International Journal of Sports Biomechanics (IJSB)
Volume 2, Issue 1, January-December 2024, pp. 1-10, Article ID: IJSB_02_01_001
Available online at https://iaeme.com/Home/issue/IJSB?Volume=2&Issue=1
Journal ID: 1523-5412, DOI: https://doi.org/10.5281/zenodo.14029515

SPORTS BIOMECHANICS FOR THE WORLD CUP 2026 USING DSPK

Prof. Samuel K. M. HO
Research Professor, Gratia Christian College, HKSAR.
Ex-Prof. & Speaker, Oxford U.; Ex-Research Fellow, Cambridge U

ABSTRACT

This paper explains how a problem-solving method based on Deming's ideas can be effective. It looks at a case study from 2006 when France lost to Italy, which is similar to what happened at the World Cup in 2022. The goal of this paper is to build on Dr. Deming's teachings for businesses and help countries aiming to win the World Cup in 2026, especially through sports science. The paper suggests a strategy to win the World Cup, especially if it goes to a penalty shootout. It also emphasizes that this approach can help improve team strategies by analyzing successful football teams and their opponents. Once the two key rules of the game are identified, coaches should have players practice shooting repeatedly—about ten times a day—until it becomes second nature. This practice will help players adjust their shooting positions naturally, increasing their chances of scoring. Additionally, to ensure consistent success, it is recommended to use an Artificial Intelligence (AI) platform that can analyze game footage for ongoing improvement (Kaizen).

Keywords: Sports Biomechanics, Deming's System of Profound Knowledge (DSPK), TQM, World Cup 2026, Penalty-shoot

Cite this Article: Ho, S. K. M. (2024). Sports Biomechanics for The World Cup 2026 Using DSPK. International Journal of Sports Biomechanics, 2(1), 1–10.
https://iaeme.com/MasterAdmin/Journal_uploads/IJSB/VOLUME_2_ISSUE_1/IJSB_02_01_001.pdf

1. INTRODUCTION

With the growing focus on total quality management (TQM), the success of businesses increasingly depends on effective management skills, especially in problem-solving. A "total quality system" does not mean that problems won't happen; rather, it acknowledges that working conditions constantly change in both the local and broader environment. Organizations need to adapt by using their systems, structures, and skills. Prevention, or quality assurance, is an advancement in total quality that comes from problem-solving experience and is based on Dr. Edward Deming's Plan-Try-Check-Act (PTCA) cycle. It's important to note that in the early 1950s, when Dr. Deming taught his "PDCA" cycle to about 40 CEOs in Japan—who were then responsible for half of Japan's GDP—the term "Try" was incorrectly translated as "Do."

This misinterpretation changed the original meaning, making PTCA a more accurate term than PDCA, which some interpreted as “Please Don’t Change Anything.”

Before solving a problem, several preliminary steps are needed to identify the most important issue. This process starts with understanding the situation when the problem arises. Next, all aspects of the problem are explored through brainstorming. After that, the problems are prioritized based on their severity. By the end of this process, we should clearly identify the most significant problem that needs immediate attention. These steps align with Deming's system of profound knowledge.

2. DEMING'S SYSTEM OF PROFOUND KNOWLEDGE (DSPK)

A common mistake managers make is jumping into decision-making right after recognizing a problem. They often overlook understanding the root cause, which can lead to wasted effort. Sometimes this might only make the situation slightly better, but it can also make the problem worse. The key point in problem-solving is that you cannot solve a problem without knowing its cause. This principle is best explained by the DSPK, which outlines four related parts, as described below.

2.1. Appreciation for a System

This highlights the importance of understanding how different functions and activities are connected. Everyone in the organization should recognize that the long-term goal is for all parties to benefit—employees, shareholders, customers, suppliers, and the environment. If this goal is not met, everyone in the system suffers. It's crucial for those who can influence the system's performance to grasp both the obvious interconnections and the less obvious ones. Not all effects can be predicted just by looking at the causes briefly.

2.2. Knowledge of Statistical Theory

This understanding should cover several key concepts, including the nature of variation, process capability, control charts, interactions, and loss functions. Knowing these elements is essential for achieving effective leadership and teamwork. As Dr. Deming emphasized:-

****

There is no such thing as a fact concerning an empirical observation ...

****

There are two types of variation: special causes and common causes:

Special causes are factors that prevent a product, process, or service from performing consistently. These can often be traced back to specific changes, like a different operator, shift, or procedure. Local operators can usually identify and sometimes eliminate these special causes.

Common causes, on the other hand, arise after special causes have been addressed. They stem from the design or operation of the process or system itself, such as poor design or inadequate equipment. While operators may recognize common causes, only management can eliminate them since they result from systemic issues.

Dr. Deming believed that managers who do not understand the difference between these two types of variation could worsen problems. He estimated that management is responsible for up to 94% of potential improvements related to common causes. Many losses go unnoticed, unrecognized, or even suspected.

2.3. Theory of Knowledge

All plans rely on predictions based on past experiences. You can't successfully replicate a successful example without understanding the underlying theory. For instance, no measurement can provide an absolute value; the results can change if the procedure is altered. In an unstable system, predictions are impossible. Even in a stable system, there is variation, and predictions are made using control limits. There is a significant difference between the past and the future when trying to determine the best course of action.

Interpreting data from tests or experiments involves making predictions, which depend on a solid understanding of the subject, not just on statistical theory. Theory helps us make predictions, and without predictions, experiences and examples won't provide useful lessons. There is no such thing as a fact concerning an empirical observation. Any two people may have different ideas on what it is important to know about any event, and hence what to record concerning anything which has happened. In this situation, there is no meaning for "Get the facts!"

2.4. Knowledge of Psychology

Understanding human interactions is essential. Leaders should leverage the differences among people to optimize performance. Many individuals are driven by intrinsic motivation and are eager to succeed. However, relying too heavily on extrinsic motivation, such as performance-based pay or grading, can stifle this intrinsic drive. When excessive external rewards are used, they can diminish the enjoyment of work and learning. Management should focus on nurturing intrinsic motivation to foster innovation, improvement, and joy in both work and learning.

3. LITERATURE REVIEW

Ho and Cicmil (1996) developed a systematic approach to problem-solving called the S-S problem-solving method, which they applied to penalty shoot-outs—a critical moment in cup competition football matches. For instance, in the 1990 World Cup semi-finals, England lost to West Germany in a penalty shoot-out, and Italy faced a similar defeat against Brazil in the 1994 World Cup final. Smith (2015) discusses how Deming's system of profound knowledge can be used by soccer teams to improve performance and decision-making during the World Cup, emphasizing the need to understand systems and manage variation in player performance. Li (2017) explores how Deming’s principles can boost the operational effectiveness of sports teams, providing examples from World Cup experiences to illustrate successful applications. Tan (2018) focuses on strategic management practices in sports, highlighting the relevance of Deming’s principles in achieving excellence in competitions like the World Cup.

Johnson (2018) investigates how applying Deming’s principles in sports management, particularly through a systems approach, can lead to better outcomes in high-stakes tournaments like the World Cup. Thompson (2019) examines the integration of Deming’s system of profound knowledge in managing sports teams, showcasing case studies from World Cup preparations and results. Clarke (2020) analyzes how Deming’s principles can assist sports teams in developing effective strategies and improving team dynamics, especially in the context of World Cup competitions. Chan (2021) highlights the application of Deming’s system in football management, stressing the importance of quality improvement processes during World Cup campaigns. Lim (2022) discusses how soccer teams can implement Deming’s system of profound knowledge to enhance their competitive strategies and performance metrics in World Cup scenarios.

4. CASE STUDY – I : THE 2006 WORLD CUP FINAL

According to the author, in penalty shooting, there are two rules that can be deduced from the DSPK.

Rule-1: To maximize the chances of scoring, it's crucial to aim for areas of the goal that are out of the goalkeeper's reach. Football regulations state that the goalkeeper must remain in the center of the goal and cannot move until the penalty shooter strikes the ball. Therefore, the best target areas are along the inside edges of the goalposts, ideally higher up, as long as the ball stays below the crossbar. In short:

- Aim for the upper corners near the goalposts.
- Ensure the shot stays below the crossbar.
- Target areas that are out of the goalkeeper's reach.

MUST aim at 0.5m near-post (on either side) at 1.5m above ground.

On the other hand, the penalty shot has a clear starting point—12 yards from the goal—and the only person involved is the goalkeeper. Since the goalkeeper cannot move until the shooter makes contact with the ball, only the shooter influences the outcome of the shot. This leads to Rule-2:

Rule-2: the shooter should assume that there is no goal-keeper and even nobody at all in the field, and concentrate on shooting the ball into the positions defined as the best by Rule-1. In short:-

MUST assume that there is NO Goal-keeper.

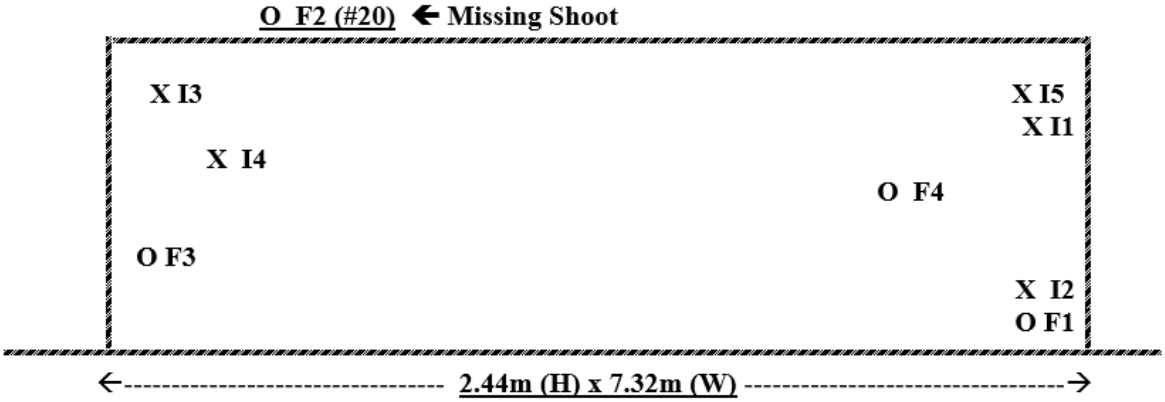
The proof of these two Golden football penalty-shoot rules using the DSPK is as follow.

Table-1: Score Table of Penalty Shoot-out

-- World Cup final 2006: Italy versus France

Team	Goal	Player	Results & Analysis
Italy (shot 1st)	I1	Pirio Materazzi	In
	I2	De Rossi Del	In
	I3	Piero Grosso	In
	I4	Gennaro Gattuso	In
	I5	Fabio Cannavaro	In
			WON World Cup – 2006
France	F1	Sylvain Wiltord	In
	F2	David Trazequet	*Hit the Cross-bar, not following **Rule-1.***
	F3	Eric Abidal	In
	F4	Willy Sagnol	In

Figure-1: Approximate positions of penalty shoot-out goals
– World Cup Final 2006: Italy (**I**) versus France (**F**)



NOTE: All 8 scores basically follow **Rule-1**.
(The BEST position is around **1.5m** above ground and **0.5m** near-post on either side.

Let us try to find out what could be the outcome if the DSPK was followed. In our case, it is argued that the missed shots are unwanted effects which are due to common causes.

4.1.. Applying Deming's System of Profound Knowledge

Let us see how the four steps of the DSPK can help to solve the World Cup match problem discussed above:

(A). Appreciation for a System

During a penalty shoot-out, every World Cup player should recognize that their performance affects the team's overall success. Therefore, they need to follow the team's requirements by strictly adhering to Rules 1 and 2. However, optimizing one player's performance can be easier than optimizing the entire team system. Some players may choose to act independently to showcase their skills and stand out, which can provide intrinsic rewards and boost their motivation. While this approach might seem beneficial, it can actually create barriers to genuine progress, as focusing on individual performance can harm overall team dynamics.

In World Cup matches, common causes of failure may stem from variations in players' abilities to hit their targets during penalty shoot-outs. Since these players are among the best in their countries, the impact of common causes should be minimal. Yet, mistakes often arise when players do not adhere to Rules 1 and 2. This can be attributed to a lack of rigorous training emphasizing the importance of following these rules closely.

(B). Knowledge of Statistical Theory

If you plot a normal distribution of goals scored over 100 matches, you'll find that 95% of the goals are approximately 0.5 meters from the post, with a standard deviation of 0.4 meters. This highlights the importance of the horizontal positioning of the ball when crossing the goal line. For the vertical position, the ball must be placed beyond the goalkeeper's reach, regardless of how high he jumps. Additionally, there should be less than a 5% chance of the ball sailing over the crossbar. Therefore, a vertical height of 1.5 meters is ideal for a goal that is 2.4 meters high.

(C) Theory of Knowledge

In football matches, particularly in high-stakes competitions like the World Cup, the coach should focus on creating a stable system that allows players to predict the outcomes more reliably. This stability can be achieved through effective strategies and tactics, relying on the skills and training of the team members while adhering to the two rules outlined in this paper.

(D) Knowledge of Psychology

In a World Cup match, the coach must deeply understand how pressure affects players, especially during penalty shoot-outs. His goal is to ensure that all shooters focus on following Rule-1 and remain unaffected by the goalkeeper's movements. Ideally, players should mentally assume there is NO goalkeeper (refer to Rule-2).

Based on this analysis, the coach's responsibility is to train players to reach peak performance. A crucial part of this training involves having the team practice Rule-1 repeatedly—up to a hundred times a day—without a goalkeeper in the goal (as per Rule-2). While this approach may seem simple, it is effective. According to Deming (1993), this is what management is about: minimizing variations caused by common factors.

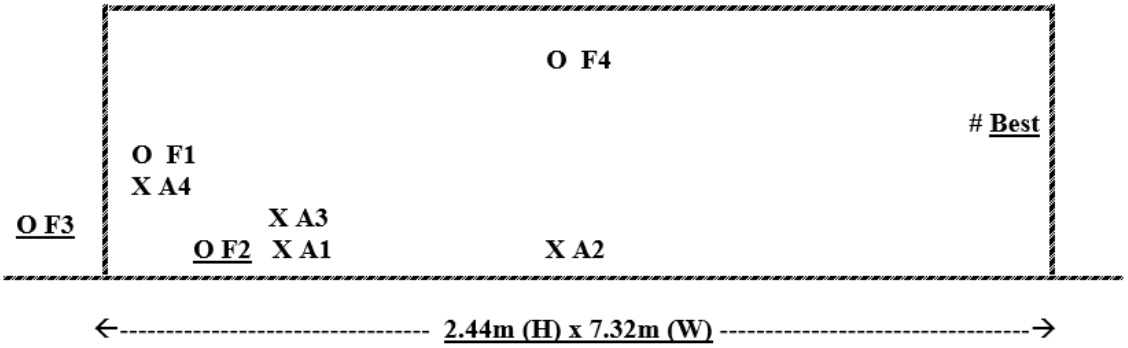
5. CASE STUDY – II : THE 2022 WORLD CUP FINAL

Table-3: Score Table of Penalty Shoot-out

-- World Cup final 2022: Argentina versus France

Team	Goal	Player	Results & Analysis
France (shot 1st)	F1	Kylian Mgappe	In – **Sure make** (+), as despite the Goal-keeper touched the ball, it still went straight in.
	F2	Kingsley Coman	Ball caught – too low *(**Failed Rule-1**: Kingsley did not aim at the Middle of the near post, but rather near the ground.)*
	F3	Aurelien Tchouameni	Ball flew left off-side *(**Failed Rule-2**: Randal was scared of the goal-keeper, and kicked the ball off-post.)*
	F4	Randal Kolo Muani	In – By **luck**, as there is a fair good chance to over-shoot the ball.
Argentina	A1	Lionel Messi	In – By **luck**, as the Goal-keeper moved to the wrong side initially, and was too late to revert and touch the ball.
	A2	Paulo Dybala	In – By **luck**, as the Goal-keeper over-shoot and cannot use his foot to kick out the ball.
	A3	Leandro Paredes	In
	A4	Gonzalo Montiel	In – **Sure make** (+).
			WON World Cup – 2022

Figure-3: Approximate positions of penalty shoot-out goals
– World Cup Final 2022: Argentina (**A**) versus France (**F**)



NOTE: Underlined balls indicate missed shots.

\# Shows the **Best** position to shoot Penalty (**1.5m** above ground and **0.5m** near-post on either side). In fact, this is the position that Mbappe aimed at, even at his 2 penalty kicks during the match. So, despite his team did not manage to score the World Cup 2022, he truly deserved to be given the Gold-Boot Award by FIFA.

NOTE: It appears to be a trend that most penalty shooters tend to aim for the left side of the goal (excluding the center). As a result, the goalkeeper should always be prepared to lean toward his right side to intercept the ball effectively.

6. LESSONS FROM THE WORLD CUP EXPERIENCE

We have to learn from the mistakes that others make. We can't live long enough to make them all ourselves.

(W. Edwards Deming)

DSPK focuses on the variation in processes within a system of human activities. To gain a deeper understanding of the variations in two World Cup matches, it's useful to analyze the positions of successful goals. The average distance from the post is approximately 1 meter, with a standard deviation of 0.4 meters. At this standard deviation, the ball would likely be inside the goal with a 95% confidence level. This shows that if players follow proper training and eliminate common causes through a good management system, they can reliably place the ball in the target area of the goal. This statistical analysis lays the groundwork for a robust monitoring and training program, making control charts for penalty shoot-outs a practical tool. An essential goal for national team coaches is to learn from the insights gained through sports science from World Cup experiences.

While this paper suggests a strategy for winning the World Cup, especially during penalty shoot-outs, similar reasoning can be applied to overall team strategies by analyzing the best practices of the last World Cup winner and their opponents. Additionally, it's crucial for managers to learn from the lessons discussed in the World Cup experience. Based on DSPK and the case studies, the key lessons for managerial problem-solving can be summarized as follows:

- The cost resulting from a problem can be enormous.
- We must acquire the actual experience of solving problems.
- The DSPK is an effective method for problem solving.
- Problems can be solved readily after the common causes are identified.

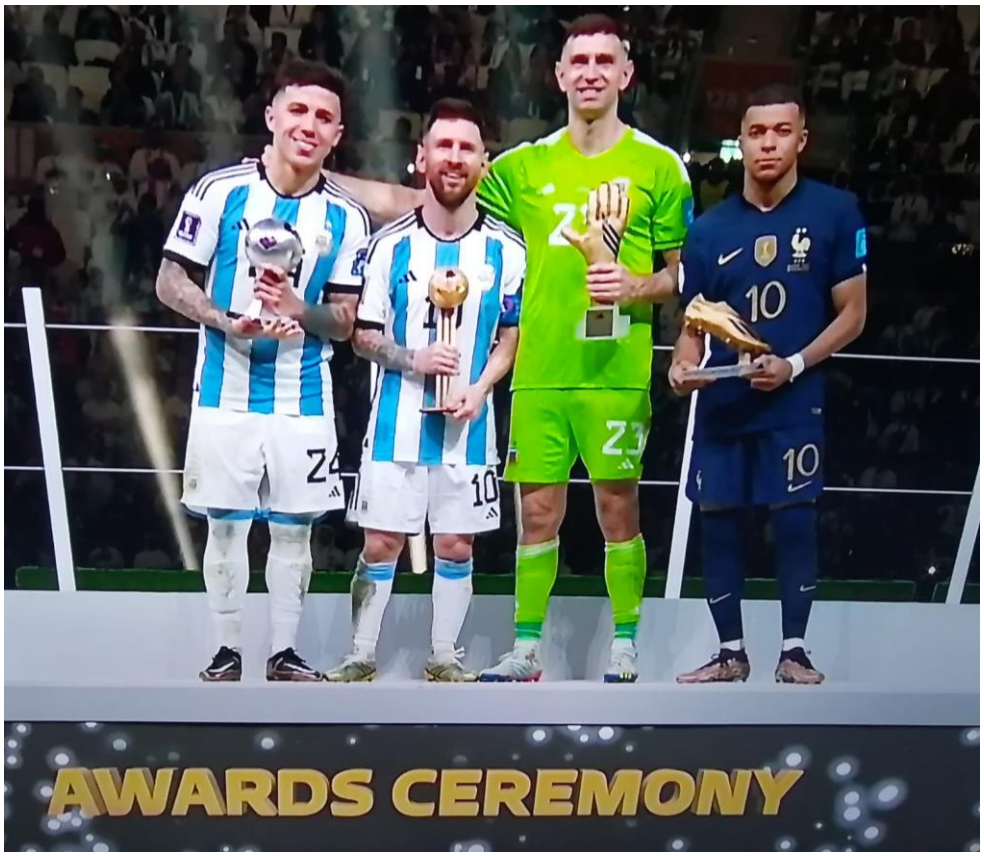
We need to develop a plan that prevents future problems from happening again. Therefore, this paper aims to build on Dr. Deming's teachings for business management in general, with a specific focus on countries aspiring to win the World Cup in 2026. To ensure repeatability and success, it is suggested that the two golden rules based on the DSPK for penalty shots be programmed into an Artificial Intelligence (AI) graphical platform. This platform can capture live images for analysis and continuous improvement, a concept known in Japan as "Kaizen." It can actively monitor the process and the psychological behavior of players during penalty shots. Furthermore, even during regular shooting, players should strive to aim for the designated targets as outlined in Rule-1 whenever possible.

7. CONCLUSION

This article began by discussing how the DSPK can be applied to problem-solving, highlighting its effectiveness in identifying root causes. Two case studies from the World Cup matches in 1994 and 2022 were examined using the DSPK to systematically analyze the situations and uncover common causes. The findings support the two rules proposed for penalty shoot-outs in football, emphasizing that all players must adhere to them. It was suggested that with careful training, this prescribed behavior can be implemented without undermining players' intrinsic motivation. Once the two golden rules are identified, the coach should train all frontline players to practice repeatedly—around ten times a day—until their shooting becomes second nature. This practice will also help players automatically adjust their shooting positions according to Rule-1 during regular shooting, increasing their chances of scoring.

The experiences from the two World Cup matches demonstrate how the DSPK can foster a culture of learning within organizations. As Dr. Deming said, "**Learning is Exciting, Fun.**" This learning is especially important for countries aiming to win the World Cup in 2026. By leveraging the DSPK through a graphic AI Kaizen platform as a training tool, these countries can turn their dreams into reality. Ultimately, this AI tool could serve as a "Going-for-Gold" resource for football players, including those preparing for WC-2026. Furthermore, this AI approach can be adapted to other business environments where achieving key performance indicators is crucial.

EPILOGUE



According to DSPK, we can come to the following observations (need more proof):-

1. If you want to be the BEST Goal-keeper, you should be around 2m high.
2. If you want to be the BEST Footballer, you should be less than 1.7m high.
3. If you want to be the BEST Goal-scorer, you should wear #10 uniform.
4. If you want to gain a FIFA Personal Award, you name must begin with 'M' *(including: Messi, Mbappe, Martinez & Maradona)*
5. If you want to win the World Cup, you should follow the Rule-1 & 2 in this paper.

REFERENCES

[1] Chan, P. (2021). Quality Management in Football: Insights from Deming's Philosophy. *HKU Sports Journal.*

[2] Clarke, L. (2020). Deming's Influence on Team Dynamics in Sports. *Cambridge Journal of Sports Science*.

[3] Deming, W. E. (1993), The New Economics for Industry Government, Education, Massachusetts Institute of Technology, Center for Advanced Engineering Study Boston, MA, 1993

[4] Ho, S.K.M. & Cicmil, S. (1996). Can the S-S problem-solving method help to win the World Cup? *Management Decision Journal*, 34/2 [1996] 53–58, UK.

[5] Johnson, A. (2018). Managing Quality in Competitive Sports: A Deming Perspective. *MIT Sloan Management Review*.

[6] Li, S. (2017). Applying Deming's System of Profound Knowledge to Sports Teams. *CUHK Business Review.*

[7] Lim, J. (2022). The Role of Quality Management in Sports: A Case Study of the World Cup. *NTU Journal of Management.*

[8] Neave, H. R. (1990), The Deming Dimension, SPC Press Knoxville, TN, 1990, p. 72.

[9] Smith, J. (2015). Quality Management in Sports: Applying Deming's Principles to World Cup Strategies. *Harvard Business Review.*

[10] Tan, W. (2018). Strategic Management in Sports: Deming's Quality Principles at Work. *NUS Business Review.*

[11] Thompson, R. (2019). The Intersection of Quality Management and Sports Performance: Lessons from Deming. *Journal of Sports Management*, Oxford University Press.

ABOUT THE AUTHOR

Samuel K. M. HO 0000-0002-8102-1481 -- Research Professor at the Gratia Christian College (GCC) in the HKSAR. As an ex-Research Fellow in TQM at Cambridge U., and Guest Speaker in Lean Mgt. at Oxford U., he was also Visiting Professor in TQM at Coventry, Paisley, RMIT, Linnaeux, NUS, HKU, CUHK, HKBU, PKU, THU & SYSU.

FUNDING DECLARATION

There is NO funding involved.

DECLARATION OF CONFLICTING INTEREST

The author declares NO conflict of interest. There are no other third parties in the design of the study, in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

ACKNOWLEDGEMENTS

There is NO need for Acknowledgements.

Citation: Ho, S. K. M. (2024). Sports Biomechanics for The World Cup 2026 Using DSPK. International Journal of Sports Biomechanics, 2(1), 1–10

Abstract Link: https://iaeme.com/Home/article_id/IJSB_02_01_001

Article Link:
https://iaeme.com/MasterAdmin/Journal_uploads/IJSB/VOLUME_2_ISSUE_1/IJSB_02_01_001.pdf

✉ **editor@iaeme.com**