



EPiC Series in Computing

Volume 81, 2022, Pages 448–455

Proceedings of 11th International Congress
on Advanced Applied Informatics



Dimensional Success Factor for Sport Science: A Systematic Literature Review

Tanty Oktavia¹, Ford Lumban Gaol¹, Takaaki Hosoda², Arsyhan Syahir¹

¹Bina Nusantara University, Jakarta, Indonesia

²Advanced Institute of Industrial Technology, Tokyo, Japan

toktavia@binus.edu, gaol@binus.edu, t-hosoda@aait.ac.jp,
arsyan.syahir@binus.ac.id

Abstract

The most common failure from sports organizations was caused by improper sports organizations to manage their resources. Sports science generally refers to model intended to improve sports organizations' performance for general and the athlete for specific. Currently, it is important to implement sports science because it can be promoted as competitive strategies to win from any sport competition. The purpose of this research is to identify the dimensional success factor for sport science systems that become an important part of sports organizations before they build the system. This study focuses to examine many articles using systematic literature reviews in sports journals and conferences as supplementary materials alongside published articles, while the topic is a relatively recent sports science phenomenon to support sport organizations. The selected papers were screened and extracted to formulate the core dimensional success factor. The result of this study is a fact-finding dimensional success factor for sports organizations based on previous research that can be considered as the mainstream foundation for sports organizations to build their system, and also it can be applied in multiple sports organizations field as a competitive strategy.

1 Introduction

Performance is an important key factor to attain achievement. It can show the effort to compose strategic planning and define the new initiative to reach best performance. Performance indicator has a significant role to make sure all participants are realized of the level of performance targeted to them [1]. Traditionally, sports organizations only focused on physical development, but according to the growth mindset in sports field related competitive advantage, a differentiation in sports organization is needed [2] to involve a higher emphasis to monitor athlete performance [3]. With sports science, sports organizations can learn how the athlete's body performance during competition or exercise and physical activity to improve performance and health from cellular to whole body components. This

aspect is an interdisciplinary science that collaborates areas of psychology, biomechanics, physiology, biochemistry, anatomy, biokinetics [4] [5]. Sport sciences are concerning their social and economic function as the aspect they help people improve [6]. From the management point of view, sports represent an evolutionary component of modern life, both its own national and international structure [7].

Safety in physical activity or sport is an important prerequisite to help sports organizations to continue and maintenance of athlete health and performance [8]. According to this reason, how to prevent, reduce, and control sports injuries are important for sports organization is important thing currently. The shifting to level up openness in sport has reached attention considering recent topic in sports organizations. Some of the impact to engage in sport science, which are more transparency of sport participant's performance. Recently, sport organization has involved sports science approach to enhance implementation of athlete performance.

Due to diversity and dissimilarity data in sport organizations, there is no systematic program to support sport organizations. Also, there no sports science application that is universally implemented [9], either in individual or group [10]. Consequently, to accommodate the implementation of sport science strategies, this motivated us to identify dimensional success factors of sports science using a systematic literature review as preliminary research to build a sports science architecture in the sports organization in the future.

2 Methodology

This study was conducted with study literature review on the dimensional success factor for sport science that divided into several processes, which are: identify research sources, define the keyword to the search process, scoping the exclusion and inclusion factor, selecting the data, and analyzing them to revealed for the research question. For the searching process, the systematic literature review included articles published in conferences and journals from January 2000 to July 2020. The selected period considered the sports science context because this study is concerned to improve sports organization performance. Therefore, the criteria could help in searching for scientific articles. The search process aimed to identify published studies. The database focused are as follow:

- IEEEXplore (<https://ieeexplore.ieee.org/>)
- ACM (<https://dl.acm.org/>)
- ScienceDirect (<https://www.sciencedirect.com/>)
- Wiley Online Library (<https://onlinelibrary.wiley.com/>)
- Emerald (<https://www.emerald.com/insight/>)
- Springer (<https://link.springer.com/>)
- Palgrave Macmillan (<https://www.palgrave.com/gp>)
- Proquest (<https://about.proquest.com/>)
- Taylor Francis (<https://www.tandfonline.com/>)

These databases include indexed journals (Scopus, Web of Science (ISI), Scielo, Lilacs, Cinhal, and Redalyc) from different countries.

The keywords definition was done by a first exploratory search in the scientific articles about study. The research strategy used the Boolean term AND/OR with the following keywords in English: dimensional success factor; sports science; athlete; sports organization.

All the identified literature was collated and uploaded to reference management software with no duplication. Titles and abstracts were screened for check the inclusion and exclusion criteria. The first classified is the "Studies Found" process for all articles identified from source publication related to

the specified keyword will keep as Studies Found. After that, the next process will filter the paper according to the title of the article and the abstract. If the title section and the abstract suitable with an inclusion criteria and match to define the research question, then this paper will define as "Candidate paper". Then after explore thoroughly to answer the research question, if the paper appropriate to the research question will be chosen as "Selected paper". Meanwhile, to identify the appropriateness of literature, the exclusion criteria are identified with some boundary, which are:

- The paper published before 2000
- Format and structure of the paper incomplete, which means all factor is not improper in the paper
- Duplicate of paper

Sport science topics are still rare in the research topic. Therefore, the paper in this research only examined 182 articles from all sources and aspect. After reviewed 182 founded articles, 57 papers decided to be candidate paper that reviewed based on related paper title and abstract that comply with the research problem. After explored deeply, found out that only 21 papers that are defined as selected studies can be seen in Table 1 as a result of data extraction.

Table 1 Data Extraction Result

Source	Found	Candidate	Selected
IEEE	63	13	5
ACM	28	7	4
ScienceDirect	45	15	5
Wiley Online	9	2	1
Emerald	3	2	1
Springer	23	11	3
Palgrave	5	2	0
Proquest	4	3	0
Taylor Francis	2	2	2
Total	182	57	21

3 Results & Discussions

The sports sector is a growing industry that needs to monitor periodically. Key areas of conceptual knowledge related to sport science issues consist of training, nutrition, capability athlete, etc. (Dieffenbach, Thompson, and Zakrajsek 2011). Therefore, it is important to improve the comprehension of winning strategy and performance in the competition. Data-oriented aspects can effectively support the requirement that suitable. Traditionally, methods to measure performance analysis drive this research to discrete performance measuring indicators towards correlational or probabilistic approaches. However, this phenomenon pushes the organization to realize that it's urgently to merge conceptual knowledge with the specific theoretical and technical knowledge of the sports science because if the organization has limited knowledge about the understanding of players condition that support the activities of players and team strategy. Therefore, this study focused to identify dimensional success factors to build sports science generally. In this result, we can get a demographic and trend characteristics of selected literature, that consist of a source of publications,

year of publications, classification of variable component, and mapping of dimensional success factors. In Table 2, we can see the distribution of the literature for the systematic literature process. Most of them come from journal publications. Currently, sports science research still lacking, it is difficult to get the article in the match subject of sports science.

Table 2 Source of Publications

No	Title	Typ	Year
1	Nurturing Sport...(Baker et al. 2003)	J	2003
2	Critical...(Ramos 2017)	J	2017
3	The Critical...(Elango, Dowpiset, and Woranet 2019)	J	2019
4	Australian...(Sotiriadou and Shilbury 2009)	J	2009
5	An analysis...(Yoon and Kim 2017)	J	2018
6	A proposed...(Baker, Wattie, and Schorer 2019)	J	2019
7	"It's not...(Sandardos and Chambers 2019)	J	2019
8	Decision...(Kaya 2014)	J	2014
9	Physical...(Richard, Mwisukha, and Muniu 2014)	J	2014
10	Environment...(Dogra 2014)	J	2014
11	Service...(Sauer, Spradley, and Cromartie 2017)	J	2017
12	Coaching...(Islam et al. 2019)	J	2019
13	The Athlete...(Xin and Fitriana 2020)	J	2019
14	Performance...(Lago-Ballesteros and Lago-Peñas 2010)	J	2010
15	Machine...(Kusmakar et al. 2020)	J	2020
16	Sports science...(Martindale and Nash 2013)	J	2013
17	Sports science integration...(Balagué et al. 2017)	J	2016
18	Use of Sports...(Kilic and Ince 2015)	J	2015
19	The influence...(Si et al. 2015)	J	2014
20	Research...(Liu et al. 2011)	C	2011
21	Artificial...(Chu et al. 2019)	J	2019

After rigorous review, we can identify the variable and dimensional for sport science that can be used to implement the sports science system. Table 3 is the classification of dimensional success factor results. The expertise in sport is determined by the successful interaction of biological (physical), psychological, and sociological (environment) variables (Baker et al. 2003). Every

variable identifies the dimensional factor as the measurement, which provides the chance to study a variety of strategies in sport (Kaya 2014).

Table 3 The Classification of Dimensional Success Factor

Variable	Dimensional	Literature
Physical	Body Shape	(Richard, Mwisukha, and Muniu 2014)
	Maturational	(Baker et al. 2003)
	Nutrition	(Kusmakar et al. 2020)
	Physical Training	(Kusmakar et al. 2020)(Martindale and Nash 2013)(Balagué et al. 2017)(Chu et al. 2019) (Baker et al. 2003)(Sandardos and Chambers 2019)(Islam et al. 2019)
	Practical application and relevance	(Kusmakar et al. 2020)(Martindale and Nash 2013)(Liu et al. 2011)
Environment	Parental	(Baker et al. 2003)
	Expert Coach	(Elango, Dowpiset, and Woranet 2019)(Kilic and Ince 2015)
	General School and Sport System	(Ramos 2017)(Sotiriadou and Shilbury 2009)
	Cultural	(Baker et al. 2003)(Ramos 2017)(Sotiriadou and Shilbury 2009)(Baker, Wattie, and Schorer 2019)(Kilic and Ince 2015)(Si et al. 2015)
	Tradition of Success	(Ramos 2017)
	Political System	(Ramos 2017)
	Naturalization	(Ramos 2017)
	Social Factors	(Elango, Dowpiset, and Woranet 2019)(Baker, Wattie, and Schorer 2019)(Kusmakar et al. 2020)
	Family Support	(Xin and Fitriana 2020)
	Academic Demands	(Richard, Mwisukha, and Muniu 2014)
Sport Psychology	Influence of media	(Xin and Fitriana 2020)
	Funding	(Elango, Dowpiset, and Woranet 2019)(Kilic and Ince 2015)
	Agenda	(Sandardos and Chambers 2019)
	Freedom to choose	(Richard, Mwisukha, and Muniu 2014)
	Experience	(Sandardos and Chambers 2019)
	Tactical & Technical	(Kaya 2014)(Lago-Ballesteros and Lago-Peñas 2010)(Kusmakar et al. 2020)
	Physiology	(Balagué et al. 2017)(Si et al. 2015)
	Biomechanics	(Balagué et al. 2017)
Sociology	Sociology	(Balagué et al. 2017)
	Relationship	(Sandardos and Chambers 2019)

The mapping result appointed the most dimensional factor that consists of physical training, cultural, tactical & technical, and practical application. It means these factors have a more significant influence if sports organizations want to build a sports science system.

The role of physical training is always considered as a pivoting tool to enhance sports performance (Khan, Khan, and Abbas 2016). The physical training focuses on training/race and type of training/conditioning (strength, flexibility, the number of sessions, intensity, and total hours per week devoted to each type of training. Different from physical training, cultural sports has influence in the sports (Duda and Allison 1990)(Si et al. 2015). Cultural sport can minimize the cultural diversity in the group and can explore social differences between athletes. The design of the pattern of player correlation might be identified the tactical & technical behavior (Kusmakar et al. 2020). Based on the previous research, the practical application be the most important and direct relevance to be implemented in the sports organization (Martindale and Nash 2013). Collaboration with data analytics tools will provide a method to integrate all information that relates to the trainers or coaches (Ray et al. 2019). This condition might be due to physical train and sport sciences, which can be a motivation to the athlete more healthy and active lifestyle (López-Sánchez et al. 2020).

4 Implication & Conclusion

Currently, sports organizations should involve more business dimensions [3] [6]. The dimensional success factor aspects used during sports management are a good strategy to develop the behavior and performance of the athlete. About coaching, it is argued that sports science is a significant part of the knowledge to fulfill information for coaches to make an effective decision and to define initiatives [2]. The implication of the dimensional success factor has two perspectives, which is for theory and practice. As a theory, the dimensional success factor can be a reference for research in sport science in the future. From a practical perspective, these factors can be used to build a sports science application that can support sport organizations. However, no statistically significant measurement for the analyzed variable in this study. For this objective, it is important to define empirical research in sport science to identify new instruments and methodologies that give impact to sports organizations.

5 Acknowledgement

“This work is supported by Research and Technology Transfer Office, Bina Nusantara University as a part of Bina Nusantara University’s International Research Grant entitled “Decision Support Systems Pada Konsep Business Intelligent Untuk Meningkatkan Pengambilan Keputusan Pada Organisasi Sepak Bola Profesional” with contract number: No.026/VR.RTT/IV/2020 and contract date: 6 April 2020.”

References

- Baker, Joseph, Sean Horton, Jennifer Robertson-Wilson, and Michael Wall. (2003). “Nurturing Sport Expertise: Factors Influencing the Development of Elite Athlete.” *Journal of Sports Science and Medicine* 2(1): 1–9.
- Baker, Joseph, Nick Wattie, and Jörg Schorer. (2019). “A Proposed Conceptualization of Talent in Sport: The First Step in a Long and Winding Road.” *Psychology of Sport and Exercise* 43(December 2018): 27–33.
- Balagué, N., C. Torrents, R. Hristovski, and J. A.S. Kelso. (2017). “Sport Science Integration: An Evolutionary Synthesis.” *European Journal of Sport Science* 17(1): 51–62.

- Chu, William Cheng Chung et al. (2019). "Artificial Intelligence of Things in Sports Science: Weight Training as an Example." *Computer* 52(11): 52–61.
- Dieffenbach, K, Melissa Thompson, and R Zakrajsek. (2011). "The Coach Education Internship Experience: An Exploratory Study." *Int J Coach Sci* 5: 3–25.
- Dogra, Dr. Sharmila. (2014). "Environment and Sports." *IOSR Journal of Sports and Physical Education* 1(6): 19–20.
- Duda, Joan L, and Maria T Allison. (1990). "Cross-Cultural Analysis in Exercise and Sport Psychology: A Void in the Field." *Journal of Sport & Exercise Psychology* 12: 114–31.
- Elango, Dinesh, Kitikorn Dowpiset, and Chinnapha Woranet. (2019). "The Critical Success Factors That Should Be Games, Alternatives to Improve Thailand National Swimming Sport to Gain The Medals for The Olympic." *SSRN*: 1–20.
- Islam, Syed Zia-Ul, Salahuddin Khan, Alamgir Khan, and Samiullah Khan. (2019). "Coaching and Training as Influential Factor, Affecting Sport at Universities Level." *Pedagogics, psychology, medical-biological problems of physical training and sports* 23(3): 145–49.
- Kaya, Adem. (2014). "Decision Making by Coaches and Athletes in Sport." *Procedia - Social and Behavioral Sciences* 152: 333–38. <http://dx.doi.org/10.1016/j.sbspro.2014.09.205>.
- Khan, Wasim, Salahuddin Khan, and Syed Asif Abbas. (2016). "Effects of Psychological Factors on Sports Training: Evidences of Male Athletes." *International Journal of Scientific & Engineering Research* 7(5): 717–22.
- Kilic, Koray, and Mustafa Levent Ince. (2015). "Use of Sports Science Knowledge by Turkish Coaches." *International journal of exercise science* 8(1): 21–37.
- Kusmakar, Shitanshu et al. (2020). "Machine Learning Enabled Team Performance Analysis in the Dynamical Environment of Soccer." *IEEE Access* 8: 90266–79.
- Lago-Ballesteros, Joaquin, and Carlos Lago-Peñas. (2010). "Performance in Team Sports: Identifying the Keys to Success in Soccer." *Journal of Human Kinetics* 25(1): 85–91.
- Liu, Yu, Wei Jie Fu, Jun Liang He, and Xiao Jie Xiong. (2011). "Research Advancements of Compression Equipments in Sports Science." *Proceedings of the 2011 International Conference on Future Computer Science and Education, ICFCE 2011*: 110–13.
- López-Sánchez, G. F. et al. (2020). "Body Composition, Physical Fitness, Physical Activity and Nutrition in Polish and Spanish Female Students of Sports Sciences." *Science and Sports* 35(1): e21–28.
- Martindale, Russell, and Christine Nash. (2013). "Sport Science Relevance and Application: Perceptions of UK Coaches." *Journal of Sports Sciences* 31(8): 807–19.
- Ramos, Ralph. (2017). "Critical Factors Influencing International Sporting Success of the Philippines: The Athletes' Perspective." *Asia Pacific Journal of Sport and Social Science* 6(2): 143–59. <http://doi.org/10.1080/21640599.2017.1323820>.
- Ray, Tyler et al. (2019). "Soft, Skin-Interfaced Wearable Systems for Sports Science and Analytics." *Current Opinion in Biomedical Engineering* 9: 47–56. <https://doi.org/10.1016/j.cobme.2019.01.003>.
- Richard, Ndambiri K, Andanje Mwisukha, and Robert K Muniu. (2014). "Physical Factors That Influence Training and Performance of Female Athletes in Sports in Teacher Training Colleges in Central Region of Kenya." *International Journal of Sports Science* 4(3): 79–83.
- Sandardos, Stacey S., and Timothy P. Chambers. (2019). "'It's Not about Sport, It's about You': An Interpretative Phenomenological Analysis of Mentoring Elite Athletes." *Psychology of Sport and Exercise* 43(August 2018): 144–54. <https://doi.org/10.1016/j.psychsport.2019.02.003>.
- Sauer, Philipp, Brandon D Spradley, and Fred J Cromartie. (2017). "Service Personnel as a Key Success Factor in a Sports Environment." *Sport Journal*: 1.

<http://ezproxy.augusta.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=121933564&site=ehost-live&scope=site>.

- Si, Gangyan et al. (2015). "The Influence of the Chinese Sport System and Chinese Cultural Characteristics on Olympic Sport Psychology Services." *Psychology of Sport and Exercise* 17: 56–67. <http://dx.doi.org/10.1016/j.psychsport.2014.08.008>.
- Sotiriadou, Kalliopi (Popi), and David Shilbury. (2009). "Australian Elite Athlete Development: An Organisational Perspective." *Sport Management Review* 12(3): 137–48. <http://dx.doi.org/10.1016/j.smr.2009.01.002>.
- Xin, Tan Yan, and Mimi Fitriana. (2020). "The Athlete Performance Management: An Impact Of Self-Integrity, Family Supports And Social Media." *Journal of Education and Social Sciences* 12(February): 54–63.
- Yoon, So Won, and Sung Eun Kim. (2017). "Article An Analysis of Critical Success Factors on Hosting Professional Golf Tournaments Using Analytic Hierarchy Process - Korean Experts' Perspective." *International Journal of Sport Management and Marketing*.