecard method based on the Objectives Matrix (OMAX) assessment model helps institutions monitor all aspects of their performance and immediately make improvements to improve institutional performance whose achievements are still far below the target ([Tawse & Tabesh, 2022](#)).

The financial perspective is identified have strategy objectives 1) improve labor cost efficiency; and 2) increase the effectiveness of the use of the budget training. Successful achievement of strategy objectives on this financial perspective will lead the university to its success achieve the stated strategic goals set ([Qingwei, 2012](#)). The customer perspective is identified have strategy objectives 1) planning employee succession; 2) employees implementing university values; 3) increase employee responsibility; and 4) increase employee satisfaction. Strategy objectives from the customer's perspective affect the strategy objectives on financial perspective. Internal business process perspective identified as having strategy objectives 1) increase employee motivation; 2) improve service speed and reimbursement payments to employee; 3) align the university culture with service quality; and 4) internal flexibility. Strategy objectives on a process perspective Internal business will affect strategy objectives from the customer perspective ([Mabel et al., 2020](#)).



## CONCLUSION

The conclusion that can be drawn from the results of this study is that the achievement of human resource performance at PT. Surya Sukses Abadi Prima is still lacking in 2019 and moderate for 2020. Key Performance Indicators did not meet the target but for 2020 almost all Key Performance Indicators have met the target, for Key Performance Indicator skills in the field of information systems are still lacking.

From the conclusions above, the suggestions given to improve the performance of company human resources at PT. Surya Sukses Abadi Prima that the company should provide additional training for employees and give a strict warning to employees who are absent from work and provide severe sanctions for employees who do not exceed the limit. For measuring the performance of human resources in the future, it is possible to make changes to the criteria for improving the performance of other human resources, according to the conditions of the company. Measuring the performance of human resources can not only be done with the HRSC method, but other methods do not cover all divisions like this method.

## REFERENCE

- Agarwal, S., Kant, R., & Shankar, R. (2022). Exploring sustainability balanced scorecard for performance evaluation of humanitarian organizations. *Cleaner Logistics and Supply Chain*, 3(September 2021), 100026. <https://doi.org/10.1016/j.clscn.2021.100026>
- Becker, G.S. (1993). Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education. In The University of Chicago Press (Vol. 3, Issue 92).
- Chen, H. M., Wu, H. Y., & Chen, P. S. (2022). Innovative service model of information services based on the sustainability balanced scorecard: Applied integration of the fuzzy Delphi method, Kano model, and TRIZ. *Expert Systems with Applications*, 205(May), 117601. <https://doi.org/10.1016/j.eswa.2022.117601>
- Dessler, G. (2020). Human Resource Management. Jakarta.
- Dinçer, H., Hacıoğlu, Ü., & Yüksel, S. (2017). Balanced scorecard based performance measurement of European airlines using a hybrid multicriteria decision making approach under the fuzzy environment. *Journal of Air Transport Management*, 63, 17–33. <https://doi.org/10.1016/j.jairtraman.2017.05.005>
- Elbanna, S., Eid, R., & Kamel, H. (2015). Measuring hotel performance using the balanced scorecard: A theoretical construct development and its empirical validation. *International Journal of Hospitality Management*, 51, 105–114. <https://doi.org/10.1016/j.ijhm.2015.09.004>
- Erwin, M., Wibisono, E., & Hadiyat, M. A. (2021). Perancangan Human Resource Scorecard untuk Mengevaluasi Kinerja Divisi Rekrutmen XYZ Group. *KELUWIH: Jurnal Sains Dan Teknologi*, 2(1), 16–29. <https://doi.org/10.24123/saintek.v2i1.4048>

- Esther Akinbowale, O., Eckart Klingelhöfer, H., & Fekadu Zerihun, M. (2022). The use of the Balanced Scorecard as a strategic management tool to mitigate cyberfraud in the South African banking industry. *Heliyon*, 8(12). <https://doi.org/10.1016/j.heliyon.2022.e12054>
- Fatima, T., & Elbanna, S. (2020). Balanced scorecard in the hospitality and tourism industry: Past, present and future. *International Journal of Hospitality Management*, 91(February), 102656. <https://doi.org/10.1016/j.ijhm.2020.102656>
- Guix, M., & Font, X. (2020). The Materiality Balanced Scorecard: A framework for stakeholder-led integration of sustainable hospitality management and reporting. *International Journal of Hospitality Management*, 91(October 2019), 102634. <https://doi.org/10.1016/j.ijhm.2020.102634>
- Jardali, H. Al, Abdallah, F., & Barbar, K. (2015). Measuring Intentions among Employees toward the Use of a Balanced Scorecard and Information System: A Conceptual Approach Using the Theory of Planned Behavior and the Technology Acceptance Model. *Procedia Economics and Finance*, 26(15), 1146–1151. [https://doi.org/10.1016/s2212-5671\(15\)00944-2](https://doi.org/10.1016/s2212-5671(15)00944-2)
- Jones, D. M., & Doberstein, B. (2022). Encouraging co-benefits in climate-affected hazard adaptation: Developing and testing a scorecard for project design and evaluation. *International Journal of Disaster Risk Reduction*, 74(July 2021), 102915. <https://doi.org/10.1016/j.ijdrr.2022.102915>
- Kádárová, J., Durkáčová, M., & Kalafusová, L. (2014). Balanced Scorecard as an Issue Taught in the Field of Industrial Engineering. *Procedia - Social and Behavioral Sciences*, 143, 174–179. <https://doi.org/10.1016/j.sbspro.2014.07.382>
- Kancherla, V., Weakland, A. P., Xu, S. Y., & Walani, S. R. (2019). Scorecard for spina bifida research, prevention, and policy: Score analysis by Human Development Index and WHO region. *Preventive Medicine*, 123(September 2018), 1–7. <https://doi.org/10.1016/j.ypmed.2019.02.020>
- Kang, J. S., Chiang, C. F., Huangthanapan, K., & Downing, S. (2015). Corporate social responsibility and sustainability balanced scorecard: The case study of family-owned hotels. *International Journal of Hospitality Management*, 48, 124–134. <https://doi.org/10.1016/j.ijhm.2015.05.001>
- Lee, S., Costello, F. J., & Lee, K. C. (2021). Hierarchical balanced scorecard-based organizational goals and the efficiency of controls processes. *Journal of Business Research*, 132(October 2019), 270–288. <https://doi.org/10.1016/j.jbusres.2021.04.038>
- Lohana, S., Abidi, N. A., Sahoo, N., Sameer Babu, M., Pallathadka, H., & Singh, U. S. (2021). Performance measurement of human resource by design a human resource scorecard. *Materials Today: Proceedings*, 51, 677–681. <https://doi.org/10.1016/j.matpr.2021.06.203>

- Mabel, Z., Libassi, C. J., & Hurwitz, M. (2020). The value of using early-career earnings data in the College Scorecard to guide college choices. *Economics of Education Review*, 75(December 2019), 101958. <https://doi.org/10.1016/j.econedurev.2020.101958>
- Maheswari, H., Yudoko, G., Adhiutama, A., & Agustina, H. (2020). Sustainable reverse logistics scorecards for the performance measurement of informal e-waste businesses. *Heliyon*, 6(9), e04834. <https://doi.org/10.1016/j.heliyon.2020.e04834>
- Maradita, F. (2020). HUMAN RESOURCE SCORECARD Mengaitkan Orang, Strategi dan Kinerja SDM ( Suatu Model Pengukuran Kinerja SDM). *Jurnal Ekonomi Dan Bisnis Indonesia*, 05(01), 15–18.
- Masruroh, N. (2013). Pengukuran Kinerja Menggunakan Human Resources Scorecard dalam rangka Meningkatkan Kinerja di PT. Rajawali Tanjungsari. *Jurnal Ilmu Administrasi Bisnis*, 2(4), 1–11.
- Pgri, S., Jombang, D., & Sejahtera, K. S. P. (2015). 176-283-1-Pb. *Jurnal Akuntansi Dan Bisnis*, vol.15(Pengukuran Kinerja SDM Metode Human Resources Scorecard sebagai upaya Optimalisasi Kinerja Organisasi), 1–8.
- Qingwei, F. (2012). Research on Evaluation Index System of Management Effectiveness on Hospital Human Resource Based on Balanced Scorecard. *Procedia Environmental Sciences*, 12(Icese 2011), 1040–1044. <https://doi.org/10.1016/j.proenv.2012.01.385>
- Shen, Y. C., Chen, P. S., & Wang, C. H. (2016). A study of enterprise resource planning (ERP) system performance measurement using the quantitative balanced scorecard approach. *Computers in Industry*, 75, 127–139. <https://doi.org/10.1016/j.compind.2015.05.006>
- S.Pratama &, & Ismail, I. (2018). Mengukur Kinerja dengan HR Scorecard (Studi Pada PT BPRS Bhakti Sumekar, Sumenep). *Seminar Nasional Dan Call for Paper Sustainable Competitive Advantage (SCA) 8, September*, 1–13.
- Tawse, A., & Tabesh, P. (2022). Thirty years with the balanced scorecard: What we have learned. *Business Horizons*, 66(1), 123–132. <https://doi.org/10.1016/j.bushor.2022.03.005>
- Torgautov, B., Zhanabayev, A., Tleuken, A., Turkyilmaz, A., Borucki, C., & Karaca, F. (2022). Performance assessment of construction companies for the circular economy: A balanced scorecard approach. *Sustainable Production and Consumption*, 33, 991–1004. <https://doi.org/10.1016/j.spc.2022.08.021>
- Türüdüoğlu, F., Suner, N., & Yıldırım, G. (2014). Determination of Goals under Four Perspectives of Balanced Scorecards and Linkages between the Perspectives: A Survey on Luxury Summer Hotels in Turkey. *Procedia - Social and Behavioral Sciences*, 164(August), 372–377. <https://doi.org/10.1016/j.sbspro.2014.11.090>
- Vidal Flores, D., & Domenge Muñoz, R. (2017). Simulador de vuelo ejecutivo como medio de aprendizaje en la planeación de recursos de nuevas empresas bajo el enfoque del marcador

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Septiani and Setiadi

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balanceado. *Contaduria y Administracion*, 62(2), 577–599.

<https://doi.org/10.1016/j.cya.2017.02.005>

Wang, J. S., Liu, C. H., & Chen, Y. T. (2022). Green sustainability balanced scorecard—Evidence from the Taiwan liquefied natural gas industry. *Environmental Technology and Innovation*, 28(51), 102862. <https://doi.org/10.1016/j.eti.2022.102862>