



Sports mega event legacy: a proposed measurement of Brazil 2014 FIFA World Cup™ Arenas

Legado de megaeventos deportivos: medición propuesta de Arenas de la Copa Mundial FIFA™ Brasil 2014

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Abstract

Introduction: Measuring the legacies of mega sporting events has been the subject of constant research, but few studies investigate the effects of post-event legacies longitudinally. Therefore, seeking to measure the legacy of the 2014 FIFA World Cup Brazil™ represents a timely gap in the field of science.

Proposed questions: “Is it possible to measure the legacy of Brazilian arenas?” “Are there parameters and indicators capable of measuring the legacy of Brazilian arenas?” and “Could sports make it possible to measure the legacy of arenas by providing their own numbers and information?”.

Method and approach: Essays are formal, dialectical, and analytical scientific works that are theoretically based and lead to conclusions. The approach used here can be defined as the organized presentation of the studies conducted and the original conclusions reached.

Results and Discussion: Qualitative parameters: definition of legacy, sport mega event, type of legacy, competition, period, database for comparison, gross or net legacy. Quantitative indicators: financial results, average attendance, average ticket, occupancy rate, sportive usage and real estate appreciation.

Conclusion: The critical analysis conducted in this study developed qualitative parameters and quantitative indicators capable of measuring the legacies of the 2014 FIFA World Cup Brazil™ venues, using figures produced by the sport itself. It is hoped that these parameters and indicators can be tested and applied to World Cup venues in Brazil, serving as a validated protocol for measuring legacies, thus contributing to the management of sport and society.

Keywords

Arenas; indicators; measure; parameters; protocol.

Resumen

Introducción: La medición del legado de los megaeventos deportivos ha sido objeto de constante investigación, pero pocos estudios investigan longitudinalmente los efectos del legado. Por lo tanto, intentar medir el legado de la Copa Mundial de la FIFA Brasil 2014™ representa una brecha oportuna en el campo de la ciencia.

Preguntas propuestas: “¿Es factible medir el legado de los estadios brasileños?” “¿Existen parámetros e indicadores que permitan cuantificar el legado de los estadios brasileños?” “¿Podría el deporte permitir la medición del legado de los estadios proporcionando sus propias cifras e información?”

Método y enfoque: Ensayos son trabajos científicos formales, dialécticos y analíticos con base teórica que conducen a conclusiones. El enfoque utilizado puede definirse como la presentación organizada de los estudios realizados y las conclusiones originales alcanzadas.

Resultados y discusión: Parámetros cualitativos: definición de legado, megaevento deportivo, tipo de legado, competición, período, base de datos comparativa, legado bruto o neto. Indicadores cuantitativos: resultados financieros, asistencia promedio y venta de entradas, tasa de ocupación, uso deportivo y plusvalía inmobiliaria.

Conclusión: El análisis crítico realizado en este estudio desarrolló parámetros cualitativos e indicadores cuantitativos capaces de medir el legado de las sedes de la Copa Mundial de la FIFA Brasil 2014™, utilizando cifras generadas por el propio deporte. Se espera que estos parámetros e indicadores puedan probarse y aplicarse en las sedes de la Copa Mundial en Brasil, sirviendo como un protocolo validado para la medición de legados, contribuyendo así a la gestión del deporte y sociedad.

Palabras clave

Arenas; indicadores; medida; parámetros; protocolo.

Introduction

Sports mega events (SMEs) legacies are the object of multifaceted scientific studies, particularly in areas involving Sports Management, Tourism and the Environment (Niebles Nuñez, et al., 2023; Reis et al., 2023). With each country or city(ies) receiving SMEs, new research emerges, revealing criticisms, calculations, contestations and theories, generating favorable and unfavorable positions on these legacies' results (Bondarik, 2018; Byers et al., 2020; Cottle, 2014; DaCosta et al., 2008; Damo and Oliven, 2013; Kassens-noor et al., 2015; Miranda et al., 2025; Paiva, 2018; Preuss, 2008; Reis, 2017; Reis et al., 2019; Reis, Triani et al., 2019; Reis et al., 2021; Reis et al., 2023).

Brazil became an exponent after hosting back-to-back SMEs, including the Rio 2007 Pan-American Games, Rio 2011 Military World Games, Brazil 2014 FIFA World Cup™, Rio 2016 Olympic and Paralympic Games and the 2019 and 2021 CONMEBOL Copa America (DaCosta et al., 2008; Reis, 2017, Reis et al., 2021; Reis et al., 2023). There are many questions regarding legacies in this context.

The Brazilian government created a pre-event matrix of responsibilities containing approximately 130 infrastructure works but did not deliver them all before the event occurred (Ministério do Esporte, 2014; Paiva, 2018). Item B of this matrix – “Stadiums” – contained the World Cup arenas: 1) Amazônia Arena: Manaus, State of Amazonas/AM; 2) Castelão Arena: Fortaleza, State of Ceará/CE; 3) Pernambuco Arena: São Lourenço da Mata, State of Pernambuco/PE; 4) Dunas Arena: Natal, State of Rio Grande do Norte/RN; 5) Fonte Nova Arena: Salvador, State of Bahia/BA; 6) Mané Garrincha National Stadium: Brasília, Federal District/DF; 7) Pantanal Arena: Cuiabá, State of Mato Grosso/MT; 8) Mineirão: Belo Horizonte, State of Minas Gerais/MG; 9) Maracanã: Rio de Janeiro, State of Rio de Janeiro/RJ; 10) Corinthians Arena: Itaquera, State of São Paulo/SP; 11) Baixada Arena: Curitiba, State of Paraná/PR; and 12) Beira-Rio: Porto Alegre, State of Rio Grande do Sul/RS. This essay considered the twelve arenas as part of the event's tangible legacy, delivered and available for use by the Brazilian population.

Reis et al. (2023) mentioned that theoretical and practical studies seek to measure SME legacies, although few studies investigated their tangible legacy. Conversely, Preuss (2008, 2013) stated that few studies investigate the effects of post-event legacies longitudinally. Similarly, Scheu et al. (2019) clarified that there are few empirical and experimental studies measuring SME legacies. Preuss (2007) believed it possible to measure SME legacies, though it requires knowledge and clear definitions from the researcher. Thus, investigating or measuring the legacy of the Brazil 2014 FIFA World Cup™ was a viable research gap.

Considering this, there was the opportunity to conduct an analysis, produce reflections, concepts and knowledge through an essay focusing on the matter (Meneghetti, 2011). According to Meneghetti (2011), essays do not focus on searching for true answers and statements, but on question(s) that lead the subjects to deeper reflections. Thus, the first question guiding this essay was: “Is it possible to measure the legacy of the Brazilian arenas?”. Second question: “Are there parameters and indicators capable of measuring the legacy of Brazilian arenas?”. Third question: “Would sport make it possible to measure the legacy of arenas through its own numbers and information?”.

Method

Essays are formal, dialectic and analytical scientific works that are theoretically based and lead to conclusions. They possess logical and reflective demonstration through the combination of strong arguments, a high level of interpretation and the researchers' considerations (Prodanov and Freitas, 2013).

To those expecting to encounter herein the systematized structure of a “standard” article, with introduction, methods, results, analysis, discussion and conclusions sections, we must explain that this will not occur. The approach used herein can be defined as the organized exposition of studies conducted and original considerations reached by the researchers after years of study and a rigorous examination of the subject (Prodanov and Freitas, 2013).

On one hand, writing an essay allows researchers to express themselves with more freedom in the defense of their points of view, positions and/or propositions (Meneghetti, 2011; Prodanov and Freitas, 2013). On the other hand, it exposes the researcher's intellectual maturity, knowledge about the subject



and dialectical capacity regarding the essay's guiding questions (Meneghetti, 2011; Prodanov and Freitas, 2013).

Thus, to problematize the matter, based on bibliographical support and coherent arguments, this essay delves into the subject of measuring the legacy of Brazilian arenas.

Searching for Measurement Parameters and Indicators (Results and Discussion)

Understanding the Concepts

Around 1980 (Thomson et al., 2013), legacies appeared as one of the strong arguments for sustaining a high level of investments in return for possible benefits generated for the host during the post-event period, supporting one of the premises for holding SMEs (Getz, 2008). From that moment onwards, research about legacy intensified, unveiling original definitions, various viewpoints and case studies (Thomson et al., 2013).

Socioeconomic legacies from SMEs have been a constant research focus; however, these investigations occurred intermittently, focusing on impacts and legacies, due to the specificity and analyses conducted regarding the SMEs in question (Reis et al., 2023). Li and McCabe (2013) conducted a propositional analysis geared towards mega event legacies, presenting a measurement indicator structure that can be applied, especially considering socioeconomic legacies connected with tourism.

The authors followed a rationale, viewing legacies as tangible and intangible. The intangible part refers to levels of knowledge, the country's image, and the social benefits it acquires. Girginov and Preuss (2022) proposed a different definition, titled "intangible Olympic legacy", defined as an agglutination of attributes, interactions, processes and technology aiming to create public value for the whole community/society.

We believe the intangible part is guided by people. After all, the knowledge, technology, attributes, experiences, image perception and social benefits that are achieved reside in people, who recognize the legacy's public value upon reaping its benefits.

Reis et al. (2023) stated that measuring the intangible in academic research focuses on stratifying the perception of a certain group or segment. For example, Teixeira et al. (2023), focused on the motivation and expectations of people who worked in the Rio 2016 Olympic Games as a concept of legacy. Sorrentino et al. (2020) measured the experience and perception of visiting tourists at the Italy 2013 America's Cup World Series (sailing SME) through a structured questionnaire answered by the tourists present at the event. Dickson et al. (2015) studied the motivation levels of volunteers after the Sydney 2009 World Masters Games in Australia. Tichaawa, Swart et al. (2015) and Tichaawa, Moshoeshoe et al. (2015) examined the residents' perceptions regarding the socioeconomic legacies brought by the South Africa 2010 FIFA World Cup. Finally, Reis, Malina et al. (2019) conducted a study about the management and legacies of the Brazil 2014 FIFA World Cup during the pre-event stage. Thus, measuring the intangible requires techniques, methods, and analyses, with data stemming from people, from qualitatively determining their respective impressions, subject to memory and viewpoint.

To Li and McCabe (2013), the tangible part focused on induced tourism, stadiums and extra economic activities (commerce, shop openings, services, exportations, importations, etc.) that occur after the event is held. DaCosta et al. (2008) stated that tangible legacy is also represented by infrastructure work conducted in the country/city, such as ports, airports, roads, highways and Olympic villages. However, it is important to add that equipment purchased for the event that generates benefits for the population after the event is also a part of tangible legacy, such as equipment for public security (vehicles, security cameras and intelligence services), and information and communication technology (transmission antennas, optical fiber installation and an increase in broadband internet capacity).

Regarding the tangible part, the approaches are usually quantitative (Reis et al., 2023). Li and McCabe (2013) proposed measurements using the number of tourists received in the post-event period, per capita tourist expenses, economic growth and income distribution in the host country or city generated by the promotion of tourism activities. This data can be extracted through research and even demonstrated by the growth of tourism Gross Domestic Product (GDP).



In respect of sports facilities, there is an alert regarding the high cost of financing, maintaining and converting stadium activities for education or events, which constantly generates negative results (Li and McCabe, 2013; Preuss, 2007). However, the arenas' revenue can serve as an indicator, as well as direct and indirect jobs that were created and a possible increase in real-estate values in nearby neighborhoods due to stadium construction or renovation (Li and McCabe, 2013; Cardoso et al., 2024; Reis, 2017; Reis et al., 2021).

With reference to extra economic activities, Li and McCabe (2013) suggested using microdata (focused on a city or neighborhood) such as foreign capital invested post-event, exports or imports, and services and products acquired by companies pertaining to tourism. Thus, it appears that the analyses about tangible legacies reveal quantitative indicators, which are understood and perceived through indicators that are monetary or macro and microeconomic, or treated with other methods that enable quantification.

Holger Preuss sought to discuss, contextualize, investigate, analyze and propose techniques for measuring legacies through his studies (Preuss, 2007, 2008, 2015, 2018). To Preuss (2007), the definitions of legacy present in literature are mostly qualitative with few quantitative definitions. Thus, the author suggested understanding legacy through five dimensions: a) Planned or unplanned; b) positive or negative; c) tangible or intangible; d) Duration and time of structural alteration (for example: infrastructure and urban configuration work); and e) Space affected by altered structures (benefits and improvements to city image and the redevelopment of specific spaces, such as downtown Rio de Janeiro for the Rio 2016 Olympic and Paralympic Games).

Similarly, Gratton and Preuss (2008, p.4) indicated that "Legacy is planned and unplanned, positive and negative, intangible and tangible structures created through a sport event that remain after the event". Thus, we understand that the conceptual definition from literature is qualitative, with the possibility of using quantitative data to help with measurements to extract results.

Reflecting about Parameters and Indicators

The five dimensions considered by Preuss (2007) help to identify and measure "gross legacies" and "net legacies". Gross legacies would be observable if the location was empty and static, with no development in progress or simultaneous to that of the SME legacies. Net legacies result from the difference between what the host community would receive/develop without the event and what was produced/provided due to the event (Preuss, 2007).

Considering the city of Rio de Janeiro as an example: If the city did not host the 2014 FIFA World Cup, would Maracanã have received renovation investments? Reis (2017) responded that without the World Cup, the city would not have received these investments. Furthermore, regardless of the SME, the city would have obtained its gross legacy through its own development, whether through an urban development plan or through infrastructure work planned by the local government.

Net legacy refers to the socioeconomic impacts generated by infrastructure renovation and construction conducted due to the event. One manner of measuring net legacy would be through the occupancy rates of some of the arenas in Brazilian championship games during the post-event stage. If, hypothetically, the rate was 25% before the competition and, in the post-event stage (with the arena cleared for use), said rate increased to 40%, the net legacy would be a 15% increase in this indicator.

SMEs held at different times in the same city generate different legacies; and different SMEs held in the same city also generate different legacies (Preuss, 2007). Thus, it is valid to consider Maracanã Stadium as a legacy of the Brazil 2014 FIFA World Cup™, despite the hosting of the Rio 2016 Olympic and Paralympic Games and the 2019 and 2021 editions of the CONMEBOL Copa America. This is because the stadium was renovated and used for the World Cup (Reis, 2017).

To Preuss (2007), measurements can have two approaches. The first one is "top-down", considering macro data that helps to understand the microdata. After an SME, levels of tourism activity, exportations, employment rates, gross domestic product, or sales and services are measured for the next few years, serving as quantitative indicators. However, this measurement may not correspond to reality (Preuss, 2007). It would be pretentious to analyze pre- and post-SME economic data and assume that any changes are from the legacy. In this case, the quantified legacy generates out-of-date macro measurements.



The “bottom-up” approach involves conducting comparative analyses by using the city’s long-term urban development plan to discover whether the development that occurred would have been the same even without the SME (Preuss, 2007). However, due to it being a comprehensive plan, the estimates may include higher numbers and resource levels not stemming from SME legacies (Preuss, 2007). For example, the Maracanã stadium and its vicinity may be considered a micro sphere, but it would be unrealistic to consider quantitative data about jobs created in the city of Rio or even nearby neighborhoods as an exclusive legacy of the stadium.

Both approaches can generate data going beyond the SME’s context. For measurement purposes, Preuss (2007) suggested changing the focus to new activities, such as fairs, industries, habitation, tourism activities, conferences and events. It would not be a mistake to adopt bottom-up parameters or indicators that reflect the specific reality tied to Maracanã Stadium.

Considering the FIFA World Cup’s post-event stage, it would be viable to use indicators such as the amount of new visits to the stadium, its new occupancy rate for football matches, new income, new maintenance costs, new residences built in nearby neighborhoods, new industries or businesses providing the stadium with products or services, if there was property appreciation in nearby neighborhoods, and whether new direct and indirect jobs were created, especially on match days (Cardoso et al., 2024).

In the micro sphere, it is important to consider the numbers produced by football. In Brazil, Federal Law 10671/03 and Federal Law 14597/23 (General Sports Law) made it mandatory to publish the financial bulletin (“bordero”) for each match (Brasil, 2003, 2023). Using the data from the borderos may be a manner of measuring an SME’s legacy using the numbers produced by the sport, expressing a quantitative analysis at a micro level using the World Cup arenas.

Analyzing the financial bulletins generates automatic indicators of ticket sales income, net income (result) and spectator presence, enabling the calculation of other indicators such as average ticket price, average spectators and spectator occupancy rate. Essentially, it facilitates the extraction of the net legacy by using the numbers produced by the sport, even permitting the adoption of a sort of “database for comparison” considering previous editions of the competition.

Bondarik (2018) and Reis (2017) used federal data, confirming that Maracanã cost around 1.05 billion Brazilian reais (BRL). Hence, we believe it is possible to compare net profits from matches to the amount invested. For instance, the Brazilian championship match between Flamengo and Ceará, on September 9th, 2022, netted a 1.98 million BRL profit (CBF, 2022). Thus, theoretically, approximately 530 matches would be needed for the stadium’s payback to match its cost, without considering inflation and the present net value.

Straying from socioeconomic legacy measurement, Reis et al. (2021) created a quantitative metric by calculating the number of matches held at the Brazil 2014 FIFA World Cup™ arenas in national competitions. The results demonstrated a sportive usage index of $\cong 23$ Matches/year or $\cong 02$ Matches/month at the 12 world cup arenas. Therefore, it would be applicable to continue this line of thought as a validated protocol.

Reis et al. (2021) demonstrated that there are around 19 professional and amateur football competitions in Brazil. Considering its lengthy existence, history and format, the A Series (First division) Brazilian Football Championship could be a possible parameter. The championship follows the turn and returns system, involving 20 elite clubs. It is one of the Brazilian competitions with the highest number of matches (380), distributed throughout 8 months and occurring in all seasons (Reis et al., 2021).

Reis (2017) and Reis et al. (2021) stated that the construction work for the world cup arenas ended before the world cup and the Fonte Nova, Mané Garrincha, Maracanã, Castelão, Pernambuco and Mineirão arenas hosted the test event, the 2013 Confederations Cup. After the test event and before the FIFA World Cup, some arenas were used in Brazilian championship matches in the 2014 season, such as the Maracanã stadium between June 15th and July 18th, 2014. Afterwards, the arenas were used exclusively by FIFA in the FIFA World Cup, with the Brazilian championships restarting immediately following the event (Reis, 2017). Thus, Reis et al. (2021) measured the sportive usage index considering the matches held at the stadium during the 2014 season (excluding the world cup).

The world cup arenas possess an uncommon specificity: the equipment was delivered and made available for use before the main event. To reduce conflicting data, it is possible to adopt the same principle



as Reis et al. (2021), establishing the beginning of the selected period as the date of the first round of the Brazilian championship, April 19th, 2014 – Fluminense vs. Figueirense, confirming the 2014 season of the Brazilian championship as a parameter.

Proposing Parameters and Indicators

DaCosta et al. (2008), Preuss (2007; 2015; 2018), Li and McCabe (2013), Reis et al. (2021) and Reis et al. (2023) stated that measuring SME legacy is highly complex. Preuss (2007; 2015) suggested adopting guided parameters such as the type and scope of the legacy, time of the investigation, qualitative and quantitative data, a definition of perspectives, viewpoints and interests, selecting the type of measurement approach and adjusting it to the study's objective(s).

Parameters are understood as points used to understand, conceptualize and define the analyzed legacy, indicating the fundamental or limiting criteria for analyses, discussions and frameworks for conducting the measurement longitudinally. In this context, upon analyzing and reflecting about the content, table 1 proposes parameters for measuring the legacy of the Brazilian arenas.

Table 1. Parameters for measurement

Block	Points	Selection criterion
1	Terminology, definition and concept of legacy	"Legacy is planned and unplanned, positive and negative, intangible and tangible structures created through a sport event that remain after the event (Gratton and Preuss, 2008, p.4)."
	Sports mega event	Brazil 2014 FIFA World Cup™
	Planned/unplanned	Planned
	Tangible/intangible	Tangible
	Delivered/not delivered	Delivered
2	In use/not	In use and available to the host community
	Legacy macro sphere	12 arenas from the Brazil 2014 FIFA World Cup™
	Legacy micro sphere (specific)	Arena X and nearby neighborhoods (Example: Maracanã, neighborhoods in the Greater Tijuca area and the Maracanã neighborhood)
	Approach	Bottom-up – considering the micro sphere of the stadium and nearby neighborhoods
3	Competition	A Series Brazilian Football Championship (or another competition, depending on the arena's reality)
	Database for comparison	A Series 2009 Brazilian Championship
	Initial date	April 19 th , 2014
	Final date	To be determined by the researcher
	Gross legacy/net legacy	Net legacy

The parameters proposed in table 1 are meant as a framework for extracting the legacy. The first block, which includes points between "terminology/definition" and "in use/not" contains criteria that determine the legacy itself. As such, we believe that the first block's archetype can be adjusted for other studies that do not focus solely on the arenas as legacy.

The second block of parameters includes the points between the spheres of legacy and the type of approach, expressing the macro or micro dimension of the analyzed legacy. Normally, the micro sphere becomes the focus. This type of approach has to do with the selected sphere, thus avoiding numbers or values that could lead to an overbilling or high valuation of the indexes to be calculated, which could generate precipitated conclusions such as whether the increase in tourism activity or job creation in a certain host city occurred solely due to the arena's legacy. This reduces the margin of error.

The third block includes property and information about the sport itself, that is, the selected competition and its time. It is important to highlight that the final date is defined as "to be determined by the researcher" since said limit will vary according to each future study and its chosen period.

The existence of competition with a previous historical index provides researchers with a database for comparison for obtaining comparisons and precise numbers, enabling the calculation of the net legacy. As such, numbers produced and recorded by the Brazilian arenas before and after the world cup can be easily compared. The A Series Brazilian Championship of 2009 was used as a control reference.

Well-constructed parameters generate indicators, which are examined according to quantitative techniques and types of data. The indicators serve as metrics that can express the legacy that is the object of this study, generating new knowledge, analyses, and interpretations (table 2).

Table 2. Indicators

Block	Points	Selection criteria
1	Stadium income from spectators	Income obtained from selling match tickets (paying spectators)
	Financial results	Results obtained from the matches after deducting costs, fees and taxes
	Average attendance	Average spectator attendance per season
	Average ticket	Average ticket value
	Occupancy rate	Considering matches valid for the A Series Brazilian Football Championship
2	Sportive usage	Matches valid for the A Series Brazilian Football Championship
	Real estate valuation	Valuation of real estate in the neighborhood(s) near the arena

The proposed indicators intend to generate metrics about the legacy, attempting to specify the relations between positive and negative aspects, expressing the net legacy based on the database for comparison cited in Table 1. The importance of the indicators cited in block 1 of Table 2 is that they stem from and are produced by the sport itself, making it possible to discover whether there was an increase or decrease in the post world cup period and comparing the data with that of the database for comparison. Hypothetically, if the Beira-Rio stadium had an average financial result of 30 million BRL between the 2014 and 2023 seasons and in the control reference, the old Beira-Rio obtained a 27 million BRL financial result in the 2009 season, the net legacy would be 3 million BRL, an increase of approximately 11%. This same indicator can be expressed in the comparison between the analyzed period and the control (as per the example) or generate numbers through comparisons between the database for comparison and a specific season. Thus, the indicators can probably vary throughout the period in relation to individual calculations and comparisons.

Cardoso et al. (2024) highlighted the scarcity of studies about real-estate valuation due to the construction or renovation of sports arenas. Thus, considering block 2, we believe real-estate valuation can be calculated by comparing market prices or government indexes. For instance, let's say that in neighborhood X, near Baixada Arena, a house cost around 600 thousand BRL in 2022, but the average price in 2009 was around 650 thousand BRL. The result, a 50 thousand BRL decrease, around -7.7%. This same type of calculation can consider the valuation of the built-up square meters in the neighborhood, or the prices found in advertisements for similar real estate.

Thus, the set of proposed indexes generates the expectation of exact calculations that can reflect a reality within the micro sphere of legacy, revealing the net legacy and reaching the point of determining whether the result is positive or negative.

Intervening Variables Control

The practical implementation of the proposed parameters and indicators is inherently subject to events or phenomena that may impede the execution of the analytical model presented. Such occurrences are classified as intervening variables — elements that establish cause-and-effect relationships irrespective of the scope under examination. Nevertheless, we have identified specific cases and proposed methodological adjustments to facilitate future studies.

1) Treatment of arenas absent in the 2009 baseline

Arenas utilized during the 2014 FIFA World Cup in Brazil were either renovated or newly constructed (Reis, 2017). These can be categorized as follows:

Renovated Arenas (six): Beira-Rio (Porto Alegre), Arena da Baixada (Curitiba), Maracanã (Rio de Janeiro), Mineirão (Belo Horizonte), Arena Fonte Nova (Salvador), and Arena Castelão (Fortaleza), all of which had documented competitive activity in 2009.

Arenas Rebuilt from Predecessors (four): These were designed following the demolition of earlier structures between 2010 and 2011. Examples include Arena da Amazônia (Manaus), replacing Vivaldo Lima Stadium; Arena das Dunas (Natal), replacing João Cláudio de Vasconcelos Machado Stadium; Mané Garrincha (Brasília); and Arena Pantanal (Cuiabá), replacing José Fragelli Stadium, all of which had predecessor venues with competitive records in 2009.

Newly Constructed Arenas (two): Arena Corinthians (São Paulo) and Arena Pernambuco (São Lourenço da Mata), both characterized by entirely new architectural designs and lacking historical precedent. For arenas without antecedent venues, we propose two methodological alternatives: a) Establish the initial

analytical period from 2015 onward, based on the arena's match history; b) Utilize the club's prior stadium as a reference point - for instance, Corinthians utilized Estádio do Pacaembu and Parque São Jorge in 2009, both located in São Paulo.

2) Spectator Capacity Adjustments

Prior to the World Cup, Brazilian arenas calculated total capacity by combining seated and standing areas. In accordance with FIFA regulations, all World Cup venues were restructured to accommodate exclusively seated spectators (Reis, 2017). Temporary modular structures were employed in venues such as Arena Corinthians, Arena Fonte Nova, and Arena das Dunas, but were subsequently dismantled post-event. Consequently, there was a measurable reduction in stadium capacity between 2009 and 2014, which directly impacted metrics such as average attendance, ticket pricing, and occupancy rates. Reis (2023) adjusted the maximum stadium capacity in his study to reflect the highest recorded attendance. For example, the peak attendance at Maracanã during the 2009 Brazilian Championship was 78,639 — slightly below its current official capacity of 78,838.

Thus, we recommend calibrating the maximum capacity of each stadium under study to align with historical attendance records, thereby mitigating distortions and inaccuracies in the calculated indicators.

3) Fan Membership Programs

According to Leoncini and Silva (2005), fan membership programs constitute a service offered by football clubs encompassing entertainment, leisure, and the sale of exclusive or discounted products, including match tickets. These programs were operational in 2009 and undergoing expansion and professionalization, having been initially launched by clubs such as Internacional, São Paulo, and Palmeiras in 2000 (Aidar et al., 2002; Leal et al., 2017).

However, revenues generated through such programs are not reflected in match-specific financial statements; instead, they are recorded within the club's general balance sheet. As a result, these revenues are excluded from match-day financial analyses, contributing to a standardized framework for calculating indicators.

Nonetheless, should the researcher obtain access to the financial statements of clubs that own or operate the respective stadiums, it becomes feasible to incorporate these revenues into the broader analytical model.

4) Competition Format and Match Volume

The Brazilian Championship Series A and B are recognized as the first and second divisions, respectively (Reis, 2012; Reis et al., 2013). Despite their hierarchical distinction, clubs participating in either division, and utilizing the arenas do not experience variation in the number of matches played. Since 2005, both competitions have adhered to a consistent format: 20 clubs competing in a double round-robin system, totaling 380 matches per season (Reis, 2012).

Therefore, fluctuations due to promotion or relegation are statistically diluted, facilitating comparative analyses and the application of the proposed model. For stadiums that do not regularly host Series A or B fixtures — such as Arena da Amazônia, Arena das Dunas, Arena Pernambuco, and Mané Garrincha — local state championships or regional competitions may serve as viable data sources for comparative purposes.

5) Sporting Performance

A club's sporting performance is a critical variable influencing both revenue generation and stadium utilization; however, it remains beyond the scope of direct control (Reis et al., 2013). It is an aggregate factor intrinsically linked to ticket demand and pricing. Superior performance in each season typically results in elevated ticket prices and increased attendance, whereas poor performance yields the opposite effect.

To mitigate the volatility introduced by this variable, we recommend extending the study period based on the established comparison baseline. This approach ensures that performance fluctuations are incorporated and statistically diluted over time, thereby exerting minimal influence on the indicators.



For instance, Internacional, owner of Estádio Beira-Rio, despite its relegation in 2016, achieved placements ranging from 2nd to 13th between 2009 and 2024. Thus, both peak and suboptimal performances are accounted for within the analytical framework.

6) Additional Considerations

Other intervening variables not previously mapped may emerge, including but not limited to: climatic conditions, political issues, social conflicts, public health crises, pandemics, local cultural factors, and the shared use of a stadium by multiple clubs. In such cases, it is recommended that adjustments be made to the scope of the study, with explicit clarification of the criteria for inclusion, exclusion, or modification of parameters and indicators.

For instance, the global COVID-19 pandemic significantly disrupted stadium operations, prohibiting spectator attendance and subsequently allowing only partial access during the 2020 and 2021 seasons. Should these seasons be incorporated into the analysis, the indicators presented in Table 2 will likely reflect a downward trend. It is therefore incumbent upon the researcher to determine whether or not to include these periods within the scope of the study.

Conclusions

The questions that led us to this examination were: “Is it possible to measure the legacy of Brazilian arenas?”, “Are there parameters and indicators capable of measuring the legacy of Brazilian arenas?” and “Would sport make it possible to measure the legacy of arenas by providing its own numbers and information?” The answer is: yes, it is possible and there are parameters that can be used.

Logical arguments and reasoning revealed properties pointing to sport as a central axis for measuring legacy, bringing about the affirmation regarding the numbers produced by sport, which were previously ignored in SME legacy research.

In the “Proposing parameters and indicators” section, they appear as applicable suggestions. That said, the parameters and indicators will enable a type of measurement geared towards practical aspects, using numbers produced by the sport itself and expressing a quantitative approach. However, it is important to consider that the proposed points may undergo adjustments and/or inclusions due to international and local realities, the researchers’ databases, methods, the period used in the investigation, intervening variables control, the competitions and other necessary resources for conducting future studies.

Measuring SME legacies is challenging and this study, following scientific parameters and respecting the specificities of Brazilian football, structured a methodological path geared towards the practical aspects, enriching the subject. It is expected that these parameters and indicators will be tested and applied in Brazil’s world cup arenas and reveal positive or negative results, serving as a validated protocol and contributing to sports management and society.

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