Development of digital business models in the context of digital transformation conditions

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Abstract

The aim of this article is to identify the directions of development of digital business models. The article begins with a theoretical overview, highlighting the impact of digital transformation on the evolution of digital business models and presenting their various definitions. Next, a bibliometric analysis was conducted using VOSviewer software, aimed at verifying the thematic areas co-occurring in the literature on the subject along with the concept of a digital business model. The study was based on 163 scientific publications included in the Scopus database. The analysis focused on the co-occurrence of keywords, with attention to such attributes as: number of occurrences and total link strength. Additionally, a network visualization map was presented in graphic form, which allowed for clustering all keywords adequately to the interdependencies and frequency of occurrence between them. The final part of the article presents conclusions, which allowed us to notice that research on digital business models encompasses a wide range of issues—both theoretical, such as digital transformation, and empirical, including the implementation of new technologies.

Keywords: digital business models**,** digital transformation, bibliometric analysis

1. Introduction

Digital transformation is a determinant of the current, dynamically evolving environment, which on the one hand provides space for modern enterprises to function, and on the other hand forces technological changes in the entire society. Until recently perceived as inaccessible, especially in the small and medium-sized enterprise sector, it is currently treated as a component of almost every business. It is worth noting that the need for companies to adapt to the offer of growing competition and to the increasingly complex needs of customers puts pressure on companies to implement new technologies. This approach means that companies have opportunities for development and, consequently, opportunities to gain a competitive advantage.

In the modern world, creating enterprise value is based on a properly tailored business model (BM). BM describes the logic of the enterprise's operation, taking into account many components and the interactions between them leading to the achievement of the assumed final result, which is added value [3, 6, 9, 30, 34, 38]. There is an extensive literature on the subject that organizes BM definitions, presents theoretical construction frameworks and describes existing business models [4, 10, 29, 43] in practice. However, the dynamically developing digital economy contributes significantly to the development of new business models. The impact of modern technologies and digital transformation are changing the current approach to running a business and thus forcing numerous reorientations of business models.

The main purpose of using technology in the functioning of enterprises is the need to introduce changes in the scope of conducted activities. It is assumed that the digital transformation of enterprises affects the improvement of the activities carried out by them, which ultimately translates into greater transparency, availability or speed of processes. In this respect, digital business models (DBM) are of particular importance, which in practice decide, among others, about the level of competitiveness, innovation or operational efficiency.

Referring to the above considerations, it is worth emphasizing that digital transformation has a key impact on the dissemination and development of digital business models. The search for ways to cope with growing competition and the emphasis on implementing modern technologies within business models have caused this issue to become the leading topic of numerous scientific publications. In this respect, it seems reasonable to examine the paths of development in the considerations on the approach to the digital business model. The aim of this article is to identify the directions of development of digital business models.

This article is organized as follows. Section 2 reviews the theoretical background on digital technology and digital business model. Section 3 refers to bibliometric analysis as a research method. In section 4 we present the results of analysis and we end with conclusions.

2. Literature review

Modern business practice indicates that organizational success largely depends on the ability of companies to adapt to environmental conditions and introduce innovations. The use of new technologies allows for the implementation of competitive solutions that can contribute to the optimization of processes in the company and ultimately result in increased efficiency. In this regard, digital transformation should be considered as a process aimed at expanding the business models of companies with new technologies, which is aimed at streamlining their operations and increasing competitiveness [11].

The literature on the subject shows that the use of technology in digital transformation assumes the introduction of digital innovations [18] at three levels of organization, namely:

- external, focused on customer experience and value propositions,
- internal, including changes in activities, organizational structure and procedures,
- holistic, which refers to the organization as a whole and allows for the definition of new business models [23].

Digital transformation drives organizations to increase their digital potential, which in turn enables innovative changes in digital business models. It "is the process aimed to align the business process and cultural transformation with the changing needs of the business environment" [39]. According to Ming Fang et al., keeping up with the dynamic changes in the environment by companies requires that their digital business model is based on agility and presents a new perspective on the values and core business of the company [2].

Undoubtedly, the competitive environment is shaped by digital technologies, including artificial intelligence, IoT, machine learning and cloud computing [15, 17]. It is worth noting that although these technologies force companies to introduce changes in their business models, they are also often inspiring due to the wide range of possibilities [13].

It should be noted that the emergence of the previously mentioned technologies marked the beginning of the fourth industrial revolution and the concept of the 'smart factory' [40]. In practice, it has been assumed that these technologies can contribute to the improvement of production processes and facilitate the introduction of modifications within supply chains. It has also been indicated that they serve to optimally allocate resources and effectively manage them, and allow for experimenting with business models. It is worth adding that striving to achieve higher value by a company requires it to introduce innovations in the digital business model, which is most often associated with the transformation of operational activities and acquiring a partner in the field of digital technology and starting cooperation with it [45].

The key influence on the popularization of the concept of a digital business model in business practice was the development of information and communication technologies (ICT) and the popularization of e-business. Initially, the digital business model was considered as one of the variants of e-commerce [16], however, a thorough assessment of

the impact of implemented digital technologies and the scope of transformations introduced by them have led to this concept being significantly expanded in the literature on the subject. According to the above, a business model should be treated as digital when the applied digital technology implies significant changes in the scope of the conducted business activity. A digital business model is the result of combining digital transformation with innovation, and therefore assumes the use of a modern approach in the area of technology. The digital transformation of enterprises is associated with the introduction of digital technologies to the company's operations and the expansion of business models with them [32].

DBM refers to the activities of a set of actors linked by ICTs in order to generate economic value [24].

According to Verhoef et al. "Digital business models are situations where digital technologies have fundamentally affected the way a firm structures and carries out its business and thereby creates value for customers, the firm itself, and its partners" [41]. In turn, Kohtamäki et al. indicate that DBM is „the firm's logic for value creation, delivery, and capture that has been significantly shaped by digital technologies"[21].

The digital business model is a component of digitization, which in turn includes the use of information and communication technologies within processes, products and services. The characteristics of digital business models include:

- basing on broadly understood digital technology, which allows for the improvement of business activities, the introduction of innovation on many levels and the creation of new value for customers,
- popularizing an individual approach to the customer, which makes it possible to adjust the product or service to their needs. The process of collecting and analyzing data plays a key role here, providing information on customer motivations and choices and leading to the personalization of the offer,
- popularizing the freemium model, i.e. offering a product or service in a basic version free of charge, and at a later stage offering an extended version for a fee. Such a solution is first aimed at building a customer base and then generating profits based on the sale of additional functionalities,
- using data analysis and machine learning to obtain key information, forecast trends and make decisions. These processes support the optimization of operations and the improvement of products and services,
- a high level of scalability, which indicates the possibility of freely increasing the scale of operations by the company [12].

Cristache et al., based on their own research, note that digital business models permanently contribute to increasing the efficiency of resource use by enterprises. In addition, they expand the scope of their market opportunities and make companies more competitive. However, it should be borne in mind that the introduction of digital business models requires enterprises to integrate internal conditions (including resources, including know-how) with the external environment [11].

Modern business practice shows that integrating digital technologies with innovations is considered the most effective strategy for dealing with competitiveness. At this point, it is worth paying attention to the concept of orchestrating digital innovations, which allows for precise adjustment of the business model to market needs. It is assumed that digital transformation, through shaping digital business models, provides conditions for the sustainable development of enterprises [11] and sets the direction for their modernization in terms of building a competitive advantage [33].

The definitions and characteristics of DBM presented above are consistent with our view, as they indicate how digital solutions change the current business model and emphasize their key importance in creating value.

3. Research method

In order to verify the thematic areas co-occurring in the literature on the subject along with the concept of a digital business model, a bibliometric analysis was conducted in the next

part of the article. This method, using a database of scientific publications, allows for the verification of the directions of research conducted within a specific area [2]. It is also used to search for cooperation opportunities and to analyze the structure of selected scientific concepts [31].

The following analysis was conducted using VOSviewer software, which, based on network data, allows for the graphical development of a map of connections. In general, the connections may concern scientific journals, countries, research centers or keywords, while the common features include: authorship, occurrence, citation, bibliographic connections, etc. [19].

In relation to the above, the study conducted an analysis of the co-occurrence of the term 'digital business model'. For this purpose, scientific publications included in the Scopus database were used. The search was narrowed down to:

- area: Businees, Management and Accounting,
- including phrases referring to the digital business model in keywords, title or abstract,
- focusing on scientific articles written in English,
- type of publication: journal.

No time limit was applied. After taking into account the indicated conditions, the following query was formulated:

TITLE-ABS-KEY ("digital business model" OR "digital business models") AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "BUSI")) AND (LIMIT-TO (LANGUAGE , "English"))

The initially generated database consisted of 174 articles, however, after a critical analysis of their abstracts and content, it was decided to exclude 11 publications from the study. Their topics were significantly different from the business area, instead focusing strictly on tax aspects. Ultimately, the analyzed database contained 163 scientific articles. It is also worth mentioning that in order to eliminate errors resulting from interchangeably used notations, for example: business model and business models, a thesaurus was used (Table 1).

Table 1. Thesaurus used in VOSviewer.

Label	Replace by
business models	business model
digital business models	digital business model
dynamic capability	dynamic capabilities

Source: author's elaboration

The first scientific article meeting the above criteria was published in 2010 by Clemons & Madhani in the Journal of Management Information System and referred to the then innovative business model (digital - based on third-party payments) in the context of regulatory changes. In the following years, individual articles were published covering the discussed topics. It is only since 2018 that a significant increase in interest in the DBM topic has been visible. These data are presented in Figure 1.

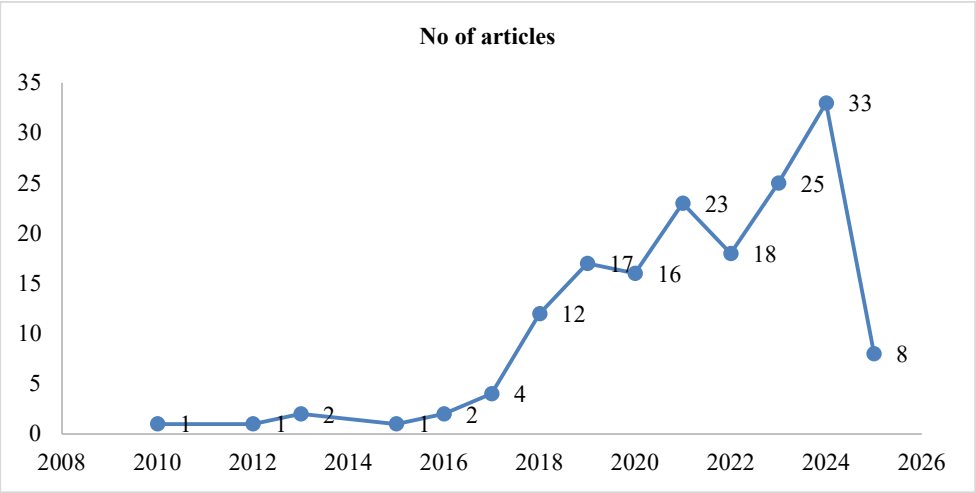

Fig. 1. The number of publications in Scopus per year.

Source: Scopus

Table 2 presents citation counts of all articles, while Table 3 presents the scientific articles that were most frequently cited according to the Scopus database. Out of the pool of 163 articles, over 12% were not cited at all, and over 31% were cited sporadically (in the range of 1 to 9 times). In addition, 9% of articles exceeded 100 times of citation, and 12% were cited at least 50 times but not more than 99 times.

Table 2. Citation of articles.

Range of citation counts	No of articles
≥ 200	5
≥ 100 < 199	10
≥ 50 < 99	20
≥ 40 < 49	5
≥ 30 < 39	15
≥ 20 < 29	17
≥ 10 < 19	20
≥ 1 < 9	51
0	20

Source: authors' elaboration based on Scopus

Table 3. The most cited scientific articles.

Title of article	Authors	Journal	Year	Citation counts Scopus	Citation counts Google Scholar
Servitization, digitization and supply chain interdependency	Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N	Industrial Marketing Management	2017	520	839
Content or community? A digital business strategy for content providers in the social age	Oestreicher-Singer, G., & Zalmanson, L	MIS Quarterly: Management Information Systems	2013	357	739
The age of digital entrepreneurship	Sahut, J. M., Iandoli, L., & Teulon, F.	Small Business Economics	2021	272	615
Knowledge- and innovation-based business models for future growth: digitalized business models and portfolio considerations	Bouncken, R. B., Kraus, S., & Roig-Tierno, N.	*Review of Managerial Science*	2021	243	468

Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms	Volberda, H. W., Khanagha, S., Baden-Fuller, C., Mihalache, O. R., & Birkinshaw, J	*Long Range Planning*	2021	231	426

Source: authors' elaboration based on Scopus and Google Scholar (16.04.2025)

4. Results and discussion

It was assumed that the necessary condition for the application of the keyword co-occurrence mapping analysis is their repeatability, which in this case was set at level 3. Based on the above criterion, based on 163 scientific articles, 33 keywords were finally selected, to which information on occurrences and total link strength was assigned (table 4). According to the literature on the subject, the occurrences attribute provides information on the number of publications in which a given keyword appears, while the total link strength, referred to as the weight attribute, shows the total strength of links between a given keyword and other keywords [19]. As can be seen from Table 4, the most frequently used term in this area was digital business model, which appeared 44 times, which is 27% of all the publications examined. It is worth noting that the total link strength in this case was 52 and was the highest among all the other results. The following positions were occupied by the concepts of business model (appeared in 29 publications), digital transformation (covered 15.33% of the analysed literature) and business model innovation (applied to 19 items). The total strength of links between the indicated keywords and other keywords was 37, 48 and 33, respectively.

Table 4. Keywords and their occurrences and total link strength attributes.

Keyword	Occurrences	Total Link Strength (TLS)
digital business model	44	52
business model	29	37
digital transformation	25	48
business model innovation	19	33
digitalization	18	30
dynamic capabilities	12	20
digital business model innovation	11	13
digitization	9	19
industry 4.0	8	10
digital innovation	7	12
innovation	6	10
smes	6	10
entrepreneurship	6	8
digital economy	6	7
digital servitization	5	11
value creation	5	11
digital technologies	5	9
artificial intelligence	5	8
strategy	4	9
covid-19	4	7
digital	4	6
e-commerce	4	5
internet of things	4	5
internationalization	4	4

sustainability	4	2
ecosystem	3	8
servitization	3	8
platform	3	7
fintech	3	5
digital entrepreneurship	3	4
family firms	3	4
blockchain	3	3
sharing economy	3	3

Source: author's elaboration on the basis of VOSviewer

Figure 2 presents a graphical presentation of the connections between the keywords included in Table 4. It should be noted that the elements (keywords here) included in the network visualization take the form of labels and circles, with their sizes depending on their ranks (a higher value determines their larger size). The strength of connections results from the distance between the keywords, with the greater the distance between them being smaller. Additionally, the elements differ in colors, which are then grouped into clusters [19].

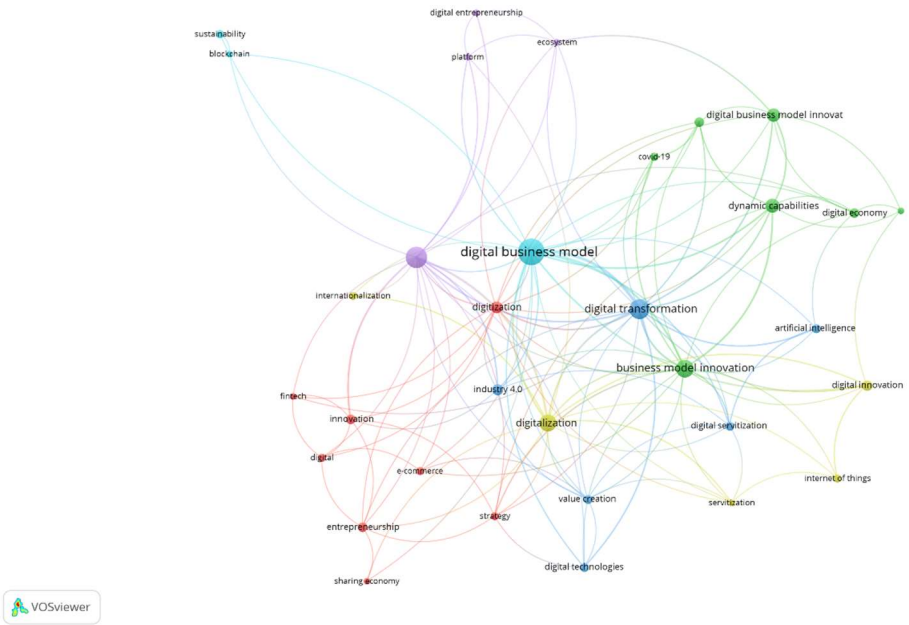

Fig. 2. Network visualization of keywords.

Source: author's elaboration on the basis of VOSviewer

The classification of keywords according to individual clusters is presented in Table 5.

Table 5. Classification of keywords by clusters.

Type of cluster (number of keywords)	**Keywords**
1st - red (8)	digital, digitization, e-commerce, entrepreneurship, fintech, innovation, sharing economy, strategy
2nd - green (8)	business model innovation, covid-19, digital business model innovation, digital economy, dynamic capabilities, family firms, smes
3rd - blue (6)	artificial intelligence, digital servitization, digital technologies, digital transformation, industry 4.0, value creation
4th - yellow (5)	digital innovation, digitalization, internationalization, internet of things, servitization

5th - purple (3)	digital entrepreneurship, ecosystem, platform
6th - turquoise (3)	blockchain, sustainability, digital business model

Source: author's elaboration on the basis of VOSviewer

As can be seen from Table 5, the keywords indicated in cluster 1 focus on the concept of digitization, which appeared in 9 out of 163 analyzed scientific publications (5.52%), with a total link strength of 19. In this area, the following issues were also considered to be among the most significant: innovation (6 items) and entrepreneurship (6 items). The issue of digitization plays a key role in the scope of social transformation and consequently, the development of digital business models, mainly due to the fact that it assumes the successive implementation of digital technologies for the purpose of acquiring, converting and transferring data [35]. As noted above, an important role in the discussed area was also assigned to the implementation of innovation, which, due to technological progress, is considered a necessary condition for the digital development of enterprises and the adaptation of business models to market requirements [14]. In this cluster, considerations were also made to issues related to, among others: fintech, e-commerce, sharing economy and strategy.

Cluster 2, similarly to 1, is the most numerous and consists of eight keywords. This area focuses on the issue of business model innovation, which appeared in 19 scientific publications (which constitutes 11.66% of all publications) with a total link strength of 33 and digital business model innovation – indicated in 11 items (6.75% of all articles), with a total link strength of 13. As stated in the literature, the scope of implemented digital innovations depends largely on the digital potential of the enterprise. It should be assumed that the knowledge and skills that the organization has in this area can support its digital business model. This includes, among others, process optimization and creating positive customer experiences [13]. In this cluster, the term dynamic capabilities also proved to be dominant, referring to 12 articles. It should be noted that dynamic capabilities are currently considered essential, especially in conditions of uncertainty and turbulent environment [37, 44]. As the remaining elements of the discussed cluster show, the approximate aspects in this respect were also considered from the perspective of: covid-19, family firms or smes [42].

Cluster 3 was assigned 6 keywords, within which the term digital transformation had the highest occurrence rate, i.e. 25 (it appeared in 15.34% of all publications). The total strength of connections between this keyword and other keywords was 48, which additionally confirms its importance. It is worth noting that the concept of digital transformation and its relationship with the digital business model were broadly introduced in the first part of this article, i.e. the introduction. Within the discussed cluster, there was also a reference to concepts such as artificial intelligence (AI), digital servitization, digital technologies, industry 4.0, value creation. Undoubtedly, the impact of artificial intelligence on the development of digital business models should not be omitted in this aspect. It is assumed that it affects the process of implementing innovations in this area, thanks to which it becomes systematic. In addition, it guarantees the integration of technological innovations with business innovations [26]. To maximize the potential of AI, companies that popularize digital servitization within their operations must transform their business models [20].

The research assigned to cluster 4 is mainly focused on digitalization, which appeared in 18 items (covering 11.04% of all articles) and achieved a total link strength of 30. This cluster also addressed issues related to digital innovation (occurring in 7 articles with a TLS of 12), as well as internationalization, internet of things and servitization. In general, digitalization is understood as the practical application of digital technologies in a company's operations [25]. The IoT aspect seems particularly important, as it allows for the provision of data for digital innovation and ultimately contributes to the development of digital business models. It should be noted that the development of digital technologies is closely related to the broadly understood international involvement [1, 7].

Cluster 5 included three keywords, namely: digital entrepreneurship, ecosystem and

platform. Each of the above concepts appeared 3 times in the publications, and their total link strength was 4, 8, 7, respectively. As the literature on the subject shows, digital entrepreneurship should be treated as a type of entrepreneurship that in practice could be implemented in a traditional (physical) way, but took a digital form [22]. It is assumed that the formulation and implementation of modern digital technologies determines digital entrepreneurship, understood as taking up new initiatives and transforming companies already operating on the market [5]. It is worth noting that these processes take place in the broadly understood business ecosystem [40], i.e. an environment based on inter-organizational relations [36].

The research included in the last cluster, i.e. 6, focus primarily on the concept of digital business model, which appeared in 44 scientific publications, thus covering 27% of the analysed database. The total link strength indicator was also ranked at the highest level in this case, reaching 52. The studies classified in this cluster also indicated blockchain (3 articles) [28], treated as a digital innovation that has disrupted the approach to managing economic entities [27] and sustainability (2 items) [8].

5. Conclusion

The considerations contained in this article prove that the development of digital technologies has permanently contributed to the broadly understood social transformation. In practice, these changes and the emphasis on searching for market opportunities and chances by enterprises have contributed to changes in the approach to innovation, making digital solutions the determinant of contemporary competition. In this respect, digital business models have played a special role, which were popularized mainly due to the high effectiveness of responding to customer needs.

The conclusions drawn from the analysis of 163 scientific articles indicate that research on DBM covers a wide range of topics, from theoretical aspects of digital transformation through research on the implementation of modern technologies to issues of sustainable development. The above analysis allows the authors to indicate the dominant areas of research in the field of DBM, i.e.:

1. digital transformation – encompassing changes in the organizational structure, operational processes of companies, as well as challenges related to implementing digital models in them
2. innovative business models – indicating the role of digital platforms in the context of relationships between consumers and suppliers and the impact of these platforms on various industries, including retail, services and industry
3. development and adaptation of new technologies – discussing how the Internet of Things (IoT), artificial intelligence (AI) and Big Data affect existing business models and the ability to create new, digital products and services
4. credibility and trust in the context of digital innovation – emphasizing the key importance of trust among consumers in the implementation of digital innovations and data security on the network
5. dynamic capabilities – emphasizing the adaptive capabilities and skills of companies to quickly respond to technological changes in the market environment
6. sustainable development and social responsibility – analyzing how digitalization contributes to greater efficiency and competitiveness of companies, taking into account the principles of sustainable development and social responsibility.

The conducted analysis proves the extensiveness of the research carried out within the digital business model, while at the same time indicating new directions undertaken in this area. Therefore, on the one hand, it provides information on the current conditions for the development of the digital business model, and on the other hand, it may suggest further analyses.

It is worth mentioning that the issue of digital transformation has a key impact on the way a company is run and, consequently, economic development. It is assumed that it contributes to increasing the efficiency of the resources involved. In addition, it increases market potential and raises the level of competitiveness. It should be noted that the

dissemination of digital innovations provokes enterprises to introduce technological changes in digital business models.

Due to the fact that the integration of digital technologies with innovations results in the creation of a digital business model and is widely considered to be the most effective way to fight competition, it seems reasonable to explore this aspect from different perspectives, and therefore search for new research directions closely related to digital transformation and digital business models.

Despite the extensive conclusions that were formulated based on the conducted study, certain limitations were noticed during its implementation. The above bibliometric analysis was conducted using one database, i.e. Scopus, while expanding its scope, for example: with the Web of Science database could provide broader conclusions on the subject under consideration. It also seems reasonable to draw attention to the limitation of the publication database only to English-language studies, which could have resulted in the omission of studies closely related to the research topic. In addition, articles outside management sciences were excluded. In accordance with the above, it is recommended that further research focus on a more interdisciplinary approach to the subject of Digital Business Model, which could ultimately contribute to identifying research gaps.

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