

## **The dental equipment industry in Brazil: origin, structure, and transformations of the space of the dominant companies**

**A indústria de equipamentos odontológicos no Brasil: origem, estrutura e transformações do espaço das empresas dominantes**

**La industria de equipos dentales en Brasil: origen, estructura y transformaciones del espacio de las empresas dominantes**

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### **Abstract**

Starting from the theoretical formulations of Pierre Bourdieu about the economic sociology, this study analyzed the origin, structure and transformations of the dental equipment industry in Brazil. It is an exploratory study, based on documentary analysis of company websites, newspapers and magazines from the economic field, semi-structured interviews, and balance sheets from 2012 to 2020. The space of the dominant dental equipment firms in Brazil was constituted of DabiAtlante, Gnatus, Alliage and Olsen, which have structured this space since the 1940s with the merger of DabiAtlante and Gnatus into Alliage, these have continued strong in the sector. The financial capital presents transformations between 2012 and 2020, with stable profit for Olsen and profits and losses in the rest. The important capital valued by the companies is their technological capital, namely their research, development and innovation capacity to compete in the market; their symbolic capital and their commercial capital, which requires further investigation. The relationship with the State, the organizations representative of the sector, the expansion of the distribution network, exports, and public sector demands warrant subsequent studies.

**Keywords:** Economic sociology; Healthcare economics; Healthcare industry; Dental care; Health economic-industrial complex; Healthcare economics and organizations.

## Resumo

A partir das formulações teóricas de Pierre Bourdieu sobre a sociologia econômica, este estudo analisou a origem, estrutura e transformações da indústria de equipamentos odontológicos no Brasil. Trata-se de um estudo exploratório, baseado em análise documental em sites de empresas de equipamentos odontológicos, jornais e revistas da área econômica, entrevistas semiestruturadas e balanços de 2012 a 2020. O espaço das empresas de equipamentos odontológicos dominantes no Brasil foi constituído pela DabiAtlante, Gnatus, Alliage e Olsen, que estruturam esse espaço desde a década de 1940 com a fusão da DabiAtlante e da Gnatus na Alliage, continuam fortes no setor. O capital financeiro apresenta transformações entre 2012 e 2020, com lucro estável na Olsen e lucros e perdas no restante. O importante capital valorizado pelas empresas é o capital tecnológico, nomeadamente a sua capacidade de investigação, desenvolvimento e inovação para competir no mercado; seu capital simbólico e seu capital comercial, o que requer uma investigação mais aprofundada. A relação com o Estado, as entidades representativas do setor, a ampliação da rede de distribuição, as exportações e as demandas do setor público merecem estudos posteriores.

**Palavras-chave:** Sociologia econômica; Economia da saúde; Assistência odontológica; Complexo econômico-industrial da saúde; Economia das organizações de saúde.

## Resumen

A partir de las formulaciones teóricas de Pierre Bourdieu sobre la sociología económica, este estudio analizó el origen, la estructura y las transformaciones de la industria de equipos dentales en Brasil. Se trata de un estudio exploratorio, basado en análisis documental de sitios web de empresas de equipos dentales, diarios y revistas del ámbito económico, entrevistas semiestruturadas y balances de 2012 a 2020. El espacio de las firmas de equipos dentales dominantes en Brasil estuvo constituido por DabiAtlante, Gnatus, Alliage y Olsen, que han estructurado este espacio desde la década de 1940 con la fusión de DabiAtlante y Gnatus en Alliage, han continuado con fuerza en el sector. El capital financiero presenta transformaciones entre 2012 y 2020, con utilidad estable para Olsen y ganancias y pérdidas en el resto. El capital importante valorado por las empresas es su capital tecnológico, es decir, su capacidad de investigación, desarrollo e innovación para competir en el mercado; su capital simbólico y su capital comercial, lo que requiere mayor investigación. La relación con el Estado, los organismos representativos del sector, la ampliación de la red de distribución, las exportaciones y las demandas del sector público ameritan estudios posteriores.

**Palabras clave:** Sociología económica; Economía de la salud; Economía en atención de salud y organizaciones; Cuidado dental; Complejo económico-industrial de la salud.

## 1. Introduction

The Brazilian healthcare medical-industrial complex, an expression initially formulated by Hesio Cordeiro in 1980 for the pharmaceutical industry, has been the object of a number of subsequent studies (Gadelha, 2003; Gutierrez et al., 2020). Its current denomination is the “healthcare productive complex” (Gadelha Maldonado et al., 2014) or “healthcare economic-industrial complex” (Gadelha 2018) and, more specifically for Brazilian dentistry, the “oral health economic-industrial complex” (Manfredini, 2006; Manfredini et al., 2006). The latter originated in the 1940s and has subsequently expanded, although the formation of a space of medical-hospital supplies and equipment businesses is more widely mentioned as of the 1950s (Furtado et al., 2001).

The concept of medical-industrial complex is closely related to the infrastructure component of health systems. However, this may present an epistemological obstacle in that it can connote homology with biological, harmonious, and interlinked systems. Studies on the distribution of capital in the bureaucratic field already reveal the potential of Pierre Bourdieu's theoretical perspective (Ventura, 2018). However, a sociological perspective, such as Pierre Bourdieu's (1996, 2001) theory of fields and the social structure of the economy, could contribute to a better understanding by recognizing the space of the industry as a subspace linked to the economic field, with agents, companies, and institutions engaged and interested in the healthcare space in Brazil. In addition, it could unveil the power relations, interests, opposition, and cooperation between these agents and institutions in the struggle for a legitimate definition of what oral health is and how to produce, distribute, and universalize it.

In one of the few studies on the topic of oral health, Marcos Manfredini et al., (2006) indicated that the growth of the dentistry industrial sector has occurred in the state of São Paulo based on local productive parks or clusters, such as that of Ribeirão Preto (Santana et al., 2009). The main characteristics of this productive sector in Brazil have been an emphasis on

exports to middle and low income countries, a balance of trade surplus, more recent technological incorporation, as well as the concentration of a small group of national companies, as the result of mergers (Barroso, 2016). The industry has maintained a focus on innovation and export strategy, especially through the factories in Ribeirão Preto (Perussi et al., 2012; Barroso, 2016).

This topic is relevant given the research gap concerning the lack of studies on the dental equipment industrial sector. No analyses were found regarding the characteristics of these companies and their owners, as well as their position in the healthcare industrial space. Thus, this study sought to map the main dental equipment companies in the sector in Brazil, and it analyzed their origin, transformations, accumulated capitals, and the trajectory of their owners.

## 2. Methodology

This is an exploratory qualitative study from a case study on the social space of companies in the dental equipment sector, guided by Pierre Bourdieu's sociology (2001, 2005), especially his studies on the economic field.

The industry that produces for the dentistry field is divided into manufacturers of equipment (full dental clinics composed of chairs, equipment, reflectors, stools, dispensers and mixers, prophylaxis devices, laser therapy, hand pieces, autoclave sterilization, dental implant equipment, and X-ray equipment) and manufacturers of consumable materials (resins, amalgams, and implants). This study elaborates on the first group and, more specifically, on the industry for dentist's chairs, reflectors, and hand pieces.

The companies were chosen based on a literature review of the topic and exploratory research online on the national companies that produce dental equipment in Brazil. Four dominant companies in this space were included: Dabi Atlante, Gnatus, Alliage, and Olsen.

This study was based on documental analysis and in-depth interviews. The balance sheet data from 2012 onward were obtained from the website <https://www.balancos.com.br>. The website of the magazines *Valor Econômico* ([www.valor.com.br](http://www.valor.com.br)) and *Os Cem Mais Influentes da Saúde* (<http://saudeonline.grupomidia.com/healthcaremanagement/100-mais-influentes-da-saude>) were also consulted. In *Valor Econômico*, the publications were identified using the keywords "company name" and "medical-dental equipment." The companies' social media were also explored, and interviews with the Chief Executive Officers (CEOs) of the four companies available on the YouTube platform were transcribed and analyzed.

The in-depth semi-structured interviews were conducted with owners and superintendent directors of the companies, using online meeting software. These interviews were recorded and transcribed for analysis purposes.

The interview script included four sets of questions, which sought the following based on the companies' and agents' capitals: (1) the origin and trajectory of the company and agent; (2) the main positions adopted regarding the public and private market; (3) the main positions adopted regarding research, development, and innovation; and (4) competition and the Brazilian market. The owners were characterized based on exploration of the data available online, such as economic capital data at the Board of Trade of the state of the federation where their company is established and information about their career, social trajectory, and positions occupied in associations and other entities. These categories guided the thematic content analysis of the empirical material collected (Minayo, 2008).

In terms of the theoretical framework, based on the contribution of Hésio Cordeiro (1980), who launched the discussion on Brazilian collective health, it can be affirmed that the healthcare medical-industrial complex refers to the relationships between the production and circulation of products, the organization of professional practices, the forms of state intervention in the sector, and the concrete individual consumption practices, which in this case includes the entire dentistry field.

Studying the economic field and the economic dynamic of the processes of production, distribution, circulation, and consumption of healthcare equipment requires an understanding of the production of knowledge in the field of economics and

of sociology, known as “economic sociology.” Pierre Bourdieu studied various social fields, including the private housing market in France. This highly empirical research gave rise to the article “*Le champs économique*,” published in 1997, and the book *Les structures sociales de l'économie*, published in 2000, where he systematizes the principles of a sociological analysis of economic phenomena using two key concepts of his theoretical production: field and *habitus* (Raud, 2007).

For Pierre Bourdieu, the notions of field, agents, their capitals, and dispositions (*habitus*) are essential for understanding the structure and dynamic of social spaces (Bourdieu, 1996, 2018). From this perspective of economic sociology, the market is the product of a social construction, where it is necessary to understand the genesis of the dispositions of the agents in the field of struggles where they face each other, with unequal resources or capitals, with an emphasis on the role of the State and its importance in the analysis of the healthcare industrial complex.

In this sense, the State results from the concentration of different types of capitals, with powers over different fields and forms of capital. It is the creator and guarantor of various “fetishes” and performs an essential role in the formation of dispositions and in the promotion of demands and induction of supply. The agents of the bureaucratic field receive from the State the power to speak in its name, thus being holders of power guaranteed by the State (Bourdieu, 2012).

The State, therefore, exercises an influence over the functioning of the economic field, especially through the different policies and the structural effects it produces, such as budgetary laws, infrastructure investments, workforce training, and the imposition of rules of the economic game and of labor laws, which are elements that make the bureaucratic field a macroeconomic stimulator for ensuring the stability and safety of the economic field (Bourdieu, 2001, 2005).

Thus, understanding the market requires an analysis of three components: a) the structure of the field of production; b) the mechanisms that determine the functioning of that field; and c) the distribution structure of economic dispositions and tastes, while establishing, via a historical analysis, the social conditions of production of the economic field in particular and of those dispositions (Bourdieu, 2001).

Based on that approach, this study considers the existence of two poles in the dentistry field: the universal one, focusing on protecting health in the collective environment, which produces the discourse of oral health for all; and that of the market (Figure 1). In the market pole, in the economic field, there is the subspace of the dental industry, understood as a space of power relations between owners, industrial companies, and distributors in search of a monopoly over the production of dental equipment, which is the focus of this study.

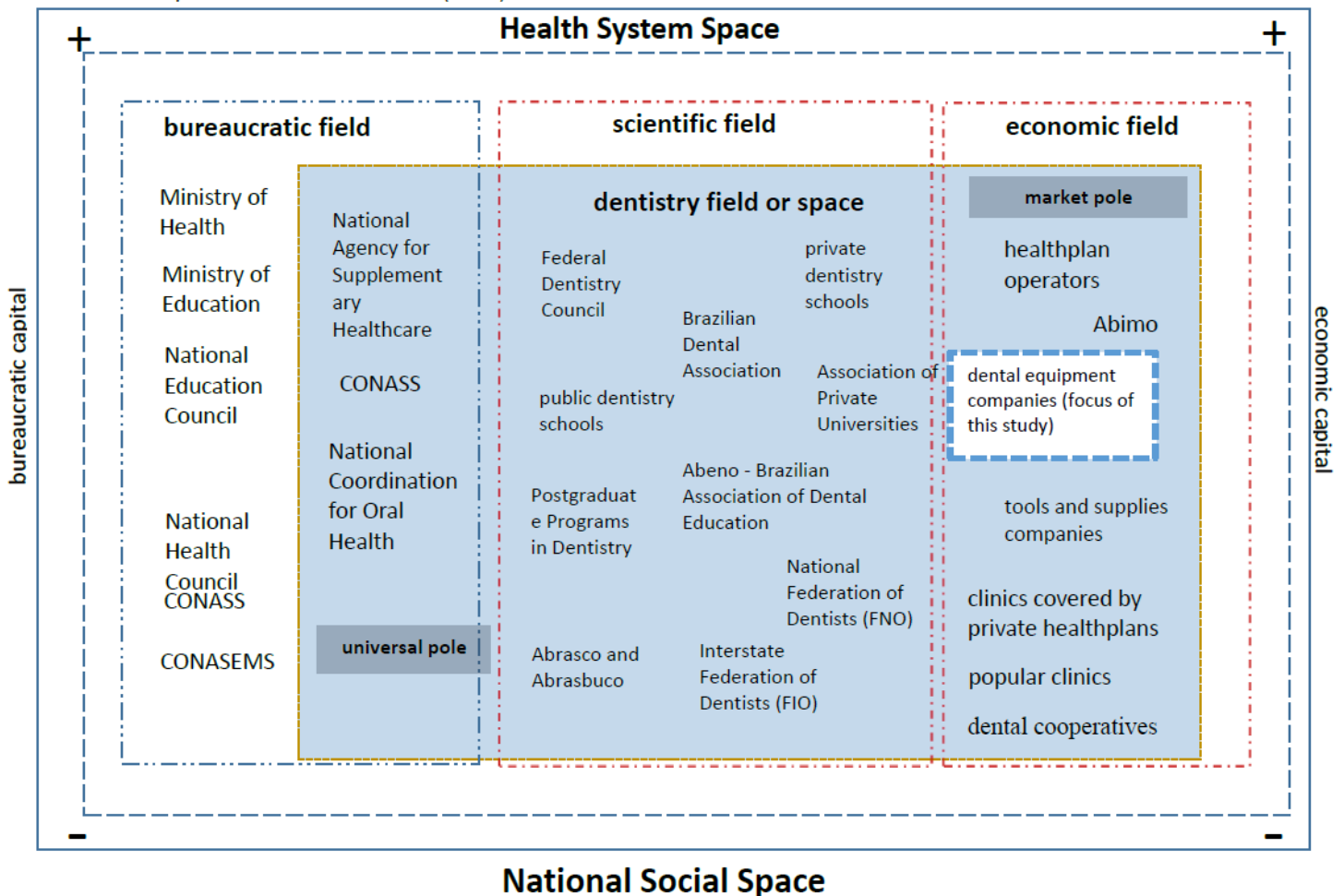
The main capitals of the agents and their companies considered in this analysis were the financial, technological, commercial, and symbolic ones (Bourdieu, 2001, 2005). Financial capital is the very sense and law of the field, represented by economic profit and the symbolic profits linked to it, and it refers to the direct or indirect control of financial resources, which enable the accumulation of the other types of capital over time. Technological capital is the portfolio of scientific resources (of research and development, innovation, as well as the mechanisms of routines, procedures, and own competences of the agent). Commercial capital includes the sales team, the control (centralized or decentralized), and size of the distribution networks. Finally, symbolic capital involves the knowledge and recognition of those agents in the space of relationships, for example through the brand image, loyalty to it, and the belief and credit in their permanent work in maintaining that recognition (Bourdieu, 2001, 2005). This last capital is considered to be the most difficult one to find; however, an approximation was made based on recognized rankings, events, and publications that are valued in the economic field and in the subspace of the dental companies.

The body of the research was analyzed based on the specified theoretical framework. The analysis was divided into two parts: the first focused on the structure of the field of production of dental equipment (its main characteristics, a brief history of the origin of the chosen companies, and the trajectories of their owners and leaders) and the second covered its

operating mechanisms, with an emphasis on analyzing the financial, technological, commercial, and symbolic capitals of each case.

The study followed the requirements of CONEP Resolution n. 466/2012. Its objectives were explained to the interviewees. All the participants signed informed consent forms. The project was approved by the Research Ethics Committee of the Institute of Collective Health of the Federal University of Bahia (CAAE: 00389318.3.0000.5030).

**Figure 1.** Outline of the dentistry field or space in Brazil with a focus on the space of the dental equipment companies (in white). Adapted from Prada & Chaves (2018).



Source: Authors.

### 3. Results

#### The structure of the field of production, a brief history of the origin of the companies, and the trajectory of the owners and leaders

It can be said that the field of production of dental equipment is relatively small in Brazil compared to other industrial parks, such as that of Bologna in Italy (Barroso, 2016), and it is constituted of medium- and large-sized family businesses run by men, thus being fractions of the Brazilian industrial bourgeoisie of states in the southeast and south regions of the country (Chart 1). Four national companies dominating this social space can be highlighted: Dabi Atlante and Gnatus, founded in Ribeirão Preto, in São Paulo; Olsen, with headquarters in the city of Palhoça, in Santa Catarina; and Alliage, the result of a merger between Dabi Atlante and Gnatus. In addition to these, there are large foreign companies, such as Kavo and Sirona, both with headquarters in Germany, as well as a few others.

In the fraction of the eminently national industrial bourgeoisie, the first of them, Dabi Atlante, was founded in 1946 in the city of Ribeirão Preto, in São Paulo, by Pedro Biagi Neto. The name Dabi is an inversion of the abbreviation for *Indústria Brasileira de Aparelhos Dentários* (Brazilian Industry of Dental Devices). Its emergence in this city and in this historical period may be related with the opening of the School of Dentistry and the School of Medicine of the University of São Paulo in Ribeirão Preto between 1932 and 1936. Specifically, Dabi emerged from a partnership between the German Pedro Licht and Byron Martins Brandão. In the 1950s, the agricultural entrepreneur Baudílio Biagi became a partner in the business.

“It was founded by entrepreneurs from this region of Ribeirão Preto, who were actually ranchers who owned lands, together with a creative German in the 1940s. My grandfather loaned money to one of those entrepreneurs, who was my grandfather’s brother-in-law and my grandmother’s brother. And through those loans and help from my grandfather, he ended up becoming a partner.” CEO Dabi Atlante.

The Biagi family has assumed control of the business since then. In 1976, Dabi bought Atlante, from São Paulo, and became known as Dabi Atlante. At the end of the 1970s, Dabi Atlante was a pioneer in the production of X-rays and hand pieces, as well as producing the *Versa* dentist’s chair, which enabled dental surgeons to work sitting down, and no longer standing up as was the case until then, radically changing the ergonomics of the work of dental surgeons. In 2021, its president was Caetano Barros Biagi, Pedro Biagi Neto’s nephew. Caetano was born in 1981 and is a mechanical engineer. He is currently also the Executive Vice President of Alliage, the result of a merger in 2015 of the companies Dabi Atlante and Gnatus, and is a member of the Board of Directors. In addition, other Biagi family members occupy positions on the Board of Directors of Alliage.

Alliage means “alliance” in French. With the merger, the pre-existing brands were maintained, such as Dabi Atlante and Gnatus, and others were created and incorporated to attend to the various publics, such as Saevo, D700, and Chroma.

Gnatus was founded in 1976 by an ex-employee of Dabi Atlante, João Padula Nomelini, who was an industrial manager of the first company for 22 years. Its current president is Gilberto Nomelini, the son of João Padula Nomelini, who is already deceased. Gnatus produces dentist’s chairs, hand pieces, dental ultrasound equipment, and other products. It was this company that equipped a good part of the Oral Health Teams at the start of the expansion of the public network promoted by the National Policy for Oral Health, Smiling Brazil, through the centralized purchases of the Ministry of Health. Gilberto Nomelini has been a Deputy Adviser of the Brazilian Association of Medical and Dental Equipment (AMIBO), the President of Gnatus (he occupied his father’s position), the Vice President of operations of Alliage, and the Superintendent Director of Dabi Atlante. The merger with Dabi, which resulted in Alliage in 2015, was approved in 2016 by the Administrative Council for Economic Defense (CADE), an agency of the Brazilian state for the protection of free competition. This has led to market dominance, with an annual turnover of R\$ 288 million in 2021 and an almost 70% share of the domestic market for dentist’s chairs, compressors, and prophylaxis and X-ray equipment.

Of the four companies, Olsen is the only one that was born outside the Ribeirão Preto axis. Its founder, Cesar Augusto Olsen, received technical training in maintaining dental equipment through the National Service for Industrial Training (SENAI) in Santa Catarina, and he created Olsen in 1976. The company has consolidated over this 45-year period and extended its market to other sectors such as animal dentistry and medical equipment (Chart 1).

**Chart 1.** Main CEOs of the dominant dental equipment companies in Brazil, social origin, professional trajectory, company where they operate, and positions occupied.

Agents	Social origin	Professional trajectory	Company and economic capital	Positions occupied and participation in companies
Caetano Barros Biagi	Born in Ribeirão Preto, São Paulo, in 1981. Married with two children. The fourth of five children. His father is Arthur Biagi and his grandfather was Baudilio Biagi. He is the nephew of Pedro Biagi Neto, one of the company's first owners in 1940.	Mechanical engineer educated at the University of São Paulo (USP). He started at the faculty when he was 17 and was already an engineer when he was 20. He started his career at <a href="#">Dabi Atlante</a> in Ribeirão Preto, in 2003, when only 21 years old, in the Production Planning department. He was asked to work at Dabi, where other family members (cousins, siblings) worked. For seven years he worked in the factory and in the engineering area, and in 2012 he assumed the position of company CEO.	<b>DabiAtlante:</b> Founded on August 30th of 1946 by Pedro Biagi Neto. In the mid-1950s the company expanded its business, using capital injected by a branch of the Biagi family, a traditional sugarcane producer and plantation owners in the region, who control the company. The company is focused on diagnostic imaging for dentistry. It produces various other types of equipment, such as dentist's chairs, X-ray machines, and air compressors.	Executive Vice President of Alliage and member of the Board. Board of Abimo 2020. Board substitute 2021. Caetano acts as a partner in 10 headquarter companies and nine subsidiaries.
Gilberto Henrique Canesin Nomelini	Born in Ribeirão Preto, São Paulo, on September 27 <sup>th</sup> of 1957. Son of João Padula Nomelini, founder of Gnatus.	Born in Ribeirão Preto, São Paulo, on September 27 <sup>th</sup> of 1957. Graduated in 1979 in mechanical engineering at the University of Mogi das Cruzes (São Paulo) aged 22. After finishing the course, he was invited by his father João Padula Nomelini to join the dental equipment company Gnatus and help him in the business. Gilberto Nomelini took over the industrial part and his father was left with the commercial part. Married with two children, he is now 64 years old.	<b>Gnatus:</b> Manufacturer of dentist's chairs, ultrasound devices for other health sectors, autoclaves, laser devices for dental treatment, dental implants, dental instruments, and whitening systems. Was substituted by the D700 brand. Currently, Dabi and Gnatus are contained within Alliage, which has the following in its portfolio: autoclaves, beds, sterilizers, exam tables, tables for surgical operations, dental X-ray devices, dentist's chairs, compressors, dental implants, dental instruments, complete dental units, MRI diagnostic devices, CT devices, X-ray equipment, parts and accessories for X-rays, and sterilization devices.	Deputy Adviser of ABIMO, President of Gnatus (took over the role of his father), Superintendent Director of Dabi Atlante, and Vice President of Operations of Alliage. Participates as a partner or on the boards of 10 headquarter companies and 10 subsidiaries.
Cesar Augusto Olsen	Born in 1957. Descendent of Norwegians on his father's side and Italians on his mother's side. His father was a road builder, he worked in a sawmill, and he worked on a ranch rearing livestock. But in the industrial area Cesar used his grandfather. His sawmill did very well but when the children took over the sawmill they began to leave it.	Technician in dental clinic maintenance trained at SENAI in Santa Catarina. His first job was as an office boy, then he worked in the graphics sector for four years. After the course at SENAI he started to provide technical support in the dental sector. He visited the clients carrying out maintenance and founded Olsen between 1978 and 1979.	<b>Olsen Industria e Comercio</b> 05/25/1979 He participates as a partner in seven companies that have been active since 1979. The company currently has 10 subsidiaries in the most important state capitals of Brazil.	Regional Council of Santa Catarina of SENAI, industry representative.

Source: Data on participation in companies available from: <http://www.sociosbrasil.com/>. Data on social origin and trajectory obtained through interviews and interviews on the internet: Caetano Biagi on the Hiper Business program <https://www.youtube.com/watch?v=Ubbar6S0q7k>

In accordance with Decree 8,777 of May 11<sup>th</sup> of 2016, the shareholder composition and management information on the legal entities is considered. Data open and free for disclosure without prior authorization.

**Operating mechanisms: the competition, profit, and the price of dental equipment in Brazil**

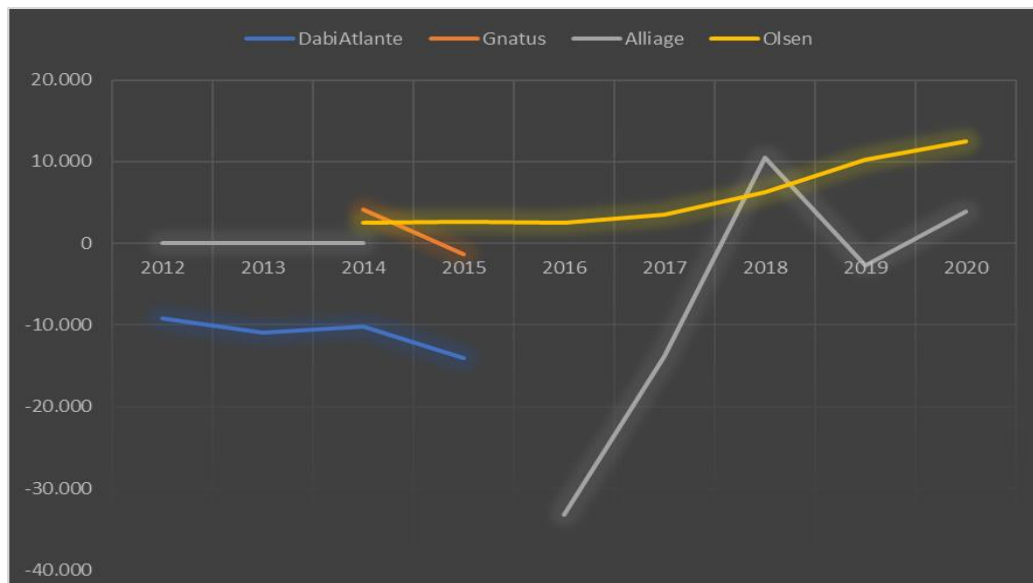
In the analysis of the different types of capital accumulated by these businesses, a specific dynamic is observed in the period. With relation to financial capital, the analysis of the companies' balance sheets for the 2014-2020 period draws attention, in which profits and losses varied (Table 1, Figure 2). Profit is the main sanction and stated objective of the economic field (Bourdieu, 2005).

**Table 1.** Statement of Net Profit or Loss, Revenue, and Assets by year (in million BRL) between 2012 and 2020 of the four companies Dabi Atlante, Gnatus, Alliage, and Olsen.

Business/year	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Net Profit</b>									
DabiAtlante	-9.177	-10.974	-10.152	-14.098					
Gnatus			4.167	-1.393					
Alliage	-	-	-		-33.292	-13.804	10.533	-2.728	3.920
Olsen			2.514	2.668	2.472	3.539	6.262	10.284	12.525
<b>Revenue</b>									
DabiAtlante	91.698	94.562	105.727	95.269	-	-	-	-	-
Gnatus	-	-	122.675	121.099	-	-	-	-	-
Alliage	-	-	-	-	68.937	231.988	260.655	259.469	287.512
Olsen	35.111	29.837	32.344	26.854	29.607	37.842	52.429	59.758	67.855
<b>Assets</b>									
DabiAtlante	170.891	181.028	173.432	220.945	-	-	-	-	-
Gnatus	-	-	147.841	134.270	-	-	-	-	-
Alliage	-	-	-	-	221.776	387.568	431.391	505.028	574.574
Olsen	11.873	13.906	15.481	16.901	19.611	24.181	30.999	32.427	51.041

Source: Balance sheets published in newspapers in compliance with legal and statutory arrangements. Available from the website: [www.balancos.com.br](http://www.balancos.com.br)

**Figure 2.** Profit or loss according to balance sheets by year (in million BRL) of the four dental equipment businesses, 2012-2020.



Source: Balance sheets of the companies published in newspapers in compliance with legal and statutory arrangements. Available from the website: [www.balancos.com.br](http://www.balancos.com.br)



Olsen presented a positive net profit in the entire period between 2014 and 2020, varying from R\$ 2.514 million in 2014 to R\$ 12.525 million in 2020. On the other hand, Dabi Atlante presented losses in the period from the start of the series for four consecutive years (of around 10 million in 2014 and 14 million in 2015). Gnatus also presented a loss in 2015. These financial results may have contributed to the merger of the two companies into the company Alliage. Alliage presented losses in the period between 2016 and 2019, and it had its first net profit in 2020, of R\$ 3.920 million. It is noteworthy that the revenues and assets of Alliage are considerably higher than those of Olsen.

Regarding technological capital, as previously mentioned, Dabi Atlante innovated in the 1970s with the *Versa* chair, which enabled dental surgeons to work sitting down. It also developed colloidal silver technology, the dental X-ray, hand pieces, implants, the Air D700 line, the Ello cabinet with RFID technology (Dellagnelo, 2010), and the Eagle digital panoramic tomography.

“One example of this is the antibacterial technology that we exclusively apply in our Dabi Atlante equipment, which leaves the whole surface of our equipment free of bacteria as we apply it, in partnership with technology developed at the Federal University of São Carlos: colloidal silver.” CEO Dabi Atlante

“[...] the Ello cabinet was one development. It’s a product with our own patent and was widely tested. It’s being placed in the market step-by-step [...] the technology enables us to use the internet to manage stock [...] it’s the same as non-stop toll collection, so our cabinet has antennas that continuously read which products are inside [...]” CEO Dabi Atlante

The presence and recognition of the importance of state induction in the development of technologies and innovations were verified, as well as lower-interest financing because national products are concerned. One example is the Eagle X-ray equipment, which can be financed through the Financing Fund for the Acquisition of Industrial Machinery and Equipment (FINAME) for up to 90% of the value, that is, financing of the production and acquisition of national machinery and equipment accredited at the National Bank for Economic and Social Development (BNDES), from which the industry benefits from the state incentive (Dabi Atlante, 2013).

“[...] we also work very closely with the government, which since the 1970s together with BNDES, FINEP, has financed us. They have costed long-term research. They finance projects such as the one for the first tomograph manufactured in the southern hemisphere, which we launched a year ago and are selling not only in Brazil, but also in the United States, the Eagle 3D. So Dabi has always had R&D in its blood” CEO Dabi Atlante

Gnatus began its industrial transformation with the first articulator with the 8600LN model for a dental prosthesis in 1977, the first Gnatus M1 clinic in the 1980s, and the first XR6010 X-ray. It invested in an original electric hand piece with a silent 400-thousand rotation turbine in 2009 and diagnostic ultrasound imaging in 2015. In 2015, this Gnatus equipment costed R\$ 10 thousand, while the normal one was around R\$ 800.

“It is a piece of equipment that makes 400 thousand rotations, and we developed an electric micromotor that does the same job, but it is a silent piece of equipment.” CEO Gnatus

Exposure to prolonged noise represents a real risk of damage to auditory organs. This question is regulated by the State through Regulatory Standard n. 15 (NR-15). Besides the noise of the high rotation pen, other noises in the dental clinic such as air conditioning, amalgamators, and compressors, among others, may exceed healthy limits (Mendes, 2015; Oliveira et al., 2019). Therefore, noise reduction is a valued technology in this subspace, both due to the occupational health arguments and for the comfort of the dental service user, and it is used to increase the symbolic capital of the company among consumers.

Another technological capital that has been valued in this sense is intraoral digital imaging sensors. This is equipment that captures high-quality digital X-ray images and transfers them to a computer, using dental imaging software, where they can be viewed, enhanced, stored, sent, or printed, among other functions (Ravaneli, 2018). Alliage innovated by creating the first digital sensor in Brazil in 2015 and diagnostic imaging in 2020, and it has Dabi Atlante and Saevo brand sensors.

“This is a nice example of our innovation. When I started to manufacture a sensor in Brazil, about six or seven years ago (2013-2014), our country bought a hundred, two hundred sensors a year. Today we produce six thousand sensors a year, but that sensor is not only good because it earns money for Alliage, but due to the elimination of chemicals and it fosters health, as the diagnosis, besides being much more precise, can be easily stored and more importantly the professional can share it with a colleague at the same time to clear up any doubts. Without mentioning the question of time, how much is a dentist’s time worth? Moreover, you expose the patient to half the dose of radiation.” CEO Alliage

Olsen, in turn, has innovations such as the Infinity equipment, nanotechnology that inhibits bacterial proliferation in paint and coverings, the Bosch motor, a veterinary line, and the 32 kg hertz ultrasound, as well as standing out for its production of the *Odontoportátil*, made exclusively for the Brazilian army.

“We developed equipment for the Armed Forces, which was made as a piece of strategic defense equipment. It is the only company in the dental medical sector that has that characteristic. That seal is valid all around the world. It is an extremely modern piece of equipment, which contains things that you can’t even imagine in a case less than one cubic meter big. It is an itinerant piece of equipment and costs around R\$ 50 thousand. It can be transported anywhere. This equipment is a solution for dentistry.” CEO Olsen

Regarding commercial capital, each business has developed different strategies to increase its capital and expand its market position. The presence of subsidiaries and distributors in other regions was identified, especially in the country’s state capitals, as well as outside Brazil to increase exports, the creation of brands and models for different publics, and investments in products capable of competing in public tenders and private sector quotations, with an emphasis on the national demand for this equipment from dentistry schools.

“Today we have around 900 collaborators, more or less 700 in Ribeirão Preto and another 100 spread around Brazil, as we have eight subsidiaries spread throughout the main Brazilian state capitals. We also have a small implant factory in Itu where there are around a dozen collaborators. We have a factory in Argentina that has 80 collaborators and a commercial operation in Mexico with around 20 full-time collaborators, currently totaling 900.” CEO Alliage March 2021

“Saevo is the number one brand of chairs in Brazil today. We created the Saevo brand in Brazil [...], with that we have brands that permeate different publics and that makes complete sense, as everyone wants their own style, don’t they? Dabi Atlante is a brand of ours for a more senior public, that is, better off or a public that works large-scale. Saevo, in turn, is a more competitive product, extremely resistant and that’ll serve large chains, the simpler faculties.” CEO Alliage March 2021

“[...] at the end of the semester now we’re going to 10 subsidiaries in the most important state capitals in Brazil. Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Minas, Bahia and Rio de Janeiro. Now we’re opening in the interior of São Paulo, opening another one in greater São Paulo and another one in Espírito Santo. [...] subsidiaries in 16 premium points of sale [...] We sell to federal universities [...] We beat the competition, they decided to take a series of actions against us, but we delivered 217 pieces of equipment before the deadline and above what they asked for. We made an upgrade! The municipal government saw that and latched on and bought another 217 including because the price was very attractive [...] After that we sold more than three thousand pieces of equipment to private and public universities, no problem.” CEO Olsen March 2021

“The export DNA, that first consortium was launched in Uruguay, it wasn’t in Brazil, so the market vision, of the world, was so big that we thought about the world, not only about Brazil. Brazil was already small for us and we were

seen as visionaries in dentistry [...] Today we have 490 employees in the factory, because we have various subsidiaries in Brazil and also various subsidiaries as you yourself mentioned, abroad, in China, in Mexico, in Bolivia and Dubai, but at the factory, 490 at the industrial park.” CEO Gnatus

“I even remember in 1981 when we took part in the first International Conference in New York, and that was when we managed to sign a contract with an American company to distribute the articulators worldwide, because we didn’t have an export structure, we sold well in Brazil, but to export it was difficult, a small company, so that... it gave us a huge advantage.” CEO Gnatus

In the symbolic capital analysis, regarding recognition capital, that is, how the company is known and recognized in the space, the analysis indicated that the *Health Care Management* magazine from Grupo Mídia publishes the *Os Cem Mais Influentes da Saúde (The Hundred Most Influential in Health)* list, which consists of the consecration of an event held annually since 2013, in São Paulo, with the presence of executives from the healthcare sector in Brazil, featuring the constant presence of CEOs from the dental industry, including the main CEOs of the three companies investigated (Figure 3).

**Figure 3.** *Os Cem Mais Influentes da Saúde em 2016.* From left to right: Caetano Biagi, Gilberto Nomelini, and César Olsen. Ater Cristófoli from the company Autoclaves is not included in this study.



Source: *Health Care Management*, Grupo Mídia. Available at: [https://issuu.com/grupomidia/docs/healthcare\\_39\\_site/87](https://issuu.com/grupomidia/docs/healthcare_39_site/87).

In the case of Dabi Atlante, recognition of its pioneering spirit in the 1940s was verified, as well as the size of its industrial complex, compared with the other competitors. The alliance with its main competitor in 2015 may have been an attempt to maintain that dominance in the Brazilian market.

“Our company’s greatest innovation is a modern way of relating with all stakeholders. I think that was what made the most difference in our company. I think: why do I have to fight with my competitor if I can join them and create something stronger?” CEO Dabi Atlante

Finally, price is the main attribute that defines the competition between the producers and the relationship between the producers and types of consumers, as well as the aforementioned elements concerning the other capitals analyzed.

To understand the space of competition between the companies, a quotation was requested via the Alliage and Olsen websites, for the respective portfolios of the Saevo, D700, and Croma brands. The price was requested via the website of the respective brands and Croma answered in four hours and Saevo and D700 in less than a day. The Olsen website asked for the state and DDD to better guide its subsidiaries and answered the request in 15 minutes by sending a catalog. All of them showed distribution network agility in their customer service.

It was observed that all the dentist's chairs have a three-way syringe, a high and low rotation terminal, and a reflector, where the type of light can differ between LED and halogen, and the price varied between R\$ 14,944 and R\$ 19,320 in April of 2021 (Table 2). Olsen presented the most competitive chair and shows the use of the Bosch motor in its advertising, as well as offering more expensive lines aimed at other publics. The Gnatus equipment was not presented in Table 2 due to the substitution of the brand by D700.

**Table 2.** Average value of dental equipment in April of 2021 from the main dental equipment manufacturers in Brazil.

Company/equipment	Value in BRL
Alliage/Saevo - S 200 Smart	15,790.50
Alliage/Saevo - S 200 F	18,285.30
Alliage/D700- Cons D 700	15,000.00
Alliage/D700 - Air D 700	16,501.50
Alliage/Croma - Cart	17,519.00
Alliage/Croma - Air	18,871.00
Olsen - SPRINT	19,320.00
Olsen - SPRINT T	14,944.00

Source: Commercial sector of the companies via email.

#### 4. Discussion

Brazil currently has around 335.8 thousand dental surgeons and 462 dentistry schools in operation in August of 2021, an impressive number if we compare it with 2015 (n=220) and the 1990s, when there were only 81 schools in the whole country (CFO, 2021; Chaves et al., 2020). This large number of consumers of dental equipment in the oral health market is fairly promising for the oral health industrial complex.

The International Dental Conference in São Paulo is the biggest in Latin America and brings together the entire space of the economic field and the industry. Participant observation of the major international dental fair in São Paulo revealed the strategies of the dental industrial complex in building the disposition for the consumption of technological products, ranging from the big brands to small producers, with large stands, prominent locations, visual and audio attractions, technological advances, as well the symbolic dispute related to queue sizes, and, from a more recent perspective, quantity of manifestations (hashtags, likes, and shares) on social media (Leme et al., 2019).

Pierre Bourdieu's (1996, 2008) theory of the social space values the agent's trajectory and the possible homologies between their trajectory and their positioning. Caetano Biagi (Dabi Atlante) and Gilberto Nomelini (Gnatus), both trained engineers, valued the innovations of their respective companies and of the engineering profession. César Olsen, who is not university-educated, but is active and a specialist in the area of dental technology, and has valued dispositions in the economic field, founded a company that has accumulated financial, technological, commercial, and symbolic capital with the potential to occupy a dominant position in the Brazilian market (Seifriz, 2002).

This study revealed that the space of the dental equipment industry has as a fundamental law the need for investment in research and development, which gives dynamism to the competition and improves the products (Camilo et al., 2019); that is, technological capital is the differential capital to be accumulated and converted into other capitals. It is worth better investigating the mechanisms of the distribution and purchases and sales networks in the public sector, in terms of the importance of commercial capital, which was scarcely explored in this study. Moreover, the merger of the smaller companies into solid companies in the national market appears to be a similar trend to that of other companies in the healthcare sector (Scheffer et al., 2019, Sestelo, 2018), suggesting a certain level of financial dominance of some companies investigated here in the oral health space.

In light of the studies that have shown the major expansion of dentistry courses in Brazil (Chaves et al., 2020; Brasil, 2020), there is an indication that the expansion of the industrial sector has a direct relationship with the increase in dental surgeons and dental clinics promoted in recent decades by the State itself in the private higher education sector.

Brazil has a strong industrial park in the area of dental equipment, but it is much smaller than the industrial parks in countries such as Italy. Both underwent an industrialization process in the 1940s and 1970s, prior to the industrialization of Brazil, concentrated in the region of Ribeirão Preto. This sector presents an emphasis on exports, the incorporation of innovative technologies, and mergers of local family businesses. The other industrial parks for dental equipment in the world, such as in Bologna in Italy (Barroso, 2016), in China (Zhou, 2018), which is still in its infancy, and in the United States deserve to be valued and explored from the viewpoint of comparative studies. A recent article published by Chinese researchers observed a movement by the Chinese state to invest in the population's oral health, given that China is the second biggest global market for medical/dental devices (Zhou, 2018). The National Health and Family Planning Commission (NHFPC) of China has launched a number of policies to favor Chinese medical and dental equipment manufacturers (Zhou, 2018), which warrants subsequent studies on the impacts on peripheral capitalist countries such as Brazil.

It can be considered that the dentistry field is guided by two logics that should be better investigated: the health one, which seeks quality of life for people and values the effectiveness and safety of products/services; and the economic one, linked to aspects of cost, equipment, and the balance of trade. It is worth reflecting on whether these logics are contradictory or not, and in which situations they are present. These logics may even interfere in dental practice. Tesser et al. (2015) highlight that in the historical origins of its professionalization, dentistry distanced itself from the barber profession and drew closer to medicine and science. More recently, there has been a change in practices driven by the market and profit logic that is distancing it from the health-disease process and bringing it closer (again) to merely esthetic questions, as also occurs in medicine, often exceeding the limits of technical indications to incorporate the desires of the "consumer-patient" in the treatments proposed. These recent changes in dental practice are more related to the market and profit logic than to oral health needs (Tesser et al., 2015).

According to Manfredini and Botazzo (2006), regulation and control of the dental equipment park in Brazil is important. The role of the State is fundamental, not only due to its purchasing power, as was seen in the acquisition of dental equipment in the expansion of the Smiling Brazil program, but also due to the recognition of the strategic role of the State in the healthcare productive complex as a policy-maker, in guiding research so that it fits healthcare policies, in disseminating innovations, in control and regulation, in the relationship between producers and healthcare organizations, and in the qualification of its actions, among many other aspects (Gadelha et al., 2016).

In the competition for the dental market in Brazil, besides the three national companies, the other competitors are the foreign companies Philips, GE, KaVo, and Sirona. Each one presents distinct technological capital, with some product overlaps. The dentist's chair, for example, is a common product of the first three, as well as hand pieces in Olsen and Gnatus. On the other hand, there are important differences between the rest in terms of imaging equipment and the use of digital

technology. Sirona arrived in Brazil in 2010 and in 2012 turned over around R\$ 35 million in the country. Its products relate to digital technology and dental implants.

The appropriation of the concept of capital in the dental equipment industry was useful and remains scarcely explored in the studies about the economic field in Brazil. It also provided a better understanding of what each dental business prioritizes from the viewpoint of the types of capital, especially in the monopoly of technological capital and accumulation of commercial capital, which was well observed in the proactive, fast, easy, and personalized service for every professional profile.

## 5. Final Considerations

In conclusion, this study contributed in an exploratory way, based on an economic sociology anchored in the sociology of Pierre Bourdieu (2005, 2018), to understand the social space of the dental equipment industry in Brazil. As an exploratory study, its main limitation was not going into depth regarding each one of the elements indicated as being fundamental for the configuration of the space, such as the relationship with the State, the other dominated companies, the expansion of the distribution network, exports, and public sector demands, which warrant subsequent studies.

Only the space of the dominant companies was investigated. It is necessary to expand the analysis of the structure of the field to the dominated and smaller companies. Studies that investigate the exports component are also needed.

An understanding of the social microcosm is essential to identify its agents, the relationships established between them, the positions occupied, and the rules of the game. Despite the growth of the national companies, Brazilian industrial policy in the medical-dental sector, and the attribution of the meta capital of the State (Bourdieu, 2012), the sector requires greater economic and symbolic investment.

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