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The Analysis on Multimodal Transport Mode of Cross-border E-commerce with 'the Belt and Road' Strategy Based on Personalized Recommendation

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Abstract: With the further advance of 'the Belt and Road' strategy, China's cross-border E-commerce has obtained powerful policy support and wide world market. But from the view of users' coverage and total import and export of the trade along 'the Belt and Road', China's cross-border E-commerce still has great potential for development, while the high transportation cost is the main resistance in business. Therefore, based on the theory of customer personalized recommendation, combining with the successful cases of personalized services recommendation system from Jingdong and eBay, this article puts forward the multimodal transport service mode of China's cross-border logistics enterprises so as to customize the optimized logistics service system for e-commerce and achieve a win-win situation for customers and enterprises.

Keywords: the Belt and Road; personalized recommendation; cross-border transport; multimodal transport

1. INTRODUCTION

In March 2015, 'The Vision and Proposed Actions Outlined on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road'^[1] has been issued by National Development and Reform Commissions. In recent years, with the support of national policies, a wave of 'cross-border e-commerce' has been raising in China. According to the report 'eWTP Assisted The Belt And Road Construction -- The Practice of the Alibaba Economy'^[2] issued by Ali Research, Aliexpress has the only cross-border B2C retail platform that cover all countries and regions along the Belt and Road and its users throughout the world located in more than 220 countries and regions. In which, only 45% users are from the Belt and Road countries. According to the National annual statistical bulletin issued by National Bureau of Statistics of the People's Republic of China, China's total import and export to countries along the Belt and Road amounted to 62,205 yuan in 2015, which accounted for 25.3% of the total annual import and export of goods. And in 2016, China's total import and export to countries along the Belt and Road amounted to 62,517 yuan, that accounted for 25.7% of the total annual import and export of goods. The above data shows that China's cross-border E-commerce still has great potential for development in the countries and regions along the Belt and Road. At present, there are problems of high cost, slow efficiency and single transportation form existing in China's cross-border logistics which restrict the development of cross-border E-commerce to a certain extent. Based on the theory of customer personalized recommendation, this paper develops optimized multimodal transport mode for each transaction in order to promote the rapid development of the cross-border E-commerce logistics among 'the Belt and Road'.

2. THE SITUATION OF ROAD TRANSPORT IN COUNTRIES ALONG 'THE BELT AND ROAD'

2.1 The situation on development of highway transportation

Since 2000, the highway freight volume between China and other countries along the Belt and Road have been increased rapidly year by year. From table 2.1, we can see that China's highway freight volume in 2016 is 10 times than that in 2000. In the past 10 years, the highway freight volume of Kazakhstan, Pakistan and Turkey also presents a faster and sustained growth trend. It shows that highway transportation is the dominant way of import and export trade among the transportation of the national and regional along the Belt and Road.

2.2 The situation on development of railway transportation

The railway freight volume of China and Kazakhstan presented a sharp decline. According to table 2.2, we can see that from 2012 to 2016, while the railway freight volume of Iran increased by 1.2 times in the four years. But compared with the railway freight volume from other countries, Iran has problem of low cardinality. And the railway freight volume of Israel has changed little, and the quantity is small. This illustrates that the status of railway transport in countries and regions along the Belt and Road is increasingly weak.

2.3 The situation on development of waterway transport

The waterway transport becomes the main mode of transportation of international trade with its low cost and huge capacity. On the basis of table 2.3, we can see that China waterway transport development is relatively mature, and the container terminal throughout of China, Malaysia, Thailand and India has been increasing year by year from 2012 to 2016 with large cardinal number and its growth is around 1.2 times. This shows that waterway transport has maintained a stable dominant position among the countries along 'the Belt and Road'.

Table 2.1. The highway freight volume between China and other countries along the Belt and Road

Country /Region	Highway freight volume (Million Tons - Kilometer)			
	2000 (year)	2005 (year)	2012 (year)	2016 (year)
China	612940	869320	5137470	6121100
Kazakhstan	/	47120	121070	/
Pakistan	90270	129250	177950	/
Turkey	152210	166830	203070	/

Source: WID database of the World Bank

Table 2.3. The container terminal throughput between China and other countries along 'the Belt and Road'

Country /Region	container terminal throughput (TEU: twenty-foot-equipment unit)				
	2012 (year)	2013 (year)	2014 (year)	2015 (year)	2016 (year)
China	163,372,100	175,805,101	186,852,801	194,755,502	199,565,501
Malaysia	20,588,244	20,910,265	22,367,904	24,012,700	24,570,000
Thailand	7,323,880.75	7,546,522.75	8,119,271	835,945.5	8,239,362.75
India	9,576,716	9,685,160	11,319,000	11,883,003	12,083,010

Source: WID database of the World Bank

Table 2.2. The railway freight volume between China and other countries along the Belt and Road

Country /Region	railway freight volume (Million Tons - Kilometer)				
	2012 (year)	2013 (year)	2014 (year)	2015 (year)	2016 (year)
China	2518310	2473477	2308669	1980061	1920285
Kazakhstan	235846	231248	216524	189759	188159
Iran	22604	22400	24461	25014	27243
Israel	1099	1099.233	1099	1155	/

Source: WID database of the World Bank

Table 2.4. The volume of air cargo between China and other countries along the Belt and Road

Country /Region	volume of air cargo (Million Tons - Kilometer)				
	2012 (year)	2013 (year)	2014 (year)	2015 (year)	2016 (year)
China	15,568.753	16,053.733	17,822.581	19,805.63	21,304.585
Russia	4,132.144	4,249.269	4,413.559	4,761.047	5,863.197
Turkey	1,933.678	2,296.039	2,630.33	2,882.162	3,493.93

Source: WID database of the World Bank

2.4 The situation on development of air transport

In accordance with table 2.4, we see that in air transportation, the volume of air cargo in China, Russia and Turkey has shown a growing trend, but the volume of goods transported is small because of high cost of air transportation. The air transport of the countries along 'the Belt and Road' is at an initial phase, but is still keep on developing slowly. This shows that there is a large development space in air transport.

3. THE PROBLEMS AND DIFFICULTIES OF CHINA'S CROSS-BORDER E-COMMERCE LOGISTICS UNDER 'THE BELT AND ROAD' STRATEGR

3.1 High cost of logistics transportation

Retailing is generally the main marketing model of the cross-border e-commerce platform. The users only want to pay limited amount cost in the logistics transportation when they buy small amount of goods with low price. But the link of cross-border logistics is very long, including domestic cargo transportation and customs clearance, international cargo transportation, foreign cargo customs clearance, transportation and so on^[3], which can lead to high logistics costs. The costs of cross-border logistics mainly include transport costs, customs duties and VAT (value added tax) and overseas logistics cost, etc. Even if the user selects the slowest postal international package with the most favorable cost, the logistics cost is still much higher than that of general logistics. The cost of international express will be much higher. Once the user has additional requirements for the timeliness or safety, the logistics cost will be increased correspondingly.

3.2 Simplification of transport form

At present, logistics of China's cross-border e-commerce is immature with single transport mode. The modes of transports are ineffective and wasteful in logistics infrastructure and energy without effective connection. In the past, China's cross-border logistics enterprises did not adopt the multimodal transport mode and different kind of transportation mode has individual information system^[4]. Therefore, most of China's logistics enterprises did not have the ability to use multiple transportation modes flexibly.

3.3 Unsmooth of logistics information

Under normal circumstances, the users hope to know about exactly what they have purchased, where they are and prepare for the reception of the goods after shopping on the cross-border e-commerce platform. With the unlikeliness between cross-border logistics and domestic logistics, cross-border e-commerce logistics is mainly divided into two parts of domestic logistics enterprises and overseas ones. It is difficult for logistics enterprises and overseas logistics enterprises to communicate and check transport logistics information because of the inconformity of information degree between domestic part and overseas part and obstacles in language communication. These factors will weaken users' consuming experience in cross-border e-commerce greatly and cut down the sales of e-commerce platforms to a certain extent^[5].

3.4 Unbalance of freight development

According to the official data issued by National Development and Reform Commissions, the volume and turnover of railway freight traffic began to decrease year by year from 2012. In 2014, railway freight volume accounted for 8.67%, highway freight volume accounted for 77.29% and railway turnover accounted for 21.19%, while highway turnover accounted for 46.97%, so railway lost the status of big artery. In 2015, the turnover of railway goods dropped by 14%. From January to May in 2016, the freight turnover of the railway dropped by 10.3%, and the decline trend of railway freight still continues. On April

19, 2017, the document of ‘The Development Planning of Railway Container Multimodal Transport in 13th Five-Year’^[6] issued by National Development and Reform Commissions, Ministry of Transport of People's Republic of China and China Railway Corporation. According to ‘the planning’, it presents that the proportion of railway freight in the United States and the European Union is about 40%, while the proportion of that in China is only 7.6%. This data shows that the development of railway transportation in China still falls behind. The railway transportation has the advantages of large freight volume, low freight rate and high safety. Therefore, the China's cross-border logistics enterprises should enhance the optimal combination of railway transportation and other modes of transportation.

Compared with the developed countries, China's cross-border logistics has a lot of problems, such as single form of logistics development, high cost, small coverage and low specialization level and so on. However, in strategic planning of ‘the Belt and Road’, transportation industry is in the basic position. For the implementation of the Belt and Road strategy, logistics is the key to solve the existing problems of cross-border trade. There is a logistics line from Guangzhou to Harbin, which is operated by a logistics company in Liaoning. In which, the length of a single road transport line is 3,390 kilometers, and the freight rate for each standard container is 7,800 yuan. After using the multimodal transport of water, road and railway, the length of the line is shortened to 3,160 kilometers, and the freight rate for each standard container is 4,900 yuan, which can reduce the transportation cost by 37.2%^[7].

On April 21, 2016, the first train of ‘joint transport of highway and railway’ mode was set up at Duoluokou station in Wuhan to the terminal station Enshi in Hubei province. According to table 3.1, we can see that if a single road transport is adopted, the logistics enterprises need to spend 4,600 yuan. After the joint transport, the freight rate will be 2,635 yuan, and the transportation costs have been reduced by 42.7%^[8]. Thus it can be seen that the flexible use of the arrangement and combination of various modes of transportation will greatly reduce the logistics cost. For the long distance and multiple batches in cross-border logistics, multimodal transport will bring more economic benefits to cross-border logistics enterprises and will also promote the rapid development of cross-border e-commerce.

Table 3.1. The cost comparison of two transportation modes

Starting place	Single transport cost (yuan)	Multimodal transport costs (yuan)	Cost saving
Guangzhou- Harbin	7,800	4,900	37.2%
Wuhan - Enshi	4,600	2,635	42.7%

4. A SUCCESSFUL CASE ANALYSIS OF CUSTOMER PERSONALIZED RECOMMENDATION SYSTEM FOR CROSS-BORDER E-COMMERCE ENTERPRISE

4.1 The theoretical analysis of customer personalized recommendation system

In 1990s, the research on personalized recommendation has just begun. Personalized recommendation is the system which can infer users' interested information, service or merchandise through learning and mining users' historical purchase behavior and comments, so as to generate recommendation list which can be recommended to users. Personalized recommendation system can help people find all kinds of resources under the network, so it can save time and cost through recommending information to users initiatively when people are looking for target information.

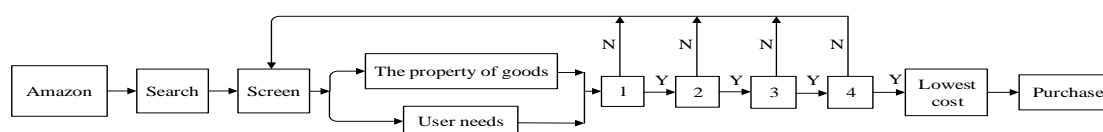
The core content of the personalized recommendation system is the algorithm. In China, many cross border e-commerce enterprises who do well in personalized recommendation adopt a classical personalized recommendation algorithm: Recommendation algorithm based on utility^[9] and recommendation algorithm based on association rule. Recommendation algorithm based on utility refers to the enterprise analyzes the

matching of good's attributes and user's needs by qualitative or quantitative analysis method, so as to meet the user's subjective and objective demands from the macro perspective, and to maximize the effect of recommendation service. Recommendation algorithm based on association rule^[10] refers to the process of an enterprise recommends products to user through analyzing the user's purchase history information to conclude a rule condition and use the rule condition to predict the user's purchase target good. This algorithm is a very basic method which is widely used in all kind of e-commerce enterprises.

4.2 Case analysis of customer personalized recommendation system for e-commerce enterprise

Since 2001, Amazon set 'customer-centric' as its service goal, and started the exploration of customer personalized service. According to table 4.1, we can see when linking the Amazon shopping interface, we will input the goal merchandise in the 'search' column, and in the upper right corner of the interface will appear a 'screening' option, here we can find all kinds of option related to product's material, price, size and comment, when we making decisions, we will take those options, our needs and payment ability into account. This is the recommended algorithm based on utility, it can quickly match the commodity's attribute with user's need, so as to effectively help users select their target goods with lowest cost. It is a win-win method, which not only satisfy the user's needs, but also improve the sale volume in the unit of time of e-commerce platform.

In 2013, with the advent of the big data era in domestic, Jingdong developed very fast in this year. Supplying multi-screen and multi-type products is the result of Jingdong's personalized recommendation system, which is the recommendation algorithm based on association rule. According to table 4.2, we can see the main method is that the e-commerce enterprise predict the customer's target product and recommend it to the customer based on his or her behavior records in the Jingdong and the other related platforms, such as analysis of customers browsing, shopping cart, attentions, searching, purchasing, and comments in the Jingdong shopping platform, and commodity information browsing on Tencent QQ and WeChat. This recommendation is a process in which the e-commerce platform recommend product to meet consumer demand from a macro perspective, which can make personalized recommendation more accurate, and help customer quickly select a product, and improve the loyalty and experience of consumer, so as to improve the quality and efficiency of user's shopping decisions and shorten the user's shopping path.



Notes: Y represents satisfaction, N represents not satisfaction

Figure4.2. Recommendation algorithm based on association rule

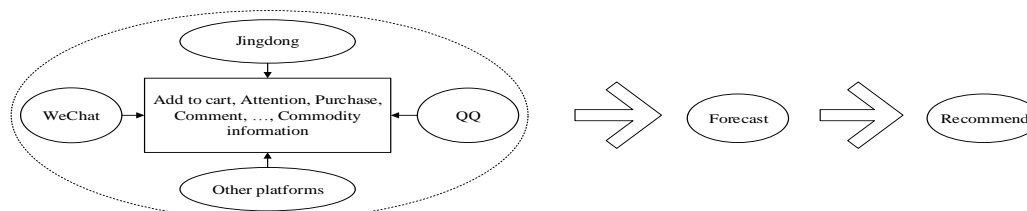


Figure4.1. Utility-based recommendation algorithm

5. THE CONSTRUCTION OF MULTIMODAL TRANSPORTATION OF CHINA'S CROSS-BORDER LOGISTICS BASED ON CUSTOMERS PERSONALIZED RECOMMENDATION UNDER 'THE BELT AND ROAD' STRATEGY

5.1 The personalized multimodal transport mode of recommendation algorithm based on utility

In April 21, 2017, Ali Research and DT Financial Research Institute issued the report named ' EWTP assisted The Belt and Road construction -- the practice of the Alibaba economy'. According to the report, the top five countries' export volume of China's cross-border e-commerce businesses are Russia, Ukraine, Israel, Belarus and Poland. Most popular products are Mobile phones and spare parts, fashion jewelry, women's clothes, clothing and accessories, and nail products. The top five countries' import volume of China's cross-border e-commerce businesses are Thailand, Singapore, Malaysia, Israel and Czech. China has a high demand for latex pillows and latex mattresses of Thailand, whose sales volume reach nearly 280,000 in Tmall international last year; in 2016, Israel's total commodity turnover has an increase of 371% in the Tmall international, and China has the most demand for personal care products from Israel.

According to the report of Ali, the commodity's attributes of cross-border electronic business for export and import is different, each product has a different volume, timeliness and value with each user also has different consume need. Therefore, China's logistics enterprises can set different options of commodity attributes with the help of cross-border e-commerce platform by predicting the intermodal transport method preferred by customers so as to recommend best multimodal transport model as followed.

5.1.1 Highway-railway transport: suitable for customer demand of multiple batches and high timeliness

Highway-railway transport is a more efficient delivery method, which can combine the advantages of highway and railway effectively on the one hand: combing the safety, punctuality, cheapness of railway transportation and the flexibility, convenience and efficiency of highway transportation, and overcome their disadvantages on the other hand: overcoming the slow speed, less network, low efficiency of railway transportation and high cost of highway transportation. The users not only can get the benefits of combined railway and highway transport, but also can appoint the location, shipping time and delivery time of goods according to their own needs. Therefore, when the users need the logistics service to transport good with small amount or multi batches or high timeliness, they can choose the highway-railway transport.

5.1.2 Sea-railway transport: suitable for customer demand of high-volume, long distance and low cost.

Railway transport is suitable for mass goods transportation, with high safety factor, less influencing from natural factors, punctuality and low freight. The sea transport has the advantages of larger volume, long distance, flexibility and low freight. Sea transportation and railway transportation both have the advantages of low cost, large volume, connection convenience and low freight. Sea-railway combined transport not only can control costs but also can solve the shortcomings of the limited coverage of single transport model. This transport method can fully connect ocean and land, and it can not only help users to purchase bulk goods from different regions at a low price, but also to achieve goods with high quality and integrity through the convenience of sea-railway transport. When customers want to deliver goods with large volume, long distance and low freight, they can choose the sea-rail transport.

5.1.3 Land-air transport: suitable for customer demand of high value, high timeliness, small size

If air transport is used only, it will limit the goods' amount and the cost is higher. If using domestic charter flights, the cost will be even more expensive. Therefore, in the case of large quantity of goods, we often choose the method of land to airport, and to international flight. Because the highway transportation is more flexible in the distribution, so land-air transport is usually being chosen. Land-air transport is a

multimodal transport model combined with land transport and air transport. There are 3 forms: a joint of railway, highway and air transport, a joint of railway and air transport and a joint of highway and air transport. The multimodal transport under the air and land combination model integrates the advantages of the quickness and safety of air transportation with the extension and flexibility of the highway, and realizes the seamless connection between them. When customers want to deliver goods with high value, high efficiency, small volume, they can choose the land-air transport.

5.1.4 Sea-air transport: suitable for customer demand of low cost, high efficiency and long distance.

Sea-air transport is a mode of transportation combined with sea transportation and air transportation. They all aim at providing fast and reliable transport services at low freight rates. Compared with single sea transport, the biggest advantage of Sea-air combined transport is saving time. While compared with single air transport, the biggest advantage of Sea-air combined transport is saving cost. This mode combined the low cost of sea transportation with the high speed of air transportation. In general, most part of this transportation is borne by sea and the final delivery section is borne by air so as to give full play to the unique advantages of both sides. When customers want to deliver goods with low cost, high value and long distance, they can choose the Sea-air transport.

5.2 Personalized multimodal transport model of recommendation algorithm based on association rule

There are six main types of countries along the ‘Belt and Road’, including China, Mongolia in east Asia, 18 countries in West Asia, 8 countries in South Asia, 5 countries in Central Asia, 7 countries in the Commonwealth of Independent States and 16 countries in Central and Eastern Europe. Every country and region along the route has different geographical features and advantages. Therefore, cross-border logistics enterprises can carry out the personalized recommendation of the user's commodity transportation mode from a macro perspective according to the overall geographical features of each region by using the recommendation algorithm based on association rule as followed.

Table 5.1. Personalized multimodal transport model of recommendation algorithm based on utility

Intermodal approaches	Product attributes	Customer needs	Advantages
Highway-railway transport	small amount, multiple batches, high timeliness	consumer goods	flexibility
Sea-railway transport	high-volume, long distance, low cost	bulk goods	low price
Land-air transport	high value, high timeliness, small size	High-end goods	efficiency
Sea-air transport	Low cost, high efficiency, long distance	fresh or high value-added products	Cheap and efficiency

Table 5.2. Personalized multimodal transport model of recommendation algorithm based on association rule

Intermodal approaches	Area	Topographical features	Climatic conditions
Sea-air transport	Southeast Asia, South Asia	Peninsula, Archipelago; Straits of Malacca	Tropical rain forest, tropical monsoon
Sea-rail transport	Central Asia, West Asia	More plains, hills; ‘sea traffic arteries’	Temperate continental
Land-air transport	China, Mongolia, the Commonwealth of Independent States and Central and Eastern Europe	Multiplayer, plateau	Mainly temperate continental

5.2.1 Sea-air transport: suitable for the freight to other Southeast Asia and South Asia countries

Southeast Asia has many peninsulas and islands, and the South Asia's topography is high in the north and south and low in the middle. Therefore, it is very inconvenience to developing land transport in this area. While most of the climate types in Southeast Asia and South Asia are belong to the tropical rain forest and tropical monsoon climate with abundant water. Southeast Asia is located at the crossroads of Asia and Oceania, the Indian Ocean and the Pacific Ocean. It is an important hub of world maritime transport and air transport. The Malacca Strait between Malay Peninsula and Sumatra Island is a natural waterway connecting the Pacific Ocean and the Indian Ocean. It is also an important waterway connecting the ports of Europe, the Indian Ocean and the Pacific's west bank.

In addition to the advantage of natural ports and air, economic factors are the main reason for the countries and areas in Southeast Asia and South Asia along 'the Belt and Road' choosing sea-air transport. In November 3, 2017, Ali announced the launch of the first digital free trade zone in Malaysia, which will create a complete logistics ecosystem, reduce costs and increase trade volume. Once implemented, all packages are expected to be delivered to ASEAN countries within 72 hours via the well-established air and sea connections at Kuala Lumpur International Airport and Klang Port, Malaysia. For the users in this region, China's cross-border logistics enterprises should recommend the mode of sea air transportation.

5.2.2 Sea-rail transport: suitable for the freight to other countries of Central Asia and West Asia

Central Asia is located in the Asian continent, its terrain is mainly plains and hills and its climate is temperate continental climate-based. And Central Asia is the area that passes by the ancient Silk Road in China and the Second Eurasian Continental Bridge in modern times, so it has a good natural and economic basis for rail transport. And West Asia is an important area connecting the Atlantic, Indian Ocean, Asia and Europe, with its location among Mediterranean, the Red Sea, the Black Sea, the Arabian Sea and the Caspian Sea. It has two superior maritime transport routes: one is the Persian Gulf - the Strait of Hormuz - the Mandeb Strait - the Suez Canal - the Strait of Gibraltar route, another is the Black Sea - the Turkish Channel - the Mediterranean route. Therefore, Sea-rail transport should be taken for China and other countries in Central Asia, West Asia along 'the Belt and Road'. For the users in this region, China's cross-border logistics enterprises should recommend the mode of Sea-rail transport.

5.2.3 Air-rail transport: suitable for the freight between China and the countries of the Commonwealth of Independent States, Central and Eastern Europe along 'the Belt and Road'

The Commonwealth of Independent States (CIS) stands for the Commonwealth of Independent States after the dissolution of the former Soviet Union. It is located in the northern part of Asia and the eastern part of Europe. Central and Eastern Europe and North Asia are characterized by temperate continental climate, with multi-plains and plateaus, flat terrain, and are suitable for the development of land-air transport. Transport in the region has been dominated by rail transport, with a radial Moscow-centered railway network in the west, the Trans-Siberian Railway in the east and a second Eurasian continental bridge running through the region. In addition, in recent years, Hainan Airlines Group strove to build an air channel connecting China with the countries along 'the Belt and Road'. At present, there are 65 international routes along 'the Belt and Road'^[11]. The region has an excellent railway infrastructure and an opportunity for rapid development of air transportation. Therefore, air-rail transport should be taken for China and other countries in CIS and Eastern European along 'the Belt and Road'. For the users in this region, China's cross-border logistics enterprises should recommend the mode of air-rail transport.

6. CONCLUSION

For the cross-border e-commerce logistics enterprises, they should firmly grasp the strategic opportunity of 'the Belt and Road' and give full play to their own advantages. And they should formulate a plan for the transport of goods that meet the customer's own actual needs, combined with the advantages of multimodal transport, to play a variety of transport advantages, promote the development of the rail transit actively, co-ordinate the integration of sea-railway transport scientifically, expand the market of land, sea and land transport continuously, and to strive to achieve the optimal combination of sea and air transport. It is significant to contribute its own strength to the smooth the realization on China's Belt and Road and create a beautiful win-win situation for cross-border e-commerce logistics enterprises and customers.

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