

# DEVELOPING MODEL OF TECHNOLOGICAL SCIENTIFIC INTERMEDIARY NETWORK OF VIETNAMESE SCIENCE AND TECHNOLOGY MARKET

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## **Abstract**

*This paper studies the current state of technology science intermediary network and propose a model of science and technology intermediary network for Vietnam. By using in-depth interviewing with managers in the system of state management agencies in science and technology, science and technology intermediaries, the research results pointed that a network of science and technology intermediaries has not existing in the science and technology market of Vietnam really. The network model of science and technology market could be proposed with the basic elements including the node point and the core point, the connection circuit between the nodal points of the network of science and technology intermediaries.*

**Keywords:** *connection, collaboration and support, science and technology intermediaries, science and technology intermediary network*

## **1. Introduction**

A network is a structure made up of nodes that are linked together by circuits. From that approach, it can be understood that an intermediate organizational network is a structure created by interrelated intermediate organizational nodes. The mediation network structure provides an opportunity for organizations to act as a science and technology intermediary (STI) by bridging structural gaps in the network or connecting different network communities (A. Caloffi, F. Rossi and M. Russo, 2015). Thus, the intermediate network must meet two basic requirements: bridging and connecting between science and technology intermediaries. A good middleman network helps intermediaries not only perform the pure “informants” and “broker” functions, but also perform other important functions such as facilitating relationships between firms by identifying potential partners for innovation projects (Shohert and Prevezer, 1996); information flow coordination (Lynn et al., 1996; Russo and Whitford, 2009) supports innovation processes by helping to encapsulate transferred technology (Watkins and Horley, 1986), selecting suppliers technology components (Watkins and Horley, 1986), adapting technology solutions available on the market according to the needs of the business (Stankiewicz, 1995) and storage operations,

possibly offers solutions that incorporate new ideas from existing ideas (Hargadon and Sutton, 1997).

According to Doan X. H. et al (2020), a network of science and technology intermediaries is formed based on the relationships between science and technology intermediaries and the supply and demand sides of the science and technology market (STM) and the relationship between those science and technology intermediaries. In terms of functions, there are 3 groups of science and technology intermediaries, including: the connection mediation group, the cooperation and support intermediary group, and the science and technology service intermediary group.

(1) The connection intermediary group has two main function that are "gatekeeper" and "broker". First, this function is expressed through following activities: Connecting patent suppliers, seekers and stakeholders; building bridges for technology start-up and investment groups; building networks to overcome limitations in technology transfer activities; carry out communication activities and coordinate physical and social resources. Second, meet the need wich is done by: Providing opportunities to find partners; providing resources and participating in projects; providing supporting information and services.

(2) Collaborative and support intermediary group is to perform functions including: (i) Connection and information processing: Integrating knowledge from stakeholders; direct transfer of expert knowledge; research mobilization of universities; (ii) Commercialization: Support marketing, sales and sponsorship activities; commercialization of technologies; (iii) Forecasts and diagnostics: Orientation of social research according to the needs of the industry; provides an interactive model for technology transfer and reception; (iv) Screening and processing information

(3) Scientific and technological service intermediary group provides services on intellectual property, training, testing and evaluation, rules and arbitration.

The formation and development of science and technology intermediary organizations (STIO) of STM (hereinafter referred to as science and technology intermediaries (STI)) is one of the issues that the Government pays attention to and directs. In a short time, science and technology intermediary organizations have been formed, with types such as traditional organizations such as hi-tech parks, software parks, hi-tech agricultural zones, and technology incubators, technology exchanges, supply-demand matching events, business promotion organizations, innovation centers, co-working spaces. According to the regulations and guidance by Circular No. 16/2014/TT-BKHCHN of the MOST, science and technology intermediaries have been established and operating in other fields and localities.

In fact, due to many reasons, the number of intermediaries operating professionally is not much. Some STIs were formed in a hurry. On the contrary, the establishment of new

science and technology intermediaries faces many obstacles because of the procedures' inconsistency. However, science and technology intermediaries, service organizations in the market (brokerage organizations, consultancy, assessment, evaluation, valuation, testing, verification...) are not operating properly. As results, a lot of science and technology intermediaries has not confirmed the role of connecting, providing services ... to promote the development of the STM. The lack of quantity and weak quality of intermediaries are obstacles to connecting science and technology intermediaries to develop science and technology intermediary networks (STIN) of STMs. Besides, the regulations on the formation and operation conditions of STIs are not clear, so the implementation is not easy. In addition, the inconsistent and unified system of policies are also major barriers and obstacles.

In order to be able to apply breakthrough policy and management solutions to promote the development of STIN of STM, it is necessary to establish a network model of science and technology intermediaries of STM. The objectives of this paper are as follows: (1) assess the current state of the STIN of the STM in Vietnam, (2) propose a network model of STIs of the Vietnamese STM.

## **2. Method**

The data needed for this study include both secondary data and primary data. Secondary data on the number, location, operational capacity,... of science and technology intermediaries is collected from reports and documents of management agencies at all levels, including mainly from the MOST and the Department of Science and Technology of some provinces/ cities. Articles and studies on domestic and foreign intermediary networks related to the subject's research have also been gathered, classified and edited for research purposes of the topic.

Primary data on assessment of the intermediary network of STM is collected through qualitative research by the technique of in-depth interviews with managers in the system of state management agencies in science and technology, science and technology intermediaries in the following industries: fisheries, food/beverage, wood processing, textiles, pharmaceutical chemistry, road construction, building materials and electrical power (solar power, wind power), science and technology experts and science and technology business administrators in related industries. In-depth interviews in each group aimed at the following objectives: First, identify the current network of intermediaries of the Vietnamese science and technology market; second, evaluate the limitations of the current network of intermediaries; third, propose a model of an intermediary organization network of the science and technology market in the near future

In-depth interviews were conducted at the headquarters of selected organizations and businesses in a convenient manner. Specifically, during the period from February 2020 to

June 2020, 56 in-depth interviews were conducted at organizations and enterprises in the North, Central and South of Vietnam. After finishing interview, the in-depth interview tapes are converted to a text format combined with the transcripts during the interview to be used for data editing prior to analysis.

The analysis of secondary data were done by using traditional methods such as statistics, synthesis and inference. Primary data were analyzed with the help of Nvivo11 software.

### **3. Results**

#### ***3.1. Current number and structure of science and technology intermediaries***

According to statistics of the Ministry of Science and Technology (MOST) updated to December 31, 2018, there are 10 technology exchanges and 1 copyright exchange, 3 technology transaction centers, and 67 technology transfer promotion and support center, 12 intellectual property valuation assistance companies, 10 incubators and business incubators in the whole country. The National Innovation Center was established also in 2019. This center is under the Ministry of Planning and Investment to support and develop a start-up ecosystem, innovate, and contribute to the renewal of the growth model on the basis of science and technology development. In the two years 2019 and 2020, a number of new intermediaries were established and put into operation. In addition to the types of intermediaries mentioned above, it is possible to list some types of intermediaries that exist in the STM, including: science and technology consulting enterprises; organization of standards, measurement and quality; science and technology organizations (in higher education institutions); science and technology enterprises; financial institutions and funds; industry associations (Le T. Th. et al., 2020). According to this approach, the number of science and technology intermediaries by 2019 will reach 1927 organizations<sup>17</sup>. In the scope of this report, types of intermediaries are listed and classified according to the specific provisions of Circular 16 of the MOST.

Regarding technology exchanges, the country has 16 online and offline technology exchanges (MOST, 2020), Pham X. Ph. (2020). In addition, Thai Binh, Lai Chau, Nam Dinh, Ha Tinh, Quang Nam and Binh Duong are building electronic trading floors and technology exchange. Most technology exchanges are operating as non-business scientific and technological units, with autonomy and self-responsibility under the Departments of Science and Technology, partly covered by the State to maintain regular activity. The main activities of exchanges include: consulting and transferring technology, information technology and organizing events on science and technology. In addition to technology exchanges in the state sector, a number of non-public exchanges have also been established such as the OTC

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<sup>17</sup> Incomplete statistics due to lack of data on events (techmart) device markets and regulators on science and technology

Idea Floor of the Business Solution Consulting Joint Stock Company, HCM City and the Copyright Exchange of Vietnam Record Book Center- Vietkings, HCM city. According to Tran V. T. (2018), in spite of achievement in developing the system of science and technology intermediaries, but science and technology intermediaries have not really shown its core role.

Regarding technology transaction centers, all 3 centers in operation are state-owned centers, of which 1 center is under the MOST, 1 center is under the Department of Information and Communication (DIC) Hanoi and 1 center under the DIC of Da Nang. However, both the centers in Hanoi and Da Nang are information and communication technology transaction centers.

Currently, in term of quantity, the centers for promoting and supporting technology transfer activities is largest. There are 67 centers of this type established and operating under different agencies, organizations and in different localities. In which, nearly half of centers are located in Hanoi, 18 centers are under ministries, 16 centers are under DST of provinces, 25 centers are under research institutes, universities and colleges. In addition, there are 8 centers in the non-state sector, including 3 centers belonging to industry associations, 4 centers privately owned and 1 center of a joint stock company.

In fact, the research and technology transfer center has been established and is active in science and technology research institutes, universities, colleges, and science and technology enterprises. For example, Center for Research and Technology Transfer under Vietnam Academy of Science and Technology, ... Up to now, there are no official studies on the number and operation of centers under this group. However, based on the results of the centers' performance in the past time, it can be said that the activities of these centers are limited to serving the technology transfer request of the organization to which it belongs.

Regarding the intellectual property valuation support center, there are 12 organizations that support the valuation of intellectual property, which are price appraisal companies out of a total of 298 companies are operating in the field of appraisal of prices in Vietnam (Ministry of Finance, 2020). All of these organizations are non-state companies, existing as independent companies, operating in the field of valuation, only engaged in providing intellectual property valuation services.

Regarding technology incubators and science and technology business incubators, according to the incomplete statistics of the MOST and Le Nguyen. D. Kh. research (2015), the number of nurseries and establishments Science and technology business incubation in Vietnam is quite modest, concentrating mainly in Hanoi and HCM City.

Some of technology business incubators and nurseries were formed quite early as the Hi-Tech Agricultural Enterprise Incubation Center in Ho Chi Minh (HCM) City in 2002 and FPT - Bach Khoa Business Incubator in 2004. However, the majority of technology business

incubators and incubators that were established in 2006 and up to now, are in the early stages of development. Some nurseries have been operating effectively such as Phu Tho Technology Business Incubator (HCM City University of Technology), Hoa Lac Hi-Tech Enterprise Incubation Center.

In term of geographic location, science and technology intermediaries are concentrated mainly in two big cities, Hanoi and HCM. Specifically, nearly half of the centers for promoting and supporting technology transfer are located in Hanoi and more than 10% are located in the HCM city. Two-thirds of technology transaction centers are located in Hanoi. Most technology business incubators and intellectual property valuation support organizations are located in Hanoi and HCM. These two cities are also the two largest and most powerful science and technology centers in Vietnam today. With a high degree of concentration in the two cities of intermediaries, detecting and identifying nodes and circuits in the network of STIs presents certain difficulties. This situation poses challenges to the strategy of building and developing an intermediary network in the future.

In terms of ownership of science and technology intermediaries, it can be seen that the presence of non-state intermediaries is still very modest. Specifically, 100% of the intellectual property valuation support organizations are non-state companies, and more than 10% of technology transfer promotion and support centers are non-state organizations. All technology exchanges, technology transaction centers and incubators and technology incubators and technology businesses, and nearly 90% of technology transfer promotion and support centers are state-owned.

For state-owned intermediaries, most of these organizations are public science and technology non-business units under the direct management of the line ministry or the governing department (at the provincial/ city-level). Despite of having certain degree of autonomy, these intermediaries basically depend on the state budget as well as the decision of the governing body on personnel mobilization and the appointment of intermediaries' leaders.

### ***3.2. The formation of a network of science and technology intermediaries***

*(1) Identify the junction, node, and core point of the intermediate organization network*

Regarding the connection circuit between individual intermediaries, the relationship between the intermediaries is formed in the process of providing STI services to the parties in the market. In terms of horizontal relation, the relationship is formed and established through cooperation and coordination between intermediaries operating in the same locality, a certain area. There are no intermediaries in the building materials industry that are related on an industry-based basis because intermediary organizations are affiliated units of the industry (Vu T. T. and Le H. T., 2020). However, intermediaries in the same industry tend

to operate relatively independently for example, intermediaries in the wood processing industry (Vu M. D., 2020). To a certain extent, the horizontal relationships between intermediaries can be considered as the horizontal link of the network in a given industry, region or locality.

The vertical relationships between the intermediaries are established mainly based on the vertical relationship from the governing body to the affiliated organizations and units. This relationship is more “administrative” than cooperative or coordinate relations. However, in reality, the vertical relationship in the network of science and technology intermediaries has not clearly formed.

The majority of science and technology intermediaries have just been established in the past 10 years. STI has operated in condition of weak resources, limited connection and cooperation. It could be said that the intermediary organization of the STM has played bridging between the supply and demand sides in the STM. But it has not yet the role of the “midwife” of technical and technological solutions, inventions, innovations. However, a number of STIs that have had quite effectively. They are technology exchanges and technology incubators and science and technology businesses such as Hai Phong Technology and Equipment Exchange, CRC – TOPIC (Hanoi University of Science and Technology), Technology Business Incubation Center, HCM city Nong Lam University.

#### *(2) Connection between network members*

Interconnect internally and locally within the network of intermediaries based on industry and local relationships. Each intermediary within industry, technology clusters and higher education institutions are relatively independent, self-contained. Moreover, the low number of intermediaries combined with the uneven distribution are factors that negatively affect the linkages and cooperation between the intermediaries of the STM.

At the level of interdisciplinary, inter-regional and regional, there has not been any connection activity between intermediaries. One of the factors hindering the connection and linkage between the intermediaries is the overlap in the functions of the intermediaries. The functions and duties of each type of intermediary organization have been identified by Circular 16. However, intermediaries has registered to carry out similar activities such as brokerage, connecting supply and demand, supporting science and technology transfer. In particular, the technology transfer promotion and support centers in the provinces perform many tasks overlapping with other types of intermediaries.

#### **4. Discussion and Conclusion**

From the above assessments, some comments on the current state of STIN could be taken as follows:

*Firstly*, science and technology intermediaries are not evenly distributed, leading to an imbalance in term of location. There is a high concentration of the number of intermediaries that could be seen in Hanoi and HCM City. However, even in these two cities, the number of intermediaries is not much and it is only concentrated in a few key technology fields. In the management aspect, although it is in the early stage of the formation process, there is a fragmented situation, many intermediaries managing the intermediary organization. Currently, at least two ministries are involved in the management and coordination of intermediaries. Specifically, the National Innovation Center belongs to the Ministry of Planning and Investment by decision of the Prime Minister. Meanwhile, the innovation centers at the provincial and city levels are under the Department of Planning and Investment in the provinces and cities. Furthermore, in each province, there exists a Center for Science and Technology Progress Application under the DST, which performs the tasks of information, consulting, linking technology supply - demand and transferring technology.

*Secondly*, the tasks and functions of the intermediary organization are not clearly defined, there is even an overlap in functions and tasks among the intermediary organizations of different types. Even in the articles of Circular 16, the functions of intermediaries have overlapped because some intermediaries in this type are allowed to perform the activities of intermediaries in other types. Specifically, according to the provisions of Article 3, Circular 16, the technology trading floor has the function of coinciding with functions of technology transaction centers, centers for promoting and supporting technology transfer activities, intellectual property valuation aid organizations and innovation support centers. A technology trading center has the same function as an exchange, an intellectual property valuation support organization, and an innovation support center. Similarly, the center for promoting and supporting technology transfer activities has the same function as the function of the intellectual property, the intellectual property valuation support organization and the innovation support center.

In the context of the need to innovate and apply technology that are not high, many intermediaries operate in moderation and do jobs that do not belong these organization. In contrast, on the demand side, enterprises cannot find an intermediary to connect with suppliers of equipment and technology. The redundancy and lack of science and technology intermediaries shows that the establishment and operation of the current intermediaries are not entirely due to the needs of the parties in the STM. Some centers for promoting and supporting technology transfer activities only exist formally, carry out movement work and are still heavily influenced by the centralized administrative mechanism.

*Thirdly*, the connection circuits between intermediaries have not yet formed. There is no connection and linkage between intermediaries of different types. Essentially, the intermediaries operate in isolation. In some cases, the intermediaries are connected and coordinated, but the connection has not been maintained regularly and sustainably. Single-

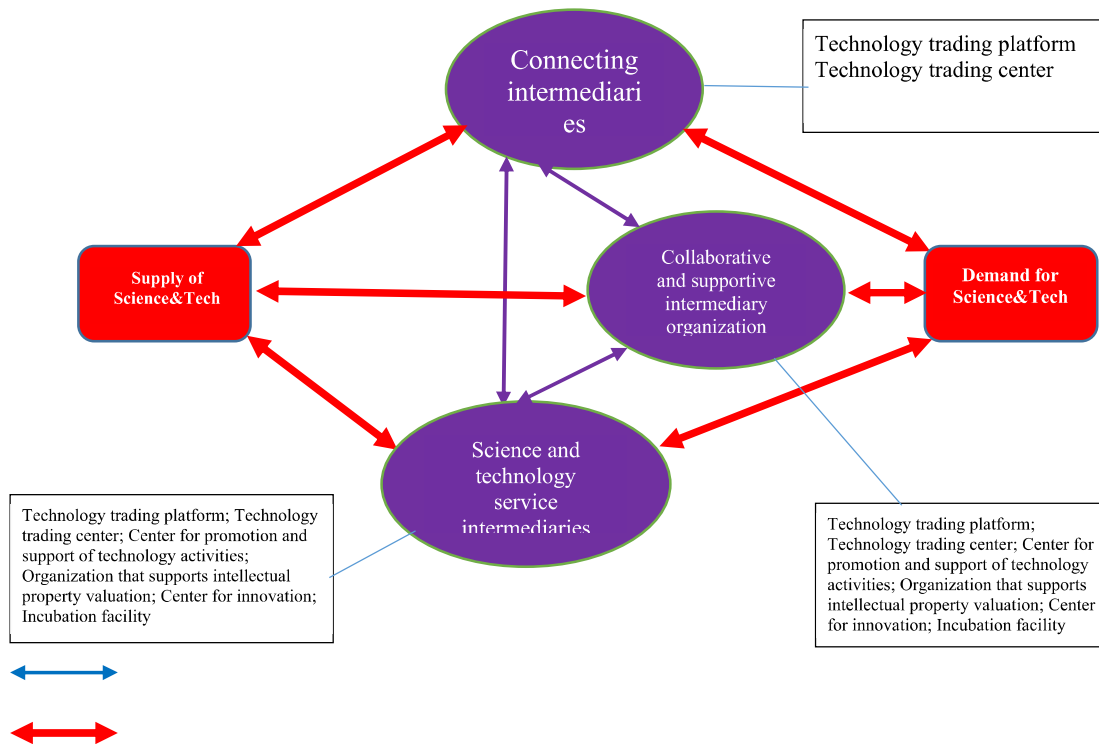


connection circuits showing single relationships still exist quite commonly. Another aspect that needs to be clarified is the linkages and connections between more administrative science and technology intermediaries rather than professional connections. The connection and linkage activities between domestic intermediaries and with international intermediaries are still limited. Trading through technology exchanges and science and technology intermediaries accounts for a small number and only accounts for about 5% of the total technology transactions on the STM (Pham T. T. L., 2020).

*Fourthly*, the activities of intermediaries are fragmented, and duplicated. Each intermediary organization itself has not yet understood the needs for provision and transfer of science and technology of enterprises. This is combined with the lack of orientation in the operation and the overlap in the functions and tasks of each intermediary organization, making fragmentation tend to increase. Therefore, it is difficult to find a key intermediary organization that have strong resources, high quality and reputable enough to connect and coordinate among intermediaries of different types. In currently, the MOST has directed the DST in provinces and cities to review centers to promote and support technology transfer activities, innovation centers and research centers and technology transfer to assess the degree of functional overlap. In some provinces/cities, centers with overlapping functions have been merged into one center; unnecessary centers were dissolved. However, the fragmentation of distribution, overlapping in operational functions, ambiguity in tasks in STIO has not been overcome basically.

*Finally*, lack of focus, unification on direction and management along the current vertical system of intermediaries. In terms of the state management of the intermediate organization, no specialized division for the STI has been set up in the organizational structure of the MOST.

From the current status of the network of science and technology intermediaries as described above, it is necessary to establish a network model of science and technology intermediaries. The formed network must represent the organizational structure of the system of science and technology intermediaries and also show the relationship and connection between STIs in that system. Based on the approach, the network model of STM could be proposed with the basic elements including the node point and the core point, the connection circuit between the nodal points.



The connection between intermediate organizations

Liaison between intermediaries and supply-demand side

Source: developed from Lopez-Vega & Vanhaverbeke, 2009; Doan X. H. et al., 2020

**Figure 1: General model of the network of intermediaries of Vietnam's STM**

1) **The nodal point** of the mediation network is each individual intermediary institution. Intermediaries are classified and grouped into three groups: connection intermediaries, cooperation and support intermediaries, and science and technology service intermediaries.

*Connecting intermediaries* connecting the supply and demand sides in the STM and brokerage to help the supply and the demand side in science and technology find and meet the right partners, match the demand. demand and supply. According to Circular 16, a technology trading floor and a technology transaction center are two organizations that perform the connection function.

*Collaborative and supportive intermediary organization* has the function of connecting, screening and processing scientific and technological information, assisting parties in marketing, sales and sponsorship activities, and commercialization of technology; research and diagnose trends of innovation and technology transfer.

*Science and technology service intermediaries* providing intellectual property consulting services, intellectual property management; training, diagnosis, analysis and testing; consulting on standards and building standards.

**2) Circuit connection:** horizontal relationship, vertical relationship

Horizontal circuits are the horizontal relationships between intermediate organizations in the same group and the network. Connections are established and maintained through information exchange, cooperation, association and coordination in support projects and programs. Each intermediate organization can have many horizontal relationships at the same time. These relationships can be permanent or just temporary. One-to-one relationships between two intermediaries could be common. However, the connectivity of the network of intermediaries will be maintained and enhanced when the intermediary has a cooperative relationship with many other intermediaries. A network of intermediaries is well connected when it is set up and oriented to meet the needs of brokerage, connection, and assistance in technology transfer and transfer of the parties in the STM. Instead of formally forming an intermediary organization with common, ambiguous and overlapping common tasks and functions, professional intermediaries need to be formed. In the condition of uncompleted and developed STM, intermediary organizations should be built on a multi-functional model. Along with the development of the STM, intermediate organizations will gradually shift towards specialization.

Longitudinal circuits - vertical relationships: vertical relationships exist between science and technology intermediaries due to the existence of a regulatory relationship by industry. Another form of longitudinal circuit will be established when some types of intermediaries have formed including: National Technology Exchange, Center for Promotion and Support of Operations. National Science and Technology and National Innovation Center. The national intermediaries play the leading role to direct, coordinate and connect the intermediaries at the sectoral, local level, not performing administrative management tasks.

**3) The core point** - that is, the key intermediaries have a central role in connecting, coordinating and coordinating activities between the intermediaries. In a network of intermediaries, national and regional technology exchanges, national innovation centers, and national technology transfer promotion and support centers are central intermediaries. In addition to national level science and technology intermediaries, intermediaries have outstanding competencies in performing the functions of connection, cooperation and support, and science and technology intermediation services in industrial clusters, industry and local can also be considered as the core intermediaries of the network local, industry, and industrial clusters.

In conclusion, the model of a network of intermediaries of the Vietnamese STM has been proposed with network components including science and technology intermediaries, and interconnections. The vertical relationship represents the management and direction relationship between the upper and lower intermediate organizations. At the same time, this relationship also includes relations of cooperation, connection and support between intermediary organizations at different levels. At each level, horizontal linkages between intermediaries are established, demonstrating a relationship of cooperation and support, connecting science and technology mediation in science and technology transfer projects, technology, innovation and application of science and technology in certain enterprises, industries and localities. The proposed model of a science and technology intermediary organization network is the basis for perfecting the intermediary organization system in terms of selecting key members to join the network, proposing mechanisms and policies to promote push participation, solutions to link space organizations and solutions to connect and share databases among intermediaries in the Vietnamese STM.

This research, as other studies, has some limitations. Firstly, the results are based on opinions from representatives of a small number of organizations and business. Secondly, the research used in-depth interview in collecting data which might be different from focus group interviewing in this case. Future research should develop the model by collecting data from a big sample and using focus group interviewing.

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