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ARTICLE

Colonialism, nationalism and reconstruction of history of science: the case of Goa

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Abstract
This paper argues that nationalist ideology influenced the writings of Goan elites who joined their Indian counterparts. The latter glorified the pre-modern history, literature, art, and architecture of India as a response to the colonial assertions of its superiority. In the case of Goa, the colonial authorities propounded the concept of Goa Dourada, or golden Goa under Portuguese rule. The local elites countered this concept through 'Goa Indica', thus exhibiting the relationship of colonial Goa with colonial India. In the process, the scholars such as Menezes Braganza, Panduranga Pissurlencar, and Adeatado Baretto discussed the contribution of ancient Indians to the field of science and technology. The glorification of ancient Indian science and technology contributed to the rise of 'pseudo-science', which is considered a byproduct of the anti-colonial movement. However, the rise of 'pseudo-science' was an unavoidable development, particularly in the colonial period. The Goan historians, while reconstructing the history of science, followed their counterparts in British India to show that Goa was a part of India. Scholars were able to achieve national unity in the pre and post-colonial periods by studying science and technology.

Keywords Colonialism · Nationalism · Ideology · Goa Indica · Science · Technology

1 Introduction

This paper shows how nationalism emerged in the early decades of the twentieth century as an ideology influencing the Indian scientists and historians of science who attempted to glorify the achievements of ancient Indians while comparing the same with the European achievement during the same period. While indulging in such an exercise, one should also look at the factors, which compelled the historians of science to emphasize the claims of ancient Indians to a considerable scientific achievement. It was a reaction to contemporary developments such as colonialism and nationalism, which reached its peak in India during this period.

2 Colonialism, nationalism, and history of science: the Indian scenario

Romila Thapar divides the historiography of India into orientalist, imperialist and nationalist phases (Thapar, 2002, pp. 1–25). In the orientalist phase, there was what Trautman calls 'Indo-mania', a love, on the part of the Europeans including the British, for everything Indian. Even before the Indian historians influenced by nationalist ideology claimed their scientific achievements, European orientalists had taken up the project of studying the Indian contribution to science and technology in the ancient period. Indians, according to these scholars including William Jones and Max Mueller, made considerable progress. However, Trautman says that the phase of Indo-mania was replaced by that of Indo-phobia when the British had fear concerning everything Indian (Trautmann, 2004, p. 99). The British needed to justify their rule and, in the process, they used the concepts such as 'white man's burden' and 'civilizing mission'. This represented the colonial phase when the British discredited the achievements of ancient Indians. According to them, Indians lacked a sense of history, it was a changeless society and they needed British intervention to get rid of its ills (Satiya, 2020, p. 87). They pointed out that even though

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Indians had achieved something to be written in the past, their achievements in the recent past (eighteenth and nineteenth centuries) were nothing to be written about compared to the achievements of the Western society, which experienced a scientific revolution. One can find such arguments in not only the scientific arena but also in other areas such as history, literature, politics, etc., as brought out by Romila Thapar (2002, p. 6). The response of Indians was to glorify their achievements in the ancient period. It was an attempt to answer the British criticism that Indians did not contribute substantially to the scientific arena in recent years. However, the colonial masters did not intend to educate Indians in the field of science and technology. The Indian scientists and even the Europeans working in India were given second-rate treatment while the British and other European scientists were appreciated for their achievements (Arnold, 2000, p. 10). The result was the emergence of colonial science, which also offered an opportunity for indigenous scientists to discuss the contribution of Indian historians to science and technology (Prakash, 1999, p. 21). It is in this context that one should place the attempt of some historians to write a history of science.

As late as the 1960s, a European scholar propounded the diffusion theory (Arnold, 2000, p. 5). It aimed to show that Indians have been passive recipients of scientific knowledge while they did not have anything to contribute to the universal knowledge of science. Indian scientists, in the early decades of the twentieth century, responded to such arguments by going back to the tradition. David Arnold argues that Indians should not be considered as passive receptors of Western scientific knowledge (Arnold, 2006, p. 5). In actuality, as argued by Dhruv Raina there was a contestation between tradition and modernity. Indians decided to conceptualize their version of modernity. While they accepted a few aspects of colonial modernity, they also asserted the relevance of Indian tradition (Raina, 2007, p. 186). The study of ancient Indian texts containing scientific principles was a part of this larger project. The studies by Deepak Kumar and S. Irfan Habib also support this contestation between tradition and modernity (Habib & Raina, 2007; Kumar, 2007, p. 108). It was a clash between the Western imposition of its version of science on the Indians and the response of the latter. This clash is also exemplified in the 'Orient-Occident' conflict when the colonial government in the early nineteenth century decided to teach 'natives' Western science at the cost of Indian science (Vasantha, 1992, p. 51). In the end, one should note this as a period when there was the emergence of a freedom movement in India. It encouraged Indians to adopt nationalist ideology. As Indian historians discussed ancient India, they naturally discussed the achievements of the Hindus while ignoring its medieval past. Consequently, the ancient period was considered a golden age while the medieval period was regarded as that of an age of decay (Thapar, 2002, p. 18). Such a trend is also noticeable in the twentieth century, in the science arena when the British accepted a few demands of the Indians, in the science arena apart from the political and social sectors (Sinha, 2008, p. 11). One can also find parallels between the pre-independence claims for the glorification of ancient India and the recent attempts of hyperactive nationalists to exhibit their superiority of Hindus to the Western civilization as discussed by Mira Nanda (Nanda, 1998). While the earlier attempts can be considered as legitimate as they aimed to fight against the British who claimed Western superiority to the Indians, the latter may be deemed as representing a communal interpretation of history mainly because they harp on the Hindu achievements without a considerable basis.

Deepak Kumar studied the debate between some Western scholars and Indian scientists or historians of science regarding the position of India in the world scientific arena (Kumar, 2007, p. 108). According to him, the Indian scientist J.C. Bose borrowed concepts from the ancient Indian tradition. Inspired by Sankhya philosophy he conceptualized the relationship between living and non-living beings. Similarly, he gave Sanskrit names to his instruments (Kumar, 2007, p. 108). Deepak Kumar also states that 'His (J.C. Bose) works were the first authentic rebuttal of the colonial view that Indians were incapable of original scientific investigations' (Kumar, 2007, p. 108). The attempt of the Indian scientists and historians of science was to revert to the remote past, particularly the ancient period, to counter the colonial argument concerning Indian achievement in the scientific arena. It implies that Indians had contributed to the scientific arena in the past and they were capable of doing the same in the present. The British also attempted to appropriate the Indian scientific tradition of the early modern period. Christopher Bailey shows that the British claimed that they contributed to the astronomical observatory of Jaisingh of Jaipur. They engaged in debate with the Indian scientists to prove the role of the British in modernizing Indian science (Bailey, 1999, p. 153).

Dhruv Raina recently demonstrated that Needham supported the contention that Europe was not the original home of science and technology, even though Asian scholars have yet to match European documentation of their science and technology. Indeed, India has a wealth of data that should be used to reconstruct its history of science and technology (Raina, 2015, p. 20). The argument of Nidham as brought out by Raina is supported by Deepak Kumar when he states that:

> the techno-scientific tradition in India has largely been a synthetic one, continuously evolving as a result of each politico-cultural interaction with the outside world and the social change within the region. ... It is true that India could not expand its knowledge base like post-Renaissance Europe did. But it definitely had

> a foundation which can be called 'proto-science and technology and this is exactly what one finds in 18th century India on the threshold of impending colonization (Kumar, 2023, pp. 1–2).

According to the preceding argument, when the British colonized India, it had a rich tradition of science and technology. Indian and Goan scholars in the early years of the twentieth century recounted the contribution of India to science and technology. The study of Projit Mukherji shows that Indian 'daktars' (doctors) practiced Western medicine as early as the seventeenth century and were prepared to assimilate Western science with the Indians even though at a later stage one finds the nationalization of Western science to suit the Indian society (Mukherji, 2009, pp. 1–2, 125). It demonstrates that Indians were aware of Western science and medicine even before the arrival of British colonialism. One may also argue that the Portuguese in Goa introduced Western science, particularly medicine. This would mean that Western medicine emerged in Goa even before it emerged in other parts of India. This is due to the colonization of Goa by the Portuguese in the sixteenth century.

Suvobrata Sarkar has researched the role of the colonizer and the colonized in the advancement of science and technology. In the case of science and technology, he has debunked the British colonial state's dominance over the subjects. He sees scientific and technological progress in India as the result of intense interaction between the colonial state and the Indians. The peculiar social and economic situation that existed in India encouraged the colonial state to experiment with new methods of producing electricity, which was later replicated in England. Thus, a few developments related to science and technology were experimented on first in the colony and then in the mother country (Sarkar, 2020, p. 6).

The development of science and technology was not a one-way process, representing the domination of the colonial state over the subjects. As a result, it has been proposed that the subjects, particularly the elites, played an important role in the spread of science and technology in India, leading to the establishment of educational institutions to disseminate knowledge about this subject.

However, colonial science did not represent a simple clash between tradition and modernity, or the Occident and the Orient, as there was a dialogue between Indians and Western scientists (Banerjee, 2020, p. 55). There was collaboration between the British and Indian scientists, even though a few Indian scientists were influenced by nationalist ideology. For example, Satyendranath Bose was supported by British scientists (Banerjee, 2020, p. 48). The Indian Science Congress, which represented the assertion of Indian identity in science, was attended by both Indian and British scientists (Banerjee, 2020, p. 39). The advancement of science and technology benefited not only the Indians but also the colonial state. Hence, one can consider nationalism as one of the many factors that inspired scientific achievement. At the same time, one cannot deny the conflict between the colonial state and a few Indian scientists who were influenced by nationalist ideology.

3 Portuguese colonialism and response of Goan intellectuals

Even before the British established colonialism in India in the eighteenth century, the Portuguese had emerged as the first colonial power of India in the early sixteenth century even though they ruled only a small portion of India. The Portuguese, in the process, used their own strategies to rule the colonial subjects. One of these attempts was to lusitanise and ignore everything indigenous (de Souza & Borgess, 1989, p. 235). For example, most of the early publications of the Portuguese dealt with the conquest of India while refraining from discussing native history. The Portuguese did not discuss the pre-Portuguese history despite the fact they were aware that there was a history of the region spanning around a thousand years before its conquest by the Portuguese. At the same time, the Portuguese attempted to claim Goa by using the concept of Golden Goa or Goa Dourada (Perez, 2011, p. 31). It envisaged a golden age of Goa when the Portuguese ruled this region. It implied that the pre-Portuguese phase was Dark Age. In this sense, one can find a similarity between the British and the Portuguese attempts to justify colonial rule. The only difference between the two was that unlike the Portuguese, the British did not convert a considerable number of Indians to Christianity. One can qualify this difference between the Portuguese and the British by saying that the Portuguese ruled a small region while the British ruled almost the whole of India and it was difficult to convert such a large region without establishing the inherent superiority of European culture. However, it would also imply the different approaches envisaged by the British. The colonial project of Goa Dourada led to the attempt of the Goans to prove the superiority of their indigenous culture and it led to the emergence of the concept—Goa Indica (Raghuraman, 2000, p. 644). At the same time, Goa Dourada and Goa Indica are the concepts used by modern historians to exhibit different trends in Goan historiography. Nevertheless, scholars such as Robert Newman (1999, pp. 17–42) and Rosa Maria Perez consider them convenient tools to study colonial Goa (Perez, 2011, pp. 31–32). We may also note that in the twentieth century, there was an emergence of a close relationship between Portuguese India (Goa) and British India (Pinto, 2007, p. 49). Goans migrated to Bombay, an important region, which fetched jobs. Goans began to speak English apart from Portuguese. The nationalist ideology, which was present in British India, also affected the

Goan historians and scholars such as Menezes Braganza, Tristao Braganza de Cunha, and many others. According to Rochelle Pinto, Goans lived between two empires—the Portuguese and the British (Pinto, 2007). As the Portuguese empire failed to fulfill the aspirations of the colonized in Goa, the Goan elites looked to British India to achieve their goal of becoming leaders of their society. It shows that like the Indians in British India, the Goans were also influenced by nationalist ideology and they began to reconstruct the Goan past. Interestingly, even the Catholic historians of science went back to the Hindu past, as they needed to counter the Portuguese claims of superiority (Barreto, 1863; de Braganca Pereira, 1991; de Figueiredo, 1963, pp. 111–125; Pope, 1937). In the process, Goan historians attempted to reconstruct the history of Goa. Along with the history of ancient Goa, historians also reconstructed the history of science in India and Goa (Pissurlencar, 1925). It also shows the Goans scholars' conviction that they were a part of the pan-Indian development of studying the Hindu past. Goan scholars, like their Indian counterparts, made some exaggerated claims of Hindu superiority when compared to the West. It is in this context that one should place the history of science in India and Goa.

As argued by Raina, the Indian government, after obtaining independence from British rule, began to explore the need to discuss the history of science (Raina, 2015, p. 2). One may note that Goa, which closely followed India in the 1950s, was influenced by this project of reconstruction of the history of science. It shows the impact of nationalism on the history of science not only in India but also in Goa, which had yet to obtain freedom from Portuguese rule. The Portuguese, like their counterparts in British India, attempted to exhibit the difference between Indian and Portuguese medical knowledge. It is true that in the early sixteenth century, the Portuguese patronized the Indian medical practitioners called *vaidyas.* However, in the later sixteenth and seventeenth centuries, the Portuguese insisted westernization of Indian medicine due to the assumption that Indian medicine was inherently inferior to the Western (Walker, 2009, p. 256). During the period of 'Golden Goa' or 'Goa Dourada', there was a domination of Portuguese physicians in Goa rather than the indigenous physicians. In actuality, the number of indigenous physicians was limited to thirty. Consequently, it has been suggested that 'the standard medical practice in Goa under the Portuguese administration remained, officially, European' (Walker, 2009, p. 256). It shows that the Portuguese policy was not much different from the British colonial policy, which questioned the scientific legacy of ancient Indians. However, it is important to note the differences between Portuguese and British approaches to the science and technology of the colonized population. While the British believed in their superiority in science and technology to the Indian science, the Portuguese were considered backward in science when compared with other European powers. The decline of the Portuguese in the Indian Ocean is attributed to the inferior quality of their ships when compared to Dutch shipping (Gupta, 2007, p. 428). Consequently, the Goan writings on Indian science and technology were not a response to the specific colonial policy towards the Goan scientific heritage, but they reflected the impact of British Indian writings on the Goan scholars who supported their Indian counterparts by discussing the history of science of India. One should note that the Goan scholars did not specifically discuss the history of science and technology in Goa but their discussion pertained to ancient Indian achievements in this field (Baretto, 1935).

Rochelle Pinto has shown, in her work on "Between Empires", the compulsion of the Goan intellectuals, as they were stuck between the British and Portuguese colonizers. The British are considered indirect colonizers while the Goans were directly exposed to the Portuguese colonial rule. The Portuguese state of India has been termed a failed state when compared with the British. The local elites' hope of reviving the image of the golden Goa failed. The failure of the Portuguese state compelled the local elites to look toward British India (Pinto, 2007).

Intellectuals such as Gerson da Cunha had already worked in the context of Mumbai, as proved by the English articles written by da Cunha. However, the emergence of the Republican constitution had given some hope to the Hindu and Catholic elites in Goa. At the same time, the rise of Salazar as the dictator of Portugal affected the elites. The Portuguese alienated the Catholic—Brahmana and Chardo—elites due to the Colonial Act of 1930, which clarified the Portuguese position concerning Goa, as the latter was termed a colony, rather than a part of Portugal having equal rights with other Portuguese citizens (Machado, 2020, pp. 119–53). However, in the 1950s, the Portuguese softened their stand towards Goa.

The scholars such as Adeatado Baretto, Panduranga Pissurlencar, Menezes Braganza, Tristao Braganza da Cunha, and others were influenced by the nationalist ideology found in British India. These scholars belonged to the school of Goa Indica, and they found reasons to oppose the Portuguese rule. The nationalist historians of British and Portuguese India took inspiration from the Orientalist writings of the nineteenth and early twentieth centuries. The Orientalist scholars praised the Indians for their knowledge of science, which was not available to the Europeans in the medieval period. At the same time, the inferiority of Indian science in the twentieth century was noted. The nationalists countered the idea of 'white man's burden' and 'civilizing mission', and attempted to prove that their civilization was much superior to the Europeans. This trend is also noticeable in Goa among the nationalist intellectuals. It assisted the attempt of the Goan intellectuals to counter the Portuguese colonial

ideology. The rise of the periodical press also assisted this movement. In the nineteenth and twentieth centuries, various newspapers and pamphlets were published with the aim of either supporting or opposing Portuguese colonialism. For example, we find the conflict between the newspapers, *A India Portuguesa* and *O Ultramar* (de Cruz & Furtado, 2011). In the Salazar era, newspapers and journals played an important role in either supporting or opposing the policies of Salazar.

4 Medicine history in the context of Portuguese colonialism

An exception was the discussion regarding the Goan tradition of medicine, which they claimed was appreciated by the Portuguese. Nationalist scholars such as Figureido made some claims, which were critically analyzed by Pearson (2001, p. 100). Pearson did not appreciate the argument of Figureido regarding the pre-Portuguese Goan knowledge of medicine and diseases, and suggests that 'His (Figureido's) information is so fragmentary as to be of little use, for we cannot distinguish between medicine and other scholarly disciplines... We have almost no evidence of hospitals, or of state involvement in health care...' (Pearson, 2001, p. 100). It is suggested by Figueireido that the Goan physicians could cure some diseases that affected the Portuguese. It was also discussed by Panduranga Pissurlencar. Figueiredo compared the Goan and Portuguese medicine and found evidence to '...professionalization of medicine in Goa and was a forerunner of the development of tropical medicine as a science in the Baconian sense (i.e., derived from experimentation rather than solely from empirical observation)" (Figueiredo, 1984, p. 225). It is noted that in 1548, the Goan doctors in 'the first Catholic university in the East' Colegio St. Paulo, served the Portuguese, thereby showing the effectiveness of Goan medicine (Figueiredo, 1984, p. 225). He also quotes from the writings of the foreign traveler Sassetti to defend his argument. Sassetti, indeed, noted the prevalence of 'Hippocrates, Galens and Dioscorides' in Goa, thereby indicating the superiority of Goan medicine when compared with the Portuguese (Figueiredo, 1984, p. 229). Sassetti also referred to the use of *nighaṇṭu*, the Sanskrit term for a dictionary of handbooks being used by Goan physicians to treat their patients. It has shown the prevalence of the tradition of medicine in Goa. Figueiredo also refers to Garcia d' Orta who appreciated the indigenous knowledge regarding medicine (Figueiredo, 1967, p. 53). He also notes that the Portuguese attempted to monitor the Goan science of medicine by insisting that the local *vaidya*s or doctors needed to pass the exam conducted by the Portuguese government. He has provided a few Portuguese documents, which show that some Goan 'doctors' passed the exam and obtained permission to practice their profession (Figueiredo, 1967, p. 53). Cristiana Bastos argues that the Portuguese colonial rule deliberately excluded the Goans from the leadership position in the Indo-Portuguese medical institutions, thus indicating an element of racism (Bastos, 2005, p. 23). Bastos also analyses the subaltern status of the Goan doctors when compared with the Portuguese physicians (Bastos, 2005, p. 31). However, she finds two phases in this development. In the first phase, there was an interface between local and colonial initiatives. This phase pertained to the nineteenth century. In the second phase, however, the local initiatives were conveniently ignored, thereby indicating the superiority of colonial knowledge (Bastos, 2010, p. 186). Such an approach of the colonial authority towards the subjects would compel the latter to prove the colonial or Indian contribution to the field of science and technology.

We may note that Figueiredo was writing in the post-colonial period when Goa obtained independence from Portuguese rule. There is a similarity between Figuerido's construction of the medical history of Goa and the attempt of scholars in other parts of India to reconstruct the history of science in the pre-colonial period. Pearson, like, Figuereido, used Portuguese sources, particularly Garcia da Orta's work, *Coloquios dos simples, e drogas he cousas medicinias de India* (Pearson, 2001, p. 103). However, Pearson was not affected by nationalist ideology and he attempted to present an objective assessment of the nature of Hindu medicine in Goa. Regarding d'Orta's experiences with Indian medicine Pearson states that 'He usually appreciated the abilities of the local *vaidyas* with whom he had contact, considering their cures as often superior to those he knew' (Pearson, 2001, p. 106). It shows that the assessment of d'Orta was not different from that of Figuereido. This may be because Orta was also a victim of the Portuguese policy of religious persecution. Orta was considered a Jew and he did not have the protection enjoyed by the Catholic Portuguese intellectuals (Pearson, 2001, p. 106). There are differences in the way the work of d'Orta was used by Figuereido, the Indian scholar influenced by nationalist ideology, and Pearson, a Western historian interested in the history of India who was not influenced by nationalist or colonial ideology. At the same time, we should note that d'Orta lived in Goa in the early sixteenth century when Western medicine also did not reach the heights that it reached in the nineteenth and twentieth centuries. Consequently, one can find differences between the approaches of the Portuguese and the British colonial scholars. It would also show the difference between British and Portuguese colonialism. The Portuguese attempted to assimilate Indians through the concept of Goa Dourada and Lusotropicalism. However, the British maintained a distance from the Indian scientific tradition and attempted, particularly in the twentieth century, to show the superiority of Western science when compared with that of Indians

(Kochar, 1992, p. 692). Pearson traces the modern superiority of Western science to the Industrial Revolution that emerged in the Western nations, particularly Great Britain. However, he accepts that up to the eighteenth century, there was not much difference between the Indian and Western commercial exchange (Pearson, 1995, p. 142).

5 Making of pseudo-science?

Meera Nanda, in the context of British colonialism, attempted to theorize the emergence of interest in ancient Indian achievements including science. She argues that by critiquing the 'Eurocentric' Western scientific discourse, the Indians and other third-world countries, particularly in the colonial and post-colonial era, attempted to retain the hegemony of the traditional elites. Consequently, the traditional elites developed their concept of science and modernity against the Western model of science and modernity. In the post-colonial period, it contributed to the emergence of anti-modern science in the Hindu fundamentalist movement (Nanda, 1999, p. 7). The argument has been applied in the case of the post-colonial period in India, as there were attempts to oppose the 'modern' scientific discourse. The argument, however, is also applicable to the colonial period when we find a similar argument. The attempt, consequently, of the traditional elites such as Hindu and Catholic elites was to protect their domination over the subalterns. The attempt of the Indian intellectuals of British and Portuguese India to reconstruct the history of science was a form of resistance, even though resistance aimed to maintain the leadership position of the traditional elites. By doing so, the traditional elites attempted to prevent the rise of the organic elites, a term used by Gramsci to refer to a new type of elites who challenged the authority of the traditional elites (Parker, 2020, p. 152).

Based on the above paradigm, one may consider the scholars such as Baretto, Pissurlencar, Menezes Braganza, and others as the traditional Brahmana and Catholic elites in the case of Goa. The organic elites, in the case of Goa, were almost absent due to the domination of the print world by the traditional elites. Meera Nanda also argues that the emergence of ethnoscience has led to the attempt to criticize Western science based on the argument that one form of ethnoscience should be replaced by another form. The argument that Indian science is an alternative to Western science is an attempt in this direction. It views that both Indian and Western sciences are ethnosciences, the product of particular human experiences. The traditional elites attempted to oppose imposition of the Western science on them in the pretext of protecting their identity (Nanda, 1998, p. 287). Along the same line, it has been suggested that scholars such as Ashis Nandy contributed to the emergence of pseudoscience by critiquing Western science, as Nandy suggested that Western science represented the hegemony of the colonial authorities over the colonized. Postmodernist thinkers do not believe in universal truth. Consequently, the fundamentalist argument may have some takers if the proponents of the same can prove their argument (Sokal, 2006, p. 310). Nanda and Sokal are critical of both Hindu nationalists and postmodernists for directly and indirectly supporting pseudoscience and Hindu nationalism. However, we are dealing with the colonial period, where the acceptance of the criticism of Indian traditional science would be deemed as acceptance of colonial ideology. To counter colonial ideology, there was the emergence of an interest in ancient science. Neither ancient nor modern sciences are comparable and reveal the real picture. The attempt to appeal to Hindu science in the colonial period was justifiable while such an exercise in the post-colonial period loses its legitimacy. However, we note the similarity between the ultra-nationalistic arguments of colonial and postcolonial elites. At the same time, the attempt to revive Hindu science benefited the traditional elites who were mostly upper-caste people. In the post-colonial period, one can find the emergence of organic elites, as the leaders do not necessarily belong to the upper caste. However, their attempt to retrieve ancient science and belief in Hindu nationalism has the purpose of improving their position as leaders.

In the case of Goa, one finds the role of traditional elites who were upper caste Hindus and Catholics, as in Goa the Catholics also claimed to belong to Brahmana, Chardo, and Sudra or Sudir. History of science, in Goa, performed several functions, despite the criticism leveled by Meera Nanda that it led to the formation of a pseudoscience. First, it allowed the Goan nationalist historians to oppose the Portuguese concept of Goa Dourada and present the ideology of Goa Indica. Reconstruction of the history of science is one way of achieving this objective even though it led to exaggerating the scientific achievements of ancient Indians. Pissurlencar wrote a work entitled *Aspectos da Civilizacao da India Antiga* (Aspects of Ancient Indian Civilization). The audience clearly in this case was both Portuguese and Indian elites. Thereby an attempt to prove the Indian basis of Goan identity was made. Pissurlencar quotes Kalle, who suggests the existence of laboratories in ancient India that encompassed thirty-one essential devices. According to Pissurlencar, chemistry was a subject of study at the Nalanda University of ancient India. The details regarding the science of chemistry are available in an Indian text *Rasārṇava* (Pissurlencar, 1925, p. 110). An iron pillar was discovered in Delhi near Kutub Minar and it is not rusted even today. Pissurlencar quotes Ferguson who praises the Indians for this achievement as the Europeans were not aware of this technology either in the past or the present. Pissurlencar mentions that the pillar weighs ten tons and has been

exposed to the vagaries of nature and despite this, it has maintained its original features (Pissurlencar, 1925, p. 111). The Cutch steel has been compared to the steel produced in Glasgow and Sheffield. In the ancient period, the Hindus did not face competition from any other civilization concerning the advancement in the science of making steel materials. A Persian proverb praises the Indians for producing high-quality commodities. Pissurlencar also praises the ancient Indians for producing the sword out of Damascus steel. To prove his argument, he also quotes from the works of the scientists or historians of science such as Royle,[1] Radhkumud Mookerji, Birdwood, Seal, B.K. Sarkar and P.C. Ray, experts in modern science (Pissurlencar, 1925, pp. 113–14; Vasantha, 1992, p. 50).

Pissurlencar also ventures to suggest that ancient Indians were the earliest to discover gunpowder and firepower and to prove the argument, he quotes Oppert who suggested that information concerning the use of gunpowder was found for the first time in the ancient Indian records. In addition, an ancient tradition mentions that Arabs knew to fabricate powder, which they obtained from India. On the other hand, the Europeans took several years to use gunpowder in wars. He obtains support from some modern studies on gunpowder technology. For example, Greek sources mention Indians hurling thunderbolts at the Greek army of Alexander when he invaded India (Pissurlencar, 1925, p. 116). However, some modern scholars consider that India obtained the art of producing gunpowder from China, thereby rebutting the argument of nationalist historians (Pissurlencar, 1925, p. 117).

Adeodato Barreto is another scholar who was influenced by nationalist ideology and he aimed to demonstrate the superiority of Indians when compared with the Europeans. He culled evidence from various sources to prove his argument. For example, the Arabic numbers were discovered by Indians and it was also mentioned by Leonardo da Pisa as those of 'indorum'. Barreto also argues that the discovery of Algebra by the Hindus had far-reaching implications than the European inventions of seventeenth and eighteenth centuries (Barreto, 1935, p. 81). He also believes that the ancient Indians were aware of modern scientific concepts such as atoms, molecules, laws of motion, time and space, opacity, refraction, the chemical impact of light, and so on (Barreto, 1935, pp. 83–84). He also suggested that Hindus discovered seven musical notes, which through the Arabs, were passed to European music in the eleventh century, thereby showing the scientific and artistic achievements of Indians when compared with Europeans (Barreto, 1935, p. 84). As mentioned earlier, the Goan elites discussed mostly the achievements of ancient India. Thus, they accepted the notion of Goa Indica rather than Goa Dourada. Even though some elements of pseudo-science are present here, one cannot rubbish all the studies made by them. For example, the claim that ancient Indians understood modern scientific concepts is a part of the pseudo-science project. At the same time, the claim that ancient Indians mastered the art of making pure iron and steel is a claim supported by evidence.

6 Conclusion

There is a major difference between the history of science that we find in British India and the history of India found in Portuguese India. The first aims to, as suggested by Deepak and Nanda, prove that indigenous science was an alternative to Western science. In some cases, it would have exhibited an element of exaggeration. The aim of Goan historians of science, on the other hand, was to prove that Goa is a part of India. This is reflected in the reconstruction of the history of India and the history of science. The latter was a part of the earlier project. We can also find an indirect method of opposing the Portuguese colonial rule by highlighting the achievements of ancient Indians and Goa was considered as a part of this nation. At the same time, we cannot equate the situation in the colonial and post-colonial periods. The colonial writing of the history of science has a specific attempt to challenge the authority of the colonial master. The post-colonial writings on the history of science have a specific attempt made to prove, due to the absence of the colonial state, the superiority of one community over the other. It led to communalism during this period. Communalism can indeed be considered a product of colonial rule, but it was not an unintended product. The history of science in the case of Goa does not remain within the perspectives of regional history even though it had emerged in the history of other spheres such as political, economic, and social. This is also because science has no regional boundary and it applies to any region of India. The lack of scientific progress in one region could be covered by studying the scientific progress in other parts of the country. However, this article has endeavoured to show that national identity was created through the study of science, technology, and modernity, which offered a unified future for the diverse groups of people who formed the modern nation.

[1] Royle attempted to establish a relationship between Indian and western sciences (Arnold, 2006, p. 163).

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