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Evaluation of leverage points of the Brazilian football value ecosystem using system dynamics

Avaliação dos pontos de alavancagem do ecossistema de valor do futebol brasileiro com o uso da dinâmica de sistemas

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Abstract: Football is interrelated to several industrial and commercial segments. It generates significant economic and social results. Thus, football needs to be understood as a value ecosystem. The multiplying and systemic effects of the football chain are not known to clubs and society. The current literature has neglected them. This study aims to dynamically evaluate improvement actions aiming to add economic value to the Brazilian football value ecosystem based on a system dynamics model. It is possible to identify a dynamic relation between variables in the football ecosystem and assess the impacts of the improvement actions proposed here. We also propose and simulate scenarios demonstrating the impacts of decisions before implementing them in the real context and identify multiplying effects on the football value ecosystem. The results of the simulation show a positive impact of professional management on the football business for the club and society.

Keywords: Football; System Dynamics Model; Brazilian football; Value ecosystem.

Resumo: O futebol se inter-relaciona com diversos segmentos industriais e comerciais, que gera expressivos resultados econômicos e sociais, portanto necessita ser compreendido como um ecossistema de valor. Os efeitos multiplicadores e sistêmicos da cadeia futebolística não são conhecidos pelos clubes e pela sociedade, e são negligenciados pela literatura vigente. Essa pesquisa tem como objetivo avaliar dinamicamente ações de melhoria visando agregação de valor econômico no ecossistema de valor do futebol do Brasil, a partir de um Modelo de Dinâmica de Sistemas. Como resultado, foi possível identificar o relacionamento dinâmico entre as variáveis existentes no ecossistema do futebol e avaliar o impacto de ações de melhorias propostas. Além disso, propôs-se e foi simulado cenários demonstrando o impacto das decisões antes de implementa-las no contexto real e identificar efeitos multiplicadores no ecossistema de valor do futebol, que por vezes não são conhecidos pelo clube, sociedade e literatura vigente. Por fim, os resultados da simulação demonstraram o impacto positivo da gestão profissionalizada no negócio futebol para o clube e sociedade.

Palavras-chave: Futebol; Modelo de Dinâmica de Sistemas; Futebol brasileiro; Ecossistema de valor.

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1 Introduction

Football is a human capital-intensive sector. Its organizational operations require the involvement of several actors (Dimitropoulos & Koumanakos, 2015). In addition to a diversity of actors, the interrelation between different industrial or commercial segments bring together different, divergent, and multiple interest groups (Marques & Costa, 2016). Football is remarkable and there is a simultaneous interest in national and international competitions played by clubs and teams (Szymanski, 2016). The lack of understanding of football as a business can lead clubs, organizations, and society to miss the benefits of operating activities as an economic sector.

Brazilian football, as an economic activity, does not operate efficiently (Lima Benevides et al., 2015). An analysis of the revenues of the Brazilian Championship Series A clubs and their accumulated debts prove this inefficiency (Langoni, 2013). In 2018, revenues were R$ 3.9 billion considering commercial revenues, ticket sales, fans, and sale of broadcast rights (Confederação Brasileira de Futebol - CBF, 2019). However, the debt of clubs increased from R$ 4.99 billion in 2012 to R$ 7.22 billion in 2017 (Ambrósio et al., 2017; Ambrósio & Aragaki, 2018). Investments sum more than the resources available for the fiscal year. The generated debts imply difficulties to sustain competitiveness.

In 2020, for example, the impacts generated by the COVID-19 resulted in losses in many economic sectors, including football. The impacts in football are direct, as the Pandemic affected the demand for competitions and the presence of the public (Grafietti, 2020). Public presence creates expressive values in matches, especially for clubs that need in-person or television audience to obtain resources (Reade & Singleton, 2020). As an effect resulting from COVID-19 for football, short-term decisions such as the purchase or sale of federative rights of players and replacements of coaching staff were adopted by many football clubs. These decisions tend to aggravate the indebtedness of clubs (Marques & Costa, 2016) and not bring satisfactory performance, neither in the football nor in the club´s economic results (Gimet & Montchaud, 2016).

In addition, the long-term effects of COVID-19 worsen global insolvency situations (Szymanski, 2020). Many clubs had fan disaffiliation and, therefore, reduced attendance at stadiums. In addition, there are indirect negative aspects, such as decreases in the sales of football products around the stadium and reduction in sales of licensed products by third parties and in television audiences. These elements are considered risks, since football connects industries with leagues, events, tourism, infrastructure, transport (United Nations, 2020).

Football, therefore, should not be regarded only as a sport, but as an ecosystem of considerable value, and as a business that exceeds entertainment (Şener & Karapolatgil, 2015). Multiple actors, with distinct and potentially conflicting interests, form a value ecosystem that needs to be articulated to generate a process of co-evolution (Moore, 1996) and strengthening as an economic sector. Actors belonging to the football value ecosystem need to understand the main problems that affect it. Some problems are organizational, such as the lack of reliable and systematized data, lack of planning, discontinuity of proposed actions, and lack of training (Marques & Costa, 2016).

Previous studies have presented linear analyses of the football value chain as a means to understand the transformation process of the strategic management of football clubs (Leoncini, 2001; Leoncini & Silva, 2005). Some of these studies were related to the identification of the actors and the commercial activities carried out (Ducrey, Ferreira, Huerta, & Marston, 2003) and the representation of the financial flows generated by football as an economic activity (Blumenschein, 2013; Soriano, 2010).

Football as an economic sector has an activity that surpasses the football match (Pérez-González et al., 2021) or products of clubs (Lonsdale, 2004). It involves a set of actors, organizations, and entities that act on this sport, adding economic and social value to the places where they are inserted (Ribascik, 2013). By pointing out the actors and links that exist in the football value chain linearly (Serrano et al., 2019a), one fails to consider the complexity of relations within this sport, its connections, and interdependencies in time and space (Mansilha et al., 2019; Martins et al., 2020; Morecroft, 2007).

Thus, it seems clear that football should not be analyzed by linear chains of cause and effect, since direct and indirect relations between variables are difficult to be represented (Senge, 2009). Linear approaches are inadequate to model the characteristics of organizations and complex social processes (Ford & Sterman, 1998; Zare Mehrjerdi, 2012). To analyze football linearly is to underestimate its specificities, such as unpredictability of results, social representativeness, and sharing of athletes between clubs. This is because, in professional football, the "success" of a club is related to the "success" of its competitors (Aidar & Faulin, 2013).

The lack of a systemic and dynamic vision contributes to the fact that football, as a value ecosystem, is not considered a generator of development for society. The participants form a complex set of actors and interrelated organizations that co-evolve in search of success and survival, forming a business ecosystem (Barnett, 2006). These actors and organizations play a symbiotic role through mutual interest at different levels (Xingyuan & Peng, 2009). Therefore, there is a need to analyze systemically and dynamically value ecosystems and supply chains to achieve an understanding of the whole and an in-depth view of reality.

However, there are difficulties in developing systemic and dynamic analyses, as we propose in this study. First, the literature is limited on the use of systemic approaches to analyze ecosystems of value in general, and of football in particular. There are few articles analyzing value ecosystems using a systemic perspective. Secondly, few studies have used systemic approaches combined with other approaches to analyze value chains (Mula et al., 2013; Rabelo et al., 2008).

In addition, the football value ecosystem is an economic sector that has difficulties in being object of quantitative analyses, as it is formed by several agents with multiple and generally conflicting interests. Interests make it difficult to release quantitative economic data of actors belonging to the ecosystem, as there is a dichotomous view of competition. Thus, the studies tend not to represent the reality of the sector. For example, the returns of football as an economic sector represent 1.8% of the Brazilian GDP (Diehl, 2018). However, this value may be higher than that reported.

Given the above, this study intends to dynamically evaluate improvement actions aiming to add economic value to the football value ecosystem in Brazil based on a system dynamics model and using economic data of a football club in the Southern region of Brazil as the basis for the study. Among the results of this study, the variables existing in the football value ecosystem are identified, and their interrelationships in a system dynamics model can be replicated in other contexts. In addition, this study evaluates the impacts of improvement actions on leverage points listed in the football value ecosystem. Leverage points derive from the leverage principle, which determines that the best results are from small actions focused on the intended objective (Senge, 2009).

Scenarios for evaluating these leverage points were proposed and simulated in the system dynamics model. They suggest different results depending on the evaluated decisions. Upon planning scenarios, it is possible to visualize a plausible set of futures, to understand them, and to learn from their development (O'Mahony et al., 2013; Saritas & Nugroho, 2012) before implementing the solution in a real context. We observed that the clubs

and society do not know the multiplying and systemic effects of the football chain, and that the current literature addresses few of them. Finally, the results of the scenarios demonstrate that upon proposing a professional management, the club, which represents the football ecosystem, has good efficiency and profitability rates in the long run.

This research is structured into six sections, in addition to this introduction. Section 2 presents the theoretical framework. Section 3 presents the methodology adopted. The results of the model are presented in Section 4. In Section 5 we present the discussions. Section 6 presents the final considerations.

2 Theoretical framework

This section presents the concepts related to using the value ecosystems approach and using this to model the football ecosystem. Furthermore, it discusses the conceptual basis of system dynamics modeling and its use for analyzing ecosystems.

2.1 Value ecosystems

New technologies, business processes, and organized life forms invade traditional business lines (Moore, 1996). They form an ecosystem of organisms in constant interaction, where diversity is paramount for their functioning (Oksanen et al., 2018). Changes identified in traditional value chains mean new business models (Senyo et al., 2019). Therefore, traditionally analyzing competitions in terms of supply and market ignores the environment in which the business is inserted, cooperation processes, conflicts, and a need for co-evolution in relation to the other members of the environment (J. F. Moore, 1996).

Discussions of the term “ecosystem” originated in the natural sciences. The term refers to a community of interacting organisms in a common environment (Skinner et al., 2018). The concept of ecosystem helps to understand complex business environments, since the ownership and the roles of actors belonging to the ecosystem are pointed out (Staicu & Pop, 2018). According to the logic of business ecosystems, the health of an organization influences the success and survival of all other participants in the ecosystem (Iansiti & Levien, 2004).

In complex systems, an ecosystem means that actors contribute to the development of processes and products and influence the strengthening of activity in the long term (Tomaszewski, 2014). Sports may be understood as a complex system, as there is a network of relations and subsequent dynamics represented by different parties (Staicu & Pop, 2018). The actors participating in a sports ecosystem have different levels of involvement and participation, but all remain essential for the business operation (Skinner et al., 2018). Thus, sport as a whole has become a mature business sector, which can thus be considered an ecosystem (Skinner et al., 2018).

The perspective of a sports ecosystem applies to football, as it deals with an expressive volume of participants, services, media, teams, leagues (Pérez-González et al., 2021). The event is the interdisciplinary epicenter of this ecosystem (Bailey, 2014). Football clubs depend on mutual success to make competitions popular, attract revenue (Şener & Karapolatgil, 2015), improve interaction with fan groups (Shuv-Ami, 2016), and consequently foster relationships between clubs and sponsors aiming to generate revenue and marketing sales (Bouchet et al., 2015). Therefore, an alignment of views and the mutual support of interested parties are necessary (Moore, 1996).

In addition, by considering football as a value ecosystem with its own characteristics, it is possible to understand how value is generated and understand the

factors that drive its development (Grundy, 1998). However, there are no analyses of football businesses using the perspective of ecosystems. Football is studied as a linear chain in order to identify the actors and commercial activities intrinsic to the business (Ducrey et al., 2003; Ferreira, 2012; Lonsdale, 2004; Ribascik, 2013; Serrano et al., 2019a). However, football is dynamic, and linear approaches may not provide a proper understanding considering the complexity of this sport. The next section discusses about system dynamics modeling and its use for the analysis of ecosystems.

2.2 System dynamics modeling

To analyze football dynamically makes it possible to identify the key variables of the system and to understand where efforts should be concentrated in order to improve performance (Ford & Sterman, 1998; Zare Mehrjerdi, 2012). Dynamically modeling the interaction of actors/links through a learning tool makes it possible to verify how human decisions affect the environment and to improve the understanding of relations inside the ecosystem analyzed (Freeman et al., 2016; Sterman, 2001).

In line with this perspective, systems dynamics models have been used to analyze the Chinese sports industry (Zhang et al., 2016) and to study the behavior of demand for service in the English Premier League (Faghih & Javanmardi, 2014). Other studies prospected future scenarios for the European football league using Delphi techniques (Merkel et al., 2016). However, investigations using dynamic approaches applied to the football context (Faghih & Javanmardi, 2014), specific to this ecosystem, are incipient.

Dynamic approaches allow an understanding of forces that shape the football value ecosystem by promoting learning and understanding of this sport as an aggregator of economic value for society. Among these tools, there is system dynamics (Sterman, 2000). One dynamic approach tool is System Dynamics, a methodology for obtaining information on problems of dynamic complexity and political resistance (Georgiadis & Besiou, 2008; Morgan & Graber-Naidich, 2019) and expand the understanding of relations in this environment (Sterman, 2001).

The principle of system dynamics modeling is that the dynamic behavior of a system follows the principle of accumulation. This means that the responses postulated by the system are a consequence of the transition of resources accumulated in stocks (Lie & Rich, 2016; Sterman, 2000). A proposed method to perform system dynamic modeling involves three steps. It starts by articulating the problem (first step), which comprises topic characterization, identification of main variables, definition of horizons of future and past times, and a reflection on the behavior of variables (Sterman, 2000).

The second stage, called dynamic hypothesis, models the main interactions and links that may explain the performance and/or the problematic behavior of a system (Morecroft, 2007). To develop it, sectoral and causal maps, such as systemic structure, can be plotted. This step seeks to identify causal relations between factors and leverage points. The systemic structure represents the relations on a subject of interest. It allows verifying which variables should be minimized or maximized by locating those that can be identified as leverage points (Martins et al., 2020). Action points derive from the leverage principle, which determines that the best results are from small local actions focused on the intended objective (Senge, 2009). At this step, future scenarios can be formulated. Future scenarios aim to prospect alternative paths for future considering the forces that generate these paths (Schwartz, 2003). Planning alternative scenarios involves identifying forces at work in the environment and projecting how changes in these forces affect other elements, thus challenging current thinking paradigms (Sankaran et al., 2013; Wack, 1985).

The third step formulates the conceptual and simulation model. The conceptual model explores relations qualitatively. It makes it possible to know the context studied and aggregate variables to strengthen the model (Norang et al., 2010; Yu & Du, 2007; Zhang & Yuan, 2016). At this stage, data are collected to determine model parameters. The conceptual model represents a schema that corresponds to the multiple parts of the model (Bankes, 1993). However, it does not represent a single model and does not specify details. Rather, it assists in the specification of existing modules, the elements of each module, and relations, contributing to reduce model uncertainty (Morandi, 2017).

The simulation model, in turn, is developed from stock and flow diagrams. The system structuring is represented mathematically (Morecroft, 2007). The stocks are accumulations that characterize the state of the system and generate information for decisions (Sterman, 2000). Flows are responsible for the movement of materials and information within the system (Pidd, 1998).

In addition, inventories create delays by accumulating differences between process inputs and outputs (Sterman, 2000). It is a mechanism to be controlled and receives the values of input flow and feedbacks them to the output flow. Thus, when the system presents an undesired behavior, such as a delay, measures are proposed so that it returns to the limit (Pidd, 1998, 2004). This processing of resources leads to a lengthening in time called the SD “dt” time (Pidd, 1998).

The fourth step refers to model testing. It is performed based on reference models or previous observed behaviors (Sterman, 2000). However, recommended using verification tests, such as t test (Sterman, 2000). The last step is the formulation and evaluation of policies to be implemented (Morecroft, 2007).

The use of these steps may vary according to the application context, so that inclusions or exclusions can be made (de Lima et al., 2017). In addition to using other methods together to ensure analysis robustness (Mingers & White, 2010), different methods provide a range of options for working with different dimensions of a specific context (Darivandi Shoushtari, 2013). Studies have combined fuzzy, neural networks, and life cycle analysis with systems dynamics (Mula et al., 2013; Rabelo et al., 2008). The use of methods in conjunction with systemic thinking was also evaluated by studies analyzing supply chains in Brazil: bioenergy production (Demczuk & Padula, 2017), semiconductors (de Lima et al., 2017) and future scenarios for the Rio Grande do Sul Biodiesel Chain (IEL-RN/RS, 2008). There are reports of applications of systemic thinking to understand the price dynamics of a mining industry (Morandi et al., 2013) and to visualize the styrene demand of a company in the Brazilian petrochemical sector (Souza et al., 2017).

Thus, in complex environments with interactions and interrelations, such as the football value ecosystem, there are political and paradigm restrictions that act simultaneously. As an example, we can cite the policy of dividing funds to promote football, which generates paradigm and physical restrictions, as there is no equal distribution of funds between clubs and sports associations. By developing a SD model and experimenting with future scenarios, it is possible to explore the impacts of alternative policies in a specific chain (Demczuk & Padula, 2017), such as the football value ecosystem. The next section presents the methodological procedures used in this study.

3 Methodological procedures

This research used a case study approach to better understand the reality of the football value ecosystem. The case study is a research strategy which focuses on understanding the dynamics present in the context (Eisenhardt, 1989). In this context the

case study contributed for obtaining the relevant generic structures for the formulation of the dynamic hypothesis of the model (Kopainsky & Luna-Reyes, 2008) with archives and observations (Eisenhardt, 1989). This study structures the football value ecosystem system dynamics model following the steps proposed by Sterman (2000).

3.1 Problem contextualization

Previous studies developed by authors (Serrano et al., 2018; Serrano et al., 2019a, b) have demonstrated the relevance of football as a business. However, these studies did not quantitatively simulate the dynamics of football as a value ecosystem. This study addresses the problem of dynamically modeling an ecosystem of complex value using a system dynamics model. We demonstrate the multiplying and systemic effects of football, topics mostly neglected by clubs and by society and literature.

3.2 Conceptual model

The conceptual model of the real problem was demonstrated using the added value statement (AVS) of a football club of Southern Brazil, as shown in Figure 1. To identify the value added by the club, we followed the methodology described in Brazilian theoretical publications (Comitê de Pronunciamentos Contábeis, 2008) that use data from the football club's statement of income (SI).

The AVS conceptual model (Figure 1) is divided into eight groups. Group 1 represents revenue and capital gains received by the football club, such as the amount collected by the club from the sale and/or loan of professional players or players from its junior categories. Group 2 represents inputs purchased from third parties, such as raw materials, third-party services, among others. Group 3 comprises the difference between revenue and inputs acquired from third parties, forming the club's gross value added (GVA). Group 4 represent retentions, that is, depreciation of fixed assets and amortization of athletes' rights. Group 5 represents the net added value (NAV) the club produces, which is the difference between groups 3 and 4. The added value received in transfer (AVRT) comprises group 6, formed by financial and equity income. Group 7 is the sum of groups 5 and 6 is the total added value to be distributed (TAVD). Group 8 describes the elements that make up the AVS, that is, the amounts spent on personnel, taxes, contributions, deficits, or surpluses in the fiscal year. The result of group 7 (TAVD) must be the same as that of group 8 (AVS).

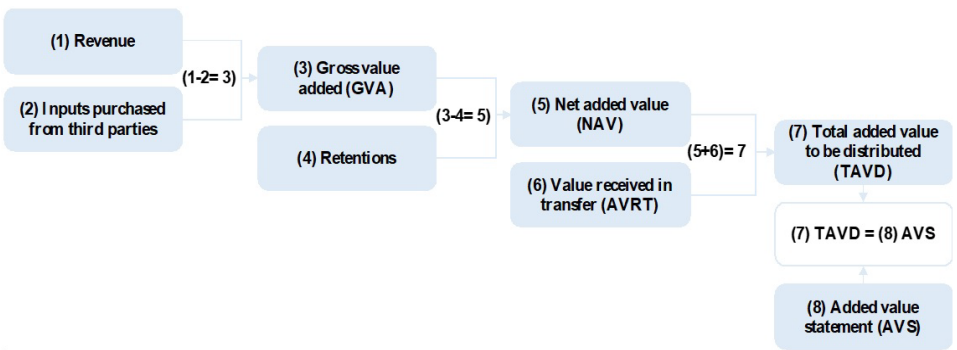


Figure 1. Conceptual Model – AVS.

Therefore, we added to the system dynamics model information about the results of third parties in relation to the club, specifically of a Hotel and the Stadium Company that has the surface right to operate the stadium. We chose the hotel because it houses the opposing clubs and the fans. We chose the Company that has the surface right to operate the stadium because it manages the number of tickets sold on match days.

3.3 Systems dynamics model

From the information presented in the conceptual model (Figure 1), we constructed the modules of the system dynamics model, which was developed using the software iThink, version 10.0.3. The Figure 2 represents three major modules, that are the Club, the Hotel and the Stadium Company modules of the model.

The Club module is in turn composed by other six modules related to the **Added Value Statement** module **(AVS)**. The first module, **Economic Income Statement** module, represents the economic and financial values received by the club and comes from the **marketing athletes** and **club debt** modules. The **marketing athletes** module demonstrates the values received from the marketing of athletes from the **junior categories** module and **professional players** module. The **Effective Result** module is influenced by the investment in athletes variable and points out how the investment result impacts the number of games and the growth rate or salary decline of players.

The **Hotel** and the **Stadium Company** modules represent the financial impact generated indirectly by the club on society. Both modules are influenced by the result of growth or decline in the number of games. Appendix 1 presents the complete model of the modules developed in software.

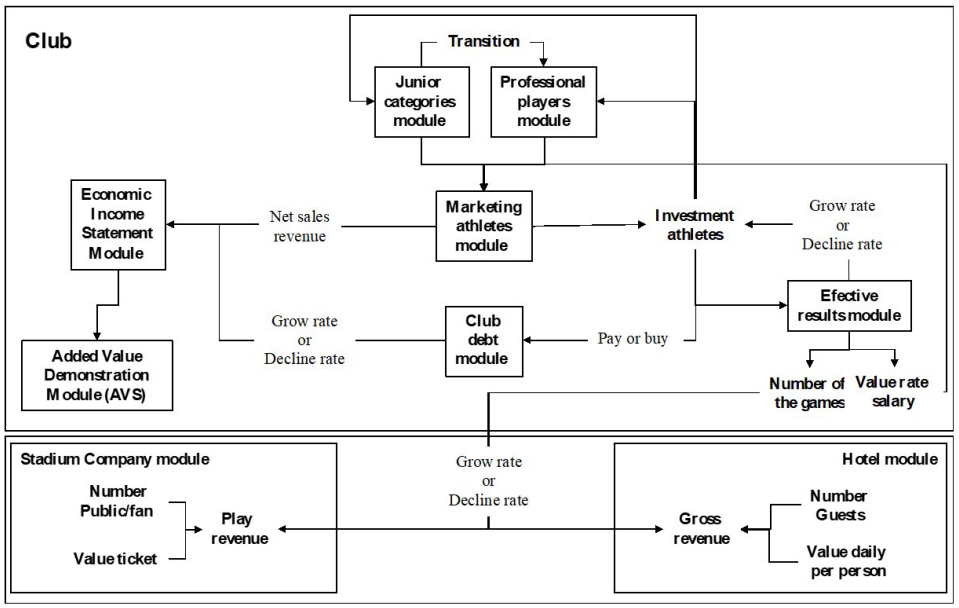


Figure 2. System dynamic model.

After constructing the system dynamics model, the equations were written (Appendix 2) and the quantitative data was inserted in the model. The data was obtained from the football club´s financial reports and data sources identified on their websites (Appendix 3). The

research was performed based on secondary data. However, proposals, delimitations, and assumptions developed were made to minimize possible bias and approximate the results generated by the simulation of the reality exposed in the club's reports.

Then, the model was preliminarily simulated. This analysis verified possible structural biases in model design (Sterman, 2000). The simulation was programmed considering 2008 to 2016, as the financial data made available by the club at the time of the simulation record values up to 2016. The time increase was (dt) 1.00 in Euler's numerical integration method (Kumar & Nigmatullin, 2011; Sterman, 2000).

Therefore, at the end of the simulation, a black box evaluation was performed. The tasks are performed aiming to discover possible flaws and identify defects (Hevner et al., 2004). No calculation errors were found due to model uncertainties (Walker et al., 2003). The model assessment considered the time horizon from 2017 to 2025. We observed that, because quantitative data was originated from secondary sources, some variables had their values estimated between minimum and maximum, as shown in Appendix 4.

3.4 Scenario analysis

In order to better understand the multiplying and systemic effects of football, models of future scenarios were developed. The aim was to verify the economic return for the club and for the third parties (hotel gross revenue and match) with the Investment in junior categories and the impact of political Alternation when it was compared with current scenario. Table 1 shows the scenarios, their composition and the assumptions adopted. The scenarios were proposed considering the reality found in the Brazilian football context. We present the results of the scenarios in the next section.

Table 1. Composition of system dynamics model scenarios.

	No.	Composition of scenarios	Assumptions adopted
Basis	*S1*	*"Current"*	This scenario represents the current policy adopted by the club. It includes continuous investment in junior categories and maintenance of political/financial management of the club.
Investment in junior categories	*S2*	*"Zero Investment"*	In this scenario there is no investment in junior categories, that is, no investment made in terms of acquisition of new federative rights for athletes. In this scenario, only the existing athletes are kept, and they leave through commercialization, withdrawal, or termination of contract
	S3	*"Amortize 100%"*	In this scenario, the club decides to get rid of the federative rights of athletes in its junior categories (dispensing or selling them) and does not invest future resources in this modality.
Political alternation	S4	*"Alternation of management policies"*	This scenario demonstrates a situation where there are alternating management policies regarding investment in athletes.

Statistical analysis was performed using the quantitative results of the scenarios and t test as a procedure. We then sought to verify whether there is statistical significance between two independent sample means for a single dependent variable (Hair et al., 2009). The dependent variable is the scenario *"Current"*. The independent variable is each scenario individually (except for the *"Current* "). Table 2 shows both scenarios.

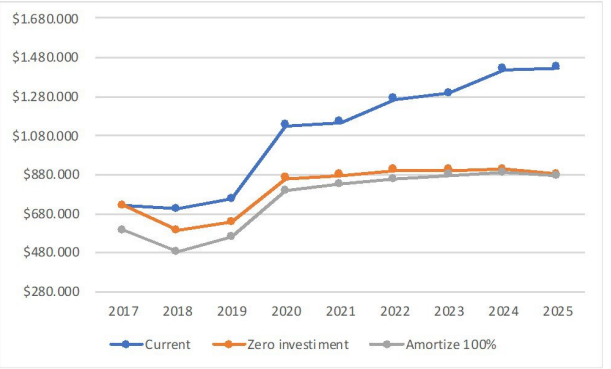
The standard deviation of the AVS variable was <10%. This value was defined as acceptable due to the number of estimated values inserted in the model. The models are calibrated by comparing the model's results with historical data series (Walker et al., 2003). The chosen parameters aim to minimize differences between the model results and the actual data. Additionally, the acceptable number of replications was calculated, defining a maximum error of 3% and a significance level of 95%. As a result, the average number of replications of the model was 50.

Based on the assumptions described in this section, we then measured the resulting impact on the key variable when proposing a change in values in the scenario scores, as Table 1 shows. The total simulation time for the scenarios and, additionally, for the base scenario (*"Current"*) was seven hours. The next section discusses the results of the study.

4 Results

The simulation results of the scenarios shown in Table 1 are presented below. The comparison with the base scenario allows identifying that when maintaining investment in junior categories, the AVS increases in periods of stability. However, when junior categories are not funded or 100% of the rights of athletes in this category are amortized, the AVS decreases sharply in the first year of decision and, subsequently, the values stabilize and approximate, as Graph 1 shows.

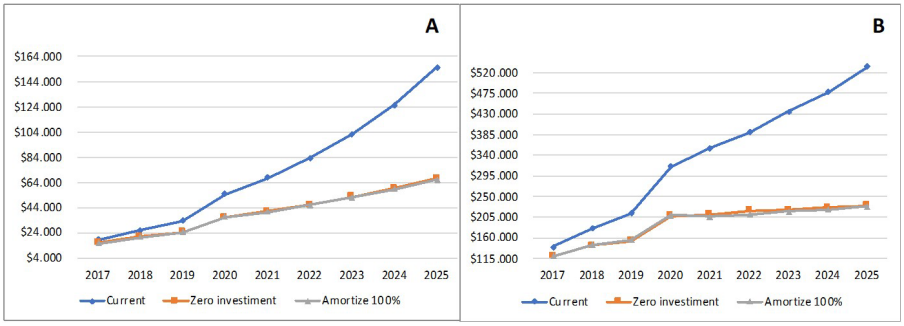
The investment in junior categories has a significant impact on the club's income. In case of not investing in athletes, the club's AVS values will go from USD 1,428 to USD 872,261 million in 2025 (values converted from Reals to dollars on July 8, 2020). In case of not investing or 100% amortization, the difference is insignificant. It should be noted that the significant decrease in values between 2017 and 2018 is because the values present in inventories in the first year of simulation are from 2016, that is, they are constant. As of 2017, estimated values are used.



Graph 1. Effects of "investment in junior categories" – AVS.

Graph 2 shows the benefits of third parties according to the "investment in junior categories." **Graph 2**-A shows the results of the hotel, and **Graph 2**-B shows the results of matches. The benefits of the hotel and the matches have a similar behavior in AVS, because if the club keeps its current investment structure in junior categories, it tends to maintain its efficiency in matches. As a result, the fan's interest in matches is maximized, and consequently the number of guests increases. However, if the club stops investing in junior categories or amortizes all athletes, it will need to invest in external players, abruptly

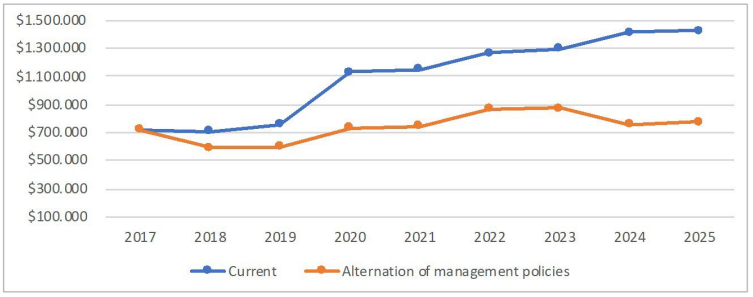
restructuring its team. This may result in a decline in efficiency in the field in the short term, diminishing the number of matches and, extrapolating, the number of delegations and fans that will stay in hotels in the region or will attend the stadium.



Graph 2. Effects of "investment in junior categories" - Hotel (A) and Stadium Company (B).

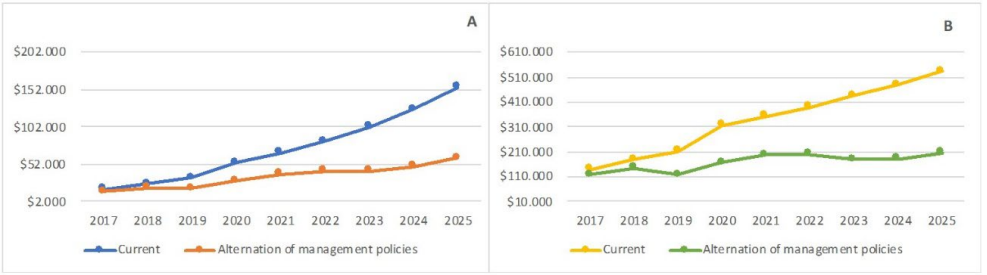
Given this result, it is possible to infer that investment in junior categories has a positive impact on the financial economic results of the club and third parties. Therefore, the "investment in junior categories" can be considered a leverage point (Serrano et al., 2019b), as there is "economic participation generated by the club in society" (key variable), that is, there is addition of value. The values of the scenarios corroborate the links identified, which attributes the benefits of the club with the athlete to two reasons. The first reason is that the athlete's permanence in the club makes it possible to monetize future results with commercialization. The second reason assumes that, by keeping athletes in junior categories, the club has a greater number of athletes available at a lower cost than that of external athletes hired. In addition, by maintaining an investment policy in junior categories, the club can conduct an in-depth assessment of future buying before making them, minimizing overestimated investments (Serrano et al., 2019b).

The **Graph 3** shows the impacts of political alternations on the club's added value statements (AVS). Therefore, a biannual change in the investment policy for the purchase of professional athletes and investments in junior categories was considered. This criterion was adopted considering the political cycle of the club. Thus, it is observed that, when there are changes in management policies, the AVS values present a lower performance, as **Graph 3** shows. Thus, by verifying the values for 2025, there is a decrease of 54% in AVS with alternate management policies. The club's attractiveness is reduced, as well as the activities derived from this variable (Serrano et al., 2018). It should be noted that the results of this scenario (S3) show that a politically stable club, that is, with a professionalized management, has a higher efficiency and profitability rates in the long run.



Graph 3. Effects of "alternating management policy" – AVS.

Third party earnings from club activities are lower compared to those presented by the *"Current"* scenario, as **Graph 4** A and B shows. Thus, the model shows that decisions taken without professionalism tend to negatively affect the club's results and from third parties. Thus, it is possible to infer that the lack of professionalism in the club management shows the lack of vision of football as a business, resulting in the reduction of social benefits of this sport for society and, consequently, in the economic participation generated by the football club in GDP (Serrano et al., 2019b). Finally, the model shows that the economic result of the club must be significant for there to be repercussions on the earnings of third parties.



Graph 4. Effects of "alternating management policy" - Hotel (A) and Stadium Company (B).

The simulation results were verified by the t-test, in Table 2, demonstrating that the model did not present any modeling and calculation errors, since the "Current" scenario is significantly and statistically different from "zero investment" and "100% amortization," as there is less than a 5% chance of not seeing a difference between the compared scenarios. The simulation results confirmed that the "Current" scenario represents the perception identified in the real context, which is positive.

Table 2. Significance of the proposed scenarios.

		Dependent variable (Scenario)	Independent Variable (Scenario)	*T* value	Accepts/ Rejects	P-value
Investment in	AVS - Final	*Current*	*Zero Investment*	37.98	Accepts	5.25E-38
			Amortization 100%	35.25	Accepts	1.79E-36
	Hotel	*Current*	*Zero Investment*	67.12	Accepts	6.85E-50
			Amortization 100%	66.20	Accepts	1.34E-49
	Stadium Company	*Current*	*Zero Investment*	50.64	Accepts	5.61E-44
			Amortization 100%	43.08	Accepts	1.30E-40
Alternation of	AVS - Final	*Current*	*Alternation of management policies*	28.27	Accepts	5.369279E-32
	Hotel	*Current*	*Alternation of management policies*	80.71	Accepts	8.85076E-54
	Stadium Company	*Current*	*Alternation of management policies*	42.92	Accepts	1.543816E-40

5 Discussion

The football club plays a direct and indirect role in the economic scenario. Even though clubs have tax exemptions, third party products (licensees), service providers (transportation), and social contributions (remuneration) reverberate on tax revenues.

Therefore, it is not possible to analyze it only as a sport, but it is necessary to regard it as a valuable ecosystem, i.e., a business (Şener & Karapolatgil, 2015).

Clubs, directly and indirectly, transact millions of dollars, as the values presented by the SIs of the football club under study show. However, to identify the "economic participation generated by the club in society," the values expressed in the statements of added value and the earnings of third parties with the presence of the club are analyzed. The results show that football adds value as an ecosystem, since the gains can be amplified for the gains of third parties (Hotel and Stadium Company). The model indicates that there is a benefit for third parties who support the club in their actions (Stadium Company) and also for those who only absorb benefits due to the club location (Hotels). However, the identification of effects resulting from the "economic participation generated by the club in society" is complex, since the literature does not portray this. Thus, we listed empirical assumptions.

The model revealed that "investment in junior categories" is relevant from the point of view of training new talents and keeping them in clubs where they started. The strengthening of junior categories allows identifying a greater number of young talents, reducing the costs with the purchase of beginner players, as well as a greater number of possible athletes available to the technical team. In addition, when investing in junior categories, the club plays a social role, as football is a sport capable of inspiring its target audience for learning and human development (Sanders et al., 2014).

In another point, the training of players allows reducing unpredictability in relation to new athletes hiring, since the professionals of the club monitor the development. In addition, future athletes tend to bring financial return for the club through marketing after training. However, the sustainability of junior categories in football clubs increases costs, as it involves the availability of a physical structure, the hiring of professionals, and the permanence of future talents (Nicoliello & Zampatti, 2016). Thus, it is necessary to reduce the performance of intermediary agents and effectively manage the club, avoiding the early commercialization of athletes. This happens prior to the economic return invested in its formation, as pointed out by the CRT (Serrano et al., 2019b) and systemic structure (Serrano et al., 2018).

By analyzing the "*Current*" scenario under the leverage point "investment in junior categories," the current club policy is identified as positive, as the results of the AVS earned by third parties with the club are positively impacted by it. This perspective corroborates with the literature, which highlights the importance of the athlete as the main intangible value of the club (Nicoliello & Zampatti, 2016).

The "alternating management policy" represents that in order to have a champion team, with the possibility of winning championships periodically, it is necessary to manage the clubs with criterion (Pérez-González et al., 2021; Soriano, 2010). The model shows that the biannual alternation in the club's management policy is prejudicial when the actions develop are changed and manutention is not realize. The constant change in manager Brazilian clubs indicate that actions start for a management are modified with new members. Therefore is necessary to professionalize the management of the sport clubs, enable to reduce its liabilities and emphasize financial control and future planning. This analysis was carried out by (Oliveira, 2016), who emphasized that management errors due to "amateurism" result in an aggregation of positions with a political bias and impair the permanence of clubs in the elite of Brazilian football. It may result in a reduction in the club's economic participation in society (Serrano et al., 2018). Thus, characteristics of private companies are necessary in the

field, which generate professionalism, transparency, and technical efficiency (Freitas et al., 2017; Pérez-González et al., 2021).

Policy alternation is important for the club, but there is a need for a strategic and long-term vision so that political changes are not more negative than positive. For example, pressure for immediate results leads to corrective decisions, such as replacing members of the technical and management teams. The number of actions developed is continually reduced and impairs technical and management stability. In addition, such situations amplify spending on unplanned hiring and dismissals. However, the opposite is also true, that is, actions developed continuously with a long-term vision minimize the need for corrective actions that significantly affect the financial results of the club. In this sense, changes in terms of club management result in a greater number of sponsors and resources invested by them in clubs (Langoni, 2013). Thus, it is possible to emphasize that the exposed third-party benefits are insignificant compared to the other possibilities of return or gains of third parties with the existence of the club in a given region.

Brazilian football is formed predominantly by small and medium-sized clubs. The problems with resource constraints are thus greater (Moore & Levermore, 2012). Thus, the presented results can be identified in small and medium-sized clubs. In addition, the implications exposed by this research can be applied to other sports or modalities, such as women's football. It should be noted that the Brazilian football clubs that opted for inclusion in PROFUT (Brasil, 2015) develop this second sport.

Finally, the scenarios proposed and analyzed represent the reality found in most Brazilian clubs, with little or no investment in training of future athletes. Brazilian clubs, due to economic-financial problems, end up selling the federative rights of the athlete in training. Thus, the simulation showed that the “Current” scenario tends to generate better economic results for the club that invests in athletes and, consequently, maintains a strategic political management that results in positive results on and off the field.

6 Final considerations

The systemic understanding of sport based on football makes it possible to verify that this modality adds economic value to society. This economic value is effective not only due to the generation of jobs and income, but also due to the role of this sport in social development. This study aimed to dynamically evaluate improvement actions aiming to add economic value to the Brazilian football value ecosystem based on a system dynamics model. The proposed model can offer results expected for the experiments carried out. This is mainly because this research is based on exploratory modeling, seeking to support a learning environment (Bankes et al., 2013).

The results of the simulation showed that the variables identified as leverage points they produce significant results for the members of the football value ecosystem. However, the results of the system dynamics model demonstrated that upon deciding for investments different from the current policy, the investment calculations must be clear. Therefore, it is important to evaluate them in time and space, as not always low indexes of change lead to the desired results. Therefore, an assessment of the tradeoff between positive results and implementation costs should be carried out.

We identified the impacts of each leverage point on the key variable, thus the important issues may have been overlooked, which is the first limitation. Likewise, the variables may have been analyzed with a high degree of influence to the detriment of

others of equal importance. As a future work, we suggest expanding the analysis of leverage points through a comparative case study. It is also possible to detail the analysis of leverage points by identifying which is the best combination between them or verify what the leverage point is given the current conditions, which can result in significant gains for the club and third parties. We also suggest, as a future work, an analysis of leverage points directly by a football club.

We observed that the system dynamics model exposed the gains of two third parties with the activity of the club because we used the principle of starting the modeling in smaller modules and, later, adding modules and values. Thus, an expansion of this model can focus on the insertion of other third parties indirectly related to the club, such as the sale of food in stadiums. However, it should be noted that the results of the system dynamics model resolved the doubts arising from the gains of third parties with the club, that is, they confirm that the club generates added value to the place where it is inserted.

From the model results, it is not possible to point out the impacts generated by the club on GDP. For future works, the construction of a system dynamics model based on primary data from a football club, including new assumptions and variables, can assist in the development of GDP calculation, validating the conclusions outlined here. Studies can also use new data considering the impact of COVID-19 on the economic scenario of a football club in Brazil and possibilities for future developments. In addition, it is interesting to extend the analysis carried out by this research to other sports, such as women's football, which requires investments (it is a requirement of PROFUT for clubs). The results of this research show that Brazilian football has economic and social relevance. The development of studies showing the gains resulting from this activity is interesting.

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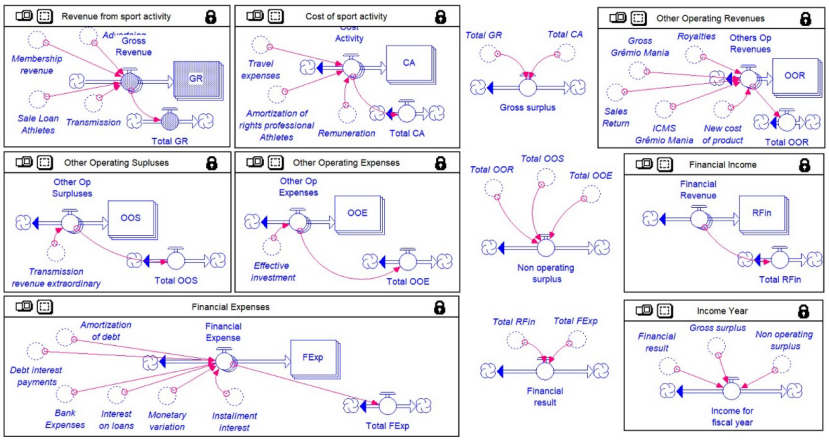
Appendix 1. Model of System Dynamics in Ithink.

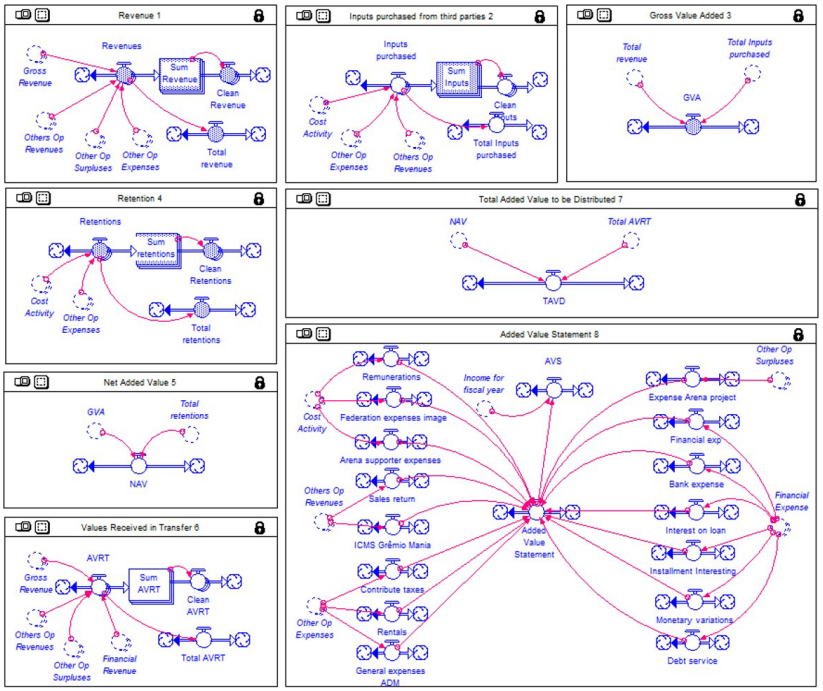
A - Economic Income Statement Module

Objective: Represent the club's financial and economic data



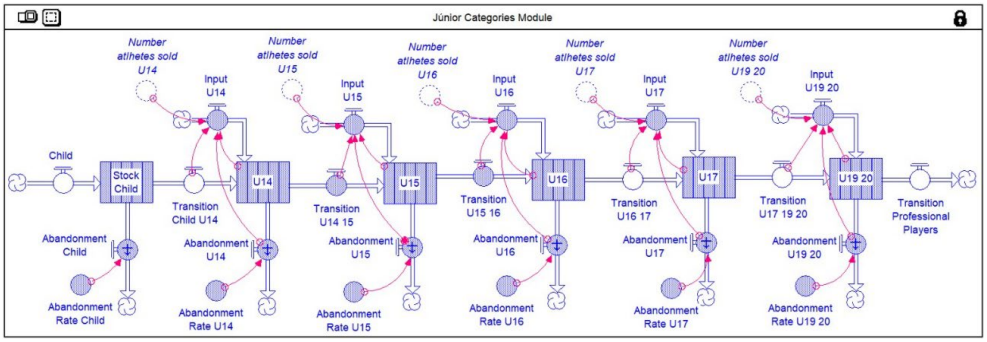
B - Added Value Demonstration Module

Objective: State how the club's financial statements are distributed



C - Junior categories module

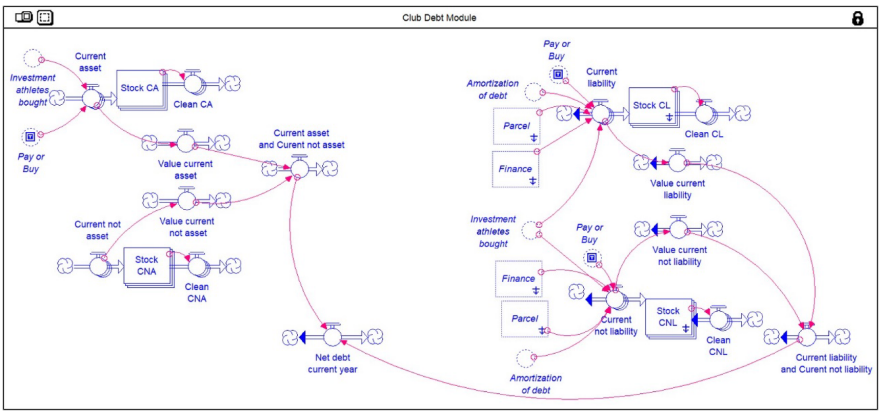
Objective: Expose the structure of junior categories, that is, the evolution of the player in the club



Name	Description	Example
Stock	**Number of athletes available to the club;**	**U17**
Transition Flow	**Migration of athletes to different levels in the club;**	**Stock U16 -» U17**
Input Flow	**Athletes acquired from other clubs, schools, new athletes;**	**Entry U17**
Abandonment Flow	**Athletes who give up playing for the club;**	**U17 Abandonment**
Converter Number of athletes sold	**Training athletes marketed by the club;**	**No. U17 Athletes sold**
Rate Converter	**Indexes adopted for calculation of variables**	**Rate U17 Abandonment**
Investor Converter/ Do not invest Junior	**Decision leverage points**	**-**

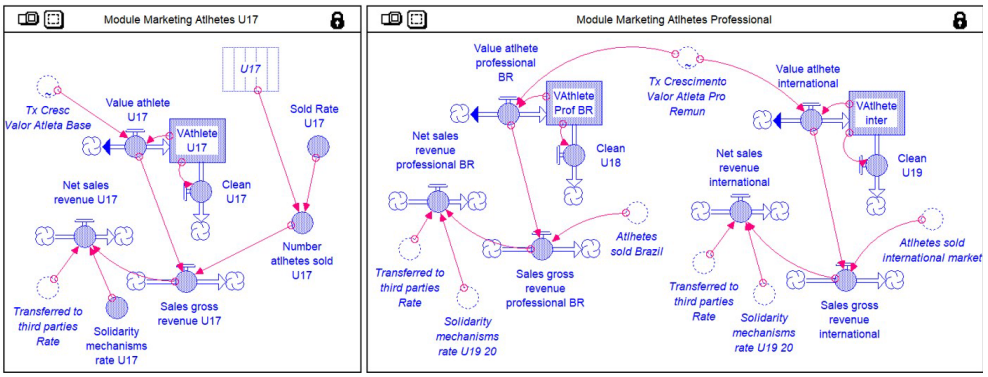
D – Club debt module

Objective: Expose the club's debt conception logic



E - Module Marketing athletes

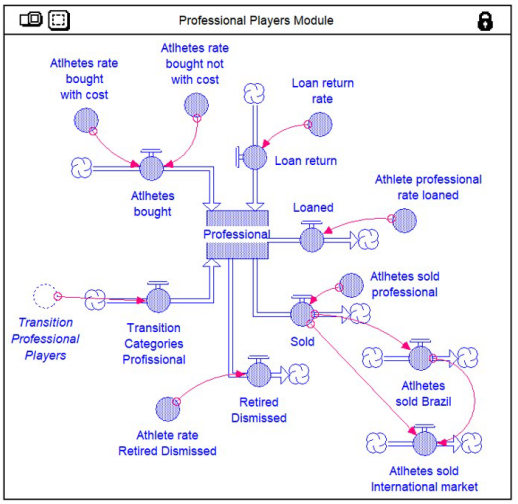
Objective: Represent the sales values of athletes in training and professionals



Name	Description
Stock U17	Number of athletes available to the club;
Inventory Value Athlete Prof. BR or U17	Value of the federative right of the athlete (intangible);
Clean Flow	Process used to maintain the updated value of the Athlete Value stock;
Flow Athlete Value	Calculation of the value of the federative right of the athlete updated annually;
Sales Gross Revenue Flow	Gross amounts generated from the sale of federative rights of athletes;
Net Sales Revenue Flow	Net amounts generated from the sale of federative rights of athletes;
Sold Athletes Flow	Number of athletes sold in Brazil and internationally
Converter Number of athletes sold	Training athletes marketed by the club;
Rate Converter	Indexes adopted for calculation of variables
Converter release all existing athletes	Decision leverage points

F - Professional Players Module

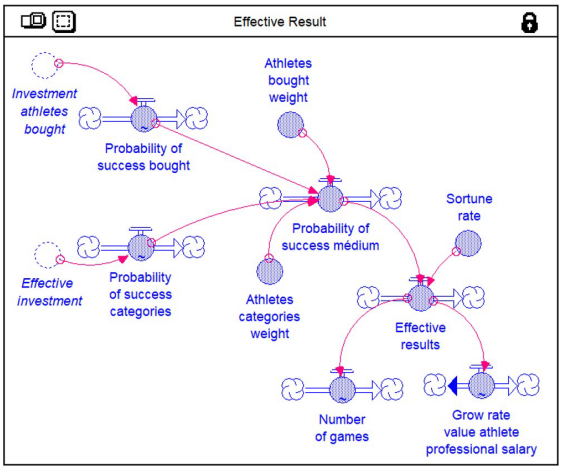
Objective: Represent the flows and stocks of players belonging to the main team



Name	Description
Professional Stock (Prof.)	Number of athletes available to the club
Flow Athletes bought	Athletes bought by the club and at no cost
Loan return Flow	Athletes returning to the club after a loan period to other clubs
Retired/Dismissed Flow	Athletes dismissed by the club or dropouts
Loaned Flow	Athletes on loan to other clubs
Flow Sold	Athletes sold in Brazil and internationally
Rate Converter	Indexes adopted for calculation of variables

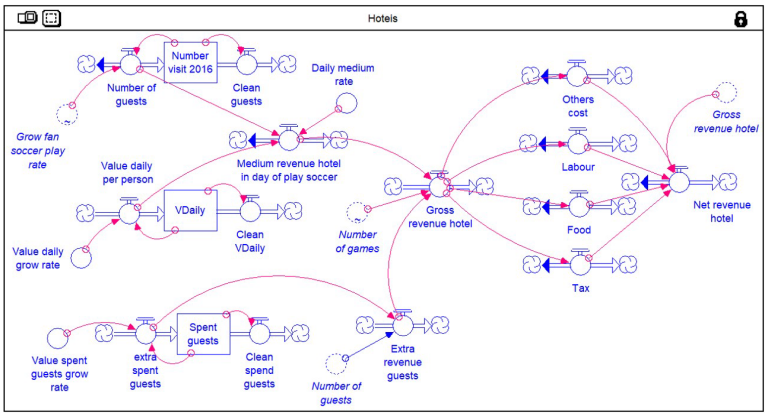
G - Effective result module

Objective: Represent the results of the amount invested by the club in the purchase of athletes and the investment in the junior categories, which generate an average probability of success



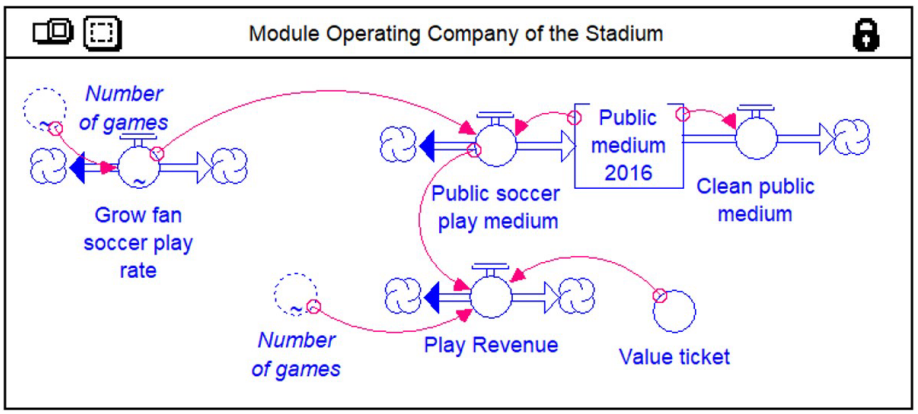
H- Hotel Module

Objective: Expose the hotel's income and expense logic



I - Module Operating company of the stadium

Objective: Represent the revenue structure of the Company that has the surface right to operate the stadium



Appendix 2. Model equations.

Reference Model	Objective	Equation
System dynamics model Junior Categories Module;	Entries in the base category of the club under study.	$Input = (If_i = 1\ Then\ \left(If_j > 30\ Then\ 0\ Else\ INT\left(j + \left(\frac{j}{2} + k - l - m\right)\right)\right) Else\ 0)$(02)
		Where: *e: admission of new athletes to junior categories; i: to invest or not to invest in junior categories; j: number of athletes in each junior category; k: transition between the junior categories; l: abandonment of athletes in each category; m: number of athletes sold in each category.*
Athletes Sell Value Module;	marketing of federative rights of athletes	$R_{LVA} = A * (TX_{MS}) * (TX_{RT})$03
		Where: *A: athlete sales gross revenue; R_{LVA}: net revenue from athlete sales; TX: rate; SM: solidarity mechanisms; RT: amounts transferred to third parties;*
		$R_{BVA} = C * INT(B)$ (A)
		Where: A: *athlete value; B: number of athletes sold; INT: integer; R_{BVA}: gross revenue from athlete sales;*
		$N_{AV} = (Sub_{17} * Tx_{(Random(0,2))})$(B)
		Where: N_{AV}: number of athletes sold; U_{17}: Junior category; Tx: rate.
		$V_{Atleta} = (V_{AP_{((SM*MCF)*M*AT)}} * TX_{CVA}$ *(C)*
		Where: *AT: athlete's transition years between categories; CVA: growth in the athlete's value; M: number of annual months; TCM: training cost multiplication index; MW: minimum wage; TX: rate; $V_{Athlete}$: athlete value; V_{AP}: partial athlete value.*
Module system dynamics model hotel income and expenses	gross hotel revenue: consists of the entries "average hotel revenue per game," "guest extras," and "number of games"	$R_{BH} = r_{mj} + r_{eh} * INT(n_j)$ (05)
		Where: R_{GH}: gross hotel revenue; *r_{mj}: average hotel revenue per game; r_{eh}: extra revenue from guests; n_j: number of games played by the club in the city.*

Appendix 3. Data Source.

Source	Category	Description	System dynamics model -EF variable
Football Club - Series A of the Brazilian Championship	Club balance sheets	Club reports support the construction of the model modules and the decisions made	SI; AVS; Junior Categories Structure; Liabilities and assets; Membership; Club sales; others described in the balance sheet
Globo.com. (2016).	Average stadium audience	The news in question presents the figures for average audience in the stadium and visitors, in addition to average ticket values	Third party Gain matches (average audience;
	Average ticket value		Ticket value) and hotel (average number of guests)
Transfermarkt GmbH & Co. KG. (2018).	Player values	The website displays the market values of players	Professional Athlete Value
Brasil. (1998).	Football Rules	Rules underpin the practice of football in Brazil and the financial organization of clubs	Athlete Value Junior Categories; junior Categories Structure
Brasil. (2006).			
Brasil. (2015).			
Confederação Brasileira de Futebol (2015).	Brazilian Series A Championship Regulations	The regulations justify the practice of football in Brazil	Amounts related to transmission revenues
Confederação Brasileira de Futebol (2017).			
GloboEsporte.com (2017b).	Awards for South American Championship	The news brings the amounts to be paid to the clubs participating in the competition	Amounts related to transmission revenues
Hernan et al. (2017).	Libertadores Championship Award	The news brings the amounts to be paid to the clubs participating in the competition	Amounts related to transmission revenues
Federação Gaúcha de Futebol (2018).	Gaucho Championship Regulation	The regulation underlies the practice of football in Rio Grande do Sul	Amounts related to transmission revenues
GloboEsporte.com (2017a).	Brazilian Championship Award	The news brings the amounts to be paid to the clubs participating in the competition	Amounts related to transmission revenues
Diretoria de Competições. (2016).	A-2016 Series Club Balance Sheets	The reports of clubs listed in the regulations of the Series A 2016 Brazilian Championship were analyzed to identify the values of royalties broken down in them	Royalties
Rodrigues et al. (2014).	Hotel information	The study addresses the use of cost accounting as a management tool applied to hotel activities	Hotel revenue structure
Brasil (2018).	Hotel information	The report addresses the rate of growth in the value of hotel rates	Hotel revenue structure

Appendix 4. System dynamics model variables composition.

No.	Variables and abbreviations of the model		Decision	
			Estimated value	Value generated by the model
01	Revenue from sport activity (Gross Operational Revenue Or GR)	Sale/Loan Athletes	-	X
		Equity	-	X
		Football Games	RANDOM (100;130)	-
		Transmission	-	X
		Advertising	-	X
02	Cost of sport activity (Cost Activity or CA)	Compensation, benefits/charges (Remuneration)	-	X
		Comp./Part. of athletes and commissions	-	X
		Amortization of rights of professional athletes	-	X
		Travel expenses	-	X
		Federation, images, services expenses (Federation expenses image)	-	X
		Exp. Arena membership tickets (Arena supporter expenses)	RANDOM (-18,000;-19,000)	-
03	**Surplus/Gross deficit of sport activity (Gross surplus)**		-	X
04	Other Operating Revenues (Other Op Revenues Or OOR)	Royalties	-	X
		Gross Grêmio Mania	-	X
		ICMS Grêmio Mania	-	X
		CMV Grêmio Mania	-	X
		Sales Dev. Grêmio Mania (Sales return)	-	X
05	Other Operating Expenses (Other Op. Ex. Or OOE)	General expenses/ADM	RANDOM (-17,899;-22,494)	-
		Third party services	RANDOM (-10,253;-12.300)	-
		Tax/contr. Federal (Contributed taxes)	RANDOM (-6,358;-8374)	-
		Legal contingencies	RANDOM (-8,321;-11.497)	-
		Rentals, insurance... (Rentals)	RANDOM (-3,608;-4,067)	-
		Depreciation of fixed assets	RANDOM (-2,635;-3,116)	-
		Water, Light, Telephony...	RANDOM (-2,821;-3,736)	-
06	Other Operating Surpluses (Other Op. Supluses Or OOS)	Indemnity contractual fines	RANDOM (550,750)	-
		Sale of fixed assets	RANDOM (7,9)	-
		Donations	RANDOM (550,740)	-
		Contractual facilitating payments	RANDOM (16,671;17,000)	-
		Recovery expenses	RANDOM (6,037;7,462)	-
		Arena Project Expenses (Exp. Arena Project)	RANDOM (-242;-300)	-
07	**Other Net Operating Income/Expenses (Non-operating surplus)**		-	X
08	Financial income (Financial Revenue Or Rfin)	-	RANDOM (6,688;10,192)	-
09	Financial Expenses (Financial expenses or FExp)	Finan. Exp.	-	X
		Bank Expenses	-	X
		Interest on loans	-	X
		Installment interest	-	X
		Monetary variation	-	X
		Debt Service	-	X
10	**Financial Result**		-	X
11	**Surpluses / Deficit for the fiscal year (Income for fiscal year)**		-	X