

Structural characterization of sports supplement market

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Abstract— Sports supplements are vital as nutritional complement and improve people's physical performance. In this sense, the objective of this study was to identify and characterize the variables that determine the sports supplement market and the actors who drive it, based on a study of the Peruvian market. For this purpose, a systematic literature review and a structural analysis of descriptive scope were used with the help of seven experts knowledgeable about the industry and the MICMAC structural characterization software. The results present as key variables of the system the economic development of the nutritional supplements market, the growth of e-commerce type companies, the fitness culture, the use of social networks and technological advances in the food industry. The most influential actors end up being local and international organizations linked to the nutritional market, the sports institutes and training centers. This study constitutes a starting point for the design of future scenarios and the strategic planning of the sports supplements market in Ibero-américa.

Keywords— sports nutrition, nutritional market, structural analysis, Perú.

I. INTRODUCTION

Nutritional supplements are understood as a meal replacement. This misconception is due to the fault of information on their use or the free prescription for their acquisition that does not consider nutritional needs, metabolism, physical activity, pathological antecedents, and others [1]. Supplements -such as sports drinks, carbohydrate gels, sports bars, protein powders, etcetera- can be an adequate and practical instrument that covers a nutritional requirement to optimize daily training or performance in competition [2].

In recent years, obesity has increased in all population groups, becoming a chronic disease associated with sedentary lifestyles and an inadequate dietary plan, leading to hypertension, diabetes, and some types of cancer [3]. According to the Peruvian Ministry of Health (MINSA), the level of obesity in Peruvians ranges between 10% and 15%, presenting in all population groups [4]. Also, according to the World Health Organization (WHO), global obesity has almost tripled during the last five decades [5]. On the other hand, since sports supplements have been immersed in the market, consumers have questioned their effectiveness and proper use. There are supplements without evidence of any health or performance

benefit, prone to be contaminated with undeclared harmful substances such as steroids, stimulants, or heavy metals [6].

Most studies related to the sports supplement market investigate the driving forces that motivate people to consume these products. From an international perspective, in most gyms from South Africa, both men and women have the goal of becoming more aesthetically attractive [7] and desire to develop more muscle mass (men) or lose weight (women) [8]. In another way, in Hungary, people are not mostly looking for an attractive appearance, but rather the protection of their health through a healthy lifestyle; however, reinforces the idea that people who want to improve their appearance consume dietary supplements in higher proportion [9].

Other studies propose to know the source of information that makes a person decide to buy a particular sports supplement. Recent research in Hungary [10] and Switzerland [11] concluded that, trainers and friends, impact supplement purchase decisions. However, a questionnaire conducted in Brazil with recreational cyclists determined that 71.1% were informed about supplements through nutritionists or physicians, while 8.7% researched in scientific articles to obtain detailed information [12]. On the other hand, a survey of high school soccer players in the United States revealed that the primary sources of information were coaches, doctors, and family members, followed by the internet and friends [13].

The above evidence affirms that no studies have yet been conducted in the region on the sports supplements market focused on identifying and characterizing the variables that make it up. Research related to this topic in Latin America is very incipient.

II. CONTEXTUAL ANALYSIS

The political-legal variables that most influence the Peruvian market for sports supplements are related to regulatory legislation and certifications of safety and innocuousness of nutritional supplements. Concerning current regulations Law No. 27821, which secure dietary supplements' quality, safety, and efficacy through conditions and requirements that moderate their production, processing, export, and import [14]. Likewise, Legislative Decree 1062 complements Law N° 27821, which secures food safety for human consumption [15]. The most relevant certification is the Hazard Analysis Critical Control Point (HACCP) certification, representing a safe production management system in food industry companies. Likewise, the Good Manufacturing Practices (GMP) certification aims to find

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evidence of good hygienic practices to ensure a safe product [16].

Regarding economic variables, according to the National Institute of Statistics and Informatics of Peru, in 2019, the Gross Domestic Product (GDP) was doubled in the last 12 years [17]. On the other hand, e-commerce in Peru has become another important point, as in 2019 alone, figures over US\$4 billion were achieved within the industry [18]. In this regard, cross-border commerce accounted for 25% of online sales, with the most requested nutritional supplements and health products [19]. While in 2020, sales in the entire sports supplement industry were approximately 53 million dollars, the trend indicates that by 2027 this amount would increase to more than 112 million, representing an increase of more than 111% [20]. On the other hand, according to Trujillo and Mendoza, exchange rate affinity has moved to manageable levels over the last five years; however, an unfortunate situation would seriously affect the prices of sports supplements as the producer will pass on the impact to consumers [21].

Regarding sociocultural variables, 22.3% of Peruvians who engage in physical activity do so moderately or highly, concluding the majority do not practice sports disciplines daily [22]. As pointed out by the Peruvian Ministry of Health, the level of overweight and obesity is 42.5% and 19.8%, respectively in people aged 30 to 59 years, being the most disadvantaged age group and with the opportunity to become potential customers of sports supplements [23]. According to Schwab, the Peruvian educational level ends up being a sensitive point in education, ranking 124th in quality of higher education out of 137 countries [24]. Likewise, Cupe et al. determined that nutritional knowledge in students of Health Sciences careers in Peru is moderate-low; this results in a poor food education culture in the country [25]. The prestige of the brands of nutritional supplements has become more important in the industry due to the significant influence it represents on the consumer's purchase decision [26].

Finally, technological development in the food industry has become a key factor for the industry sector. One example is nanotechnology, which offers the opportunity to develop more innovative products with its application in food production, packaging, and preservation [27]. The emergence of plasma technology is also presented as market support because it improves food safety and quality [28]. Finally, social media has an undeniable impact on the healthcare market through Instagram, Facebook, and Twitter. These media have transformed consumer behaviors by providing them with additional information regarding what they already knew previously [29].

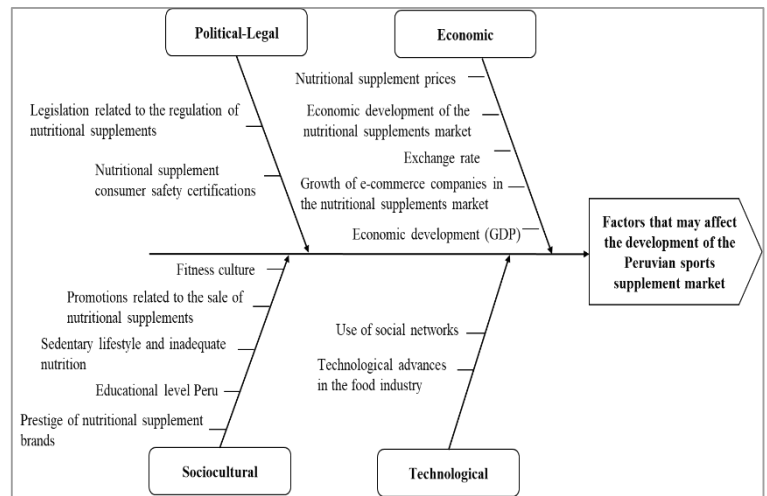


Fig. 1. PEST analysis of the peruvian sports supplement market

III. METHODS

Structural analysis is a technique designed to characterize a system based on the approval of a group of experts, using a matrix that interrelates all its variables [30]. This analysis was carried out in four phases: the formulation of the inventory of variables and actors in the system, the description of the direct and indirect relationships between them, the identification of the key variables and their most representative actors, and the analysis of the results.

In the first phase preliminary research was carried out using databases such as Scopus, Scielo, Web of Science, repositories and web pages with the objective to find current information of the sports supplements market. Additionally, an analysis of the political, economic, social and technological context (PEST) was carried out to understand the variables that have an impact on the development of the market under study. In this phase, we were assisted by three experts knowledgeable about the industry in question to validate the variables and actors presented and add some not initially stated.

The second phase had as a partial objective the determination of the relationship between each of the variables identified in the previous phase. This process was carried out with the help of a double-entry confrontation matrix and the consensual collaboration of seven experts in the dietary supplement industry.

The seven experts recently mentioned above were responsible for evaluating the level of influence and dependence that the variables have on each other, using a double-entry confrontation table. The percentage level of consensus achieved by the experts in the single round was 79%. The remaining percentage was obtained through the statistical mean.

In the third phase, the MICMAC software (Matrix of Cross Impacts Multiplication Applied to a Classification) was used to locate the variables established within the Cartesian plane shown in Figure 2. The coordinates that allowed the location of

these variables were determined by the total consensus values of columns and rows in the confrontation matrix, referring to the level of dependence (x) and motricity (y), respectively. These ratings can be understood as (x;y) coordinates representing the relative position of each variable according their degree of impact on the system. The technique makes it possible to obtain a relational matrix of direct and indirect impacts, considering possible hidden dependencies and corroborating the exclusively direct impacts. For this purpose, and in accordance with the technique, the matrix of direct impacts was raised to a potential n, achieving stability in the location of the variables and resulting in the matrix of indirect relationships [31].

A similar procedure was used to identify the most representative social actors. In contrast to the matrix between variables, the degree of power is greater when the social actor has more influence and less dependence on other actors [32].

In the last phase, with the triangulated support of the experts, the relationship between the variables studied was detailed, identifying the most sensitive or key variables within the system and those actors that direct them internally. In this way, it was possible to understand which are the variables and social actors with less and more impact inside the sports supplements market, in order to establish possible guidelines for the strategic planning for its evolution.

IV. RESULTS

The classification of the variables according to their importance is presented in the table I.

TABLE I. VARIABLES ACCORDING TO MOTRICITY AND DEPENDENCE ZONES (QUADRANTS).

Linking variables (keys)	
Highly influential and dependent variables; in charge of determining the system and unstable by nature.	V4: Economic development of the nutritional supplements market V6: Growth of e-commerce companies in the nutritional supplements market V8: Fitness culture V13: Use of social networks V14: Technological advances in the food industry
Entry variables	
A variable characterized by being more influential than dependent; consequently, it can act as a booster of the system.	V10: Sedentary lifestyle and inadequate nutrition
Objective variables	
Highly dependent and moderately influential variables; are called objective because they can become determinants in the system by influencing them.	V3: Nutritional supplement prices V9: Promotions related to the sale of nutritional supplements V12: Prestige of nutritional supplement brands
Peloton variables	
Moderately influential and dependent variable; therefore, it is impossible to conclude the role of this variable in the system.	V11: Educational level Peru

Independent variables	
Variables that are not very influential and dependent; therefore, they are not relevant for the future of the system.	V1: Legislation related to the regulation of nutritional supplements V2: Nutritional supplement consumer safety certifications V5: Exchange rate V7: Economic development (GDP)

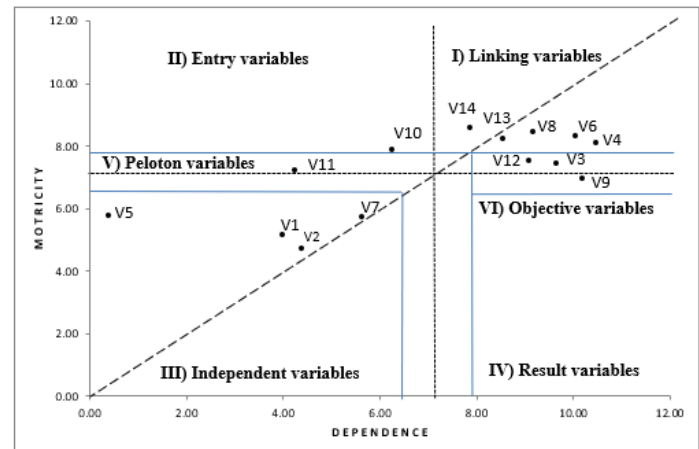


Fig. 2. Graph of influences between the system variables

Likewise, eleven social actors were also identified for the Peruvian sports supplements market, which were divided according to their relationships and the consensus of the experts. As with the variables, a grade classification was established according to the zones (quadrants) summarized in Table II.

TABLE II. SOCIAL ACTORS ACCORDING TO AREAS OF POWER

High power actors	
Actors characterized by being very influential and not very dependent on others.	A1: Influential national and international organizations A2: Peruvian Sports Institute (IPD) A4: Training centers
Medium power actors	
Actors result in being very influential but dependent on others.	A7: High-performance athletes A9: Sports center trainers A10: Sports center trainers
Low power actors	
Actors characterized by being not very influential but very dependent on others.	V5: Sports supplement stores V11: Consumers of nutritional supplements
Very low power actors	
Those actors with a low level of influence and dependence.	A3: Mass media A6: Educational centers A8: Nutritional supplement sellers

V. DISCUSSION

The research showed that a determining factor for the growth of the sports supplement industry is the fitness culture. Tarqui et al. [22] had already evidenced that the level of physical activity in Peru ends up being one of the lowest in the region. However, this can not be considered a negative aspect for the industry's growth, but as an opportunity to develop new strategies to capture the population's attention that does not exercise constantly. In effect, one of the key actors that could influence the development of sports culture are the training centers, since both the increase in their locations and the new forms of promotion -focused on attracting potential customers- would allow the development of better sports culture. This is consistent with what was studied by Kogan [33], who said that training centers were the best physical and social space for a study focused on contemporary fitness culture.

The industry's economic development is strongly related to the growth of e-commerce sports supplement companies, so its result as a key linking variable has not been unexpected. As new e-commerce businesses emerge, the market is expanding rapidly. Users prefer to buy their supplements through online sites where they find low prices and an extensive product portfolio. This is consistent with research by Hai-Li et al. [34], who mentioned that the steady increase of sports products via online would enable future development of the industry. This aligns with Hai-Li et al. [34] research, who mentioned that the steady increase of sports products via online would allow for future development of the industry. Also, with physical stores handling mostly high prices and a limited portfolio, the possibility arises that supplement sales via online could see a significant increase in the future concerning physical stores. This is in line with Condor, who mentions that the online channel represents 65% of the sales of Universal Nutrition, a leading company in sports supplementation in Peru [35].

In the same layer, online stores do not offer adequate nutritional advice on supplements, so many users turn to sports nutritionists or social networks as a source of information. This coincides with Trakman et al. research, where they conclude that athletes prefer dieticians, the internet, and nutritionists to collect information about sports nutrition [36]. For this reason, it was to be expected that sports nutritionists would be valued as a means of power actors and that the use of social networks would be categorized as a key linking variable of the system since both contemplate a high level of influence and dependence concerning the other actors and variables of the industry.

Otherwise, the technological advancement in the food industry was also presented as a key linking variable related to the economic development of the sports supplements market. This is due to the influence of technological evolution in production. Appropriate technology allows increasing the productivity of the manufacturing process of a feed supplement, which means steady economic improvement for the industry. García evidenced that technology also allows generating new ways of manufacturing, such as obtaining high protein supplements because of new forms of extraction in natural products [37]. In the same way, Ojeda et al. [27] and Mir et al. [28] concluded that nanotechnology and plasma could

contribute to the innovation of food products due to their potential application in processing, packaging, and preservation.

For Gutierrez, the influence of international and national organizations such as the Peruvian Institute of Sport (IPD) are the most important for developing policies that promote the sport [38]. This is because they can modify or establish certifications, policies, or laws related to sports supplements, so they have been recognized as key players in the research. For their part, consumers are increasingly aware of the market regulatory companies, since in this way they will be sure that the product truly complies with the appropriate standards. This is consistent with a publication by the U.S. Pharmacopeia, which details that one of the main reasons for safety assessments is so that the consumer can purchase a product with confidence that the ingredient list is complete and accurate [39].

The findings identified two objective variables belonging to the sociocultural dimension: sales-related promotions and brand prestige of nutritional supplements. According to Min-Seong and Kim, promotions in the food item significantly affect the prestige of a brand and increase consumer loyalty and active engagement [40]. On the other hand, high-performance athletes manage to be the actors with significant influence in the promotion. Their effectiveness has been evidenced in the U.S. market, where great sports celebrities have influenced people's eating habits [41]. Brand prestige is also influenced by the presence of these athletes, as consumers find greater security in products endorsed by people recognized in the industry [42]. As evidenced by Sándor and Szakály [10] and Mettler et al. [11], sports center coaches influence purchasing decisions. This allows such actors to be determinants in promoting sports supplements since they manage to be a source of information close to potential consumers and drivers of consumption.

The evidence also points to the fact that training centers play a preponderant role as key players in the Peruvian market for sports supplements. This is consistent with what was experienced during the Covid-19 pandemic, a significant challenge for Ibero-America. On the one hand, due to the pandemic, in 2020 alone, GDP was reduced by 11% in the Peruvian case [17]. As a result, the economic impact caused unemployment, instability, and closure of many training centers. According to Salas, losses due to the inoperability of gyms have reached an average of 157 million dollars plus the unemployment of 20 thousand professionals in the national industry [43]. Likewise, Noceda stated that the Peruvian government's restriction on the reopening of gyms has brought about a significant market contraction and has also driven the disappearance of small and medium-sized fitness businesses [44].

Another key linking variable that was manifested at the previously mentioned juncture was the economic development of the nutritional supplement market since people have sought to strengthen their defenses by taking supplements to combat the virus. For example, Sinisterra-Loayza et al. found that vitamin D was increasingly presented as one of the supplements preferred by the population when seeking prevention and treatment for Covid-19 [45]. It is essential to mention that the pandemic has boosted one of the variables characterized as entry

variables of the system: sedentary lifestyle and inadequate nutrition, a variable considered to be a booster of the sports supplement market. This is because people are not living in normal circumstances, and emotionally, there is a lot of instability in society. Lora mentions that, due to social isolation, mental health problems have increased, and people have acquired less healthy behaviors [46].

Finally, the background for this study showed that research aimed at understanding and characterizing the variables and social actors in the sports supplement markets are still scarce. As mentioned by Godet and Durand, it is important to understand that the reading of the results of the structural analysis presented here is not unique, so that collective reflection based on what is presented here can help to interpret further the behavior of the variables and actors of the system studied [47].

VI. CONCLUSIONS

The evidence shows that the linking and key variables for the sports supplements market are intercepted with the economic, socio-cultural, and technological dimensions. However, it is relevant to mention that the system's instability would allow the other variables to influence. The structural analysis also determined that the sports Institutes, training centers, and national and international organizations are actors with high power due to their capacity to influence the development of the market through specific actions.

This research focuses on the study of ideas belonging to a group of experts who, by consensus, manage to determine the key variables of the system. This allows us to propose a new form of planning that contrasts with the traditional one, focusing on the control and management of the key variables in order to adequately lead them towards a desired future scenario.

The Covid-19 pandemic impacted the nutritional supplement market due to the temporary closure of sports centers. This has led to increased levels of sedentary lifestyles and reduced motivation to purchase dietary supplements. Although it was considered that these changes would be temporary at the beginning, the situation has shown that both companies and consumers have had changes in their paradigms. It has significantly boosted the e-commerce sector, making it the most attractive channel for acquiring a sports supplement thanks to its prices, portfolio, and practicality of purchase.

Although this structural analysis can be interpreted as an initial diagnosis of the Peruvian market for sports supplements, the results obtained here allow the variables to be addressed through the strategic planning of scenarios that contemplate the system's evolution. This opens new lines of research related to the prospective and creation of futures conducive to developing the sports market in the Andean country and Ibero-America.

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