Contemporary Threats to the Continuity of Transport Systems

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The customers' expectations towards companies providing transport services continue to grow. Nowadays, besides common tendency to minimize the costs of operation conducted while maintaining the required quality standards, the key role is played by the issue of ensuring the conditions for continuing the implementation of transport processes. The article characterizes the key threats to the orderly functioning of the transport system and an attempt has been made to indicate the possibility of using the assumptions of the business continuity management concept in modern transport systems.

Keywords: business continuity management, transport systems, threats.

1. INTRODUCTION

Modern transport systems are extremely complex systems which consist of a set of technical sub-systems (modal, functional), organizational, financial and regulatory. Their proper functioning is determined by a number of social, technical, economic, environmental, spatial and functional factors. Currently, under the conditions of globalization, what becomes particularly important is to ensure conditions which guarantee the smooth flow of goods, and to minimize and preferably eliminate various types of risks to goods, transport means and personnel. It is certainly not easy with the magnitude of potential risks at all stages of transport processes. One way to ensure the smooth flow of goods through the subsequent stages of the transport process is the use, in the transport practice, the assumptions of the common, in the transport system, concept of Business Continuity Management (BCM).

The objective of this article is to identify the key risks to the proper functioning of the transport system and attempt to indicate the possibility of using the assumptions of the BCM concept as determinant being the condition of its uninterrupted operation. The research problem solved has been clarified in the form of: what dangers affect the continuity of transport systems today? In the material beyond the theoretical study, the results of empirical studies carried out using the diagnostic survey method were used. The adopted approach has allowed for the cross-cutting nature of the discussion while providing the basis for further, broader research into this extremely important issue.

2. THE NATURE AND TRANSPORT SYSTEM ENVIRONMENT

One of the important areas of the modern economy functioning is transport that both in theory and in practice has many dimensions. In general, for example, it is defined as human activity, the aim of which is to move in the space people and cargo using suitable means of transport[1]. In the subject terms it is defined instead as technically, organizationally and economically separated from other activities, deliberate movement of any cargo and people [2]. On the other hand, in terms of the economy, transport is attributed to the activities aimed at moving in space, involving providing rewarded services that result in the movement of persons and/or cargo, as

[1] A. Koźlak, *Ekonomika transportu. Teoria i praktyka gospodarcza*, UG, Gdańsk 2008, p. 12.
[2] Ibidem, p. 11.

well as the creating support services such as freight forwarding services, freight brokers services, counting the cargo or determining the weight, intrinsically connected with it[3].

Despite the diversity in the interpretation of the transport term in the literature there is a widespread opinion that the proper implementation of the transport service is conditioned by a number of different factors, all of which make up the **transport system**. It is created primarily by: the means of transport, transport infrastructure, human capital and well-known and applicable rules, rules for their implementation, as well as the relationships and connections between them (Figure 1).

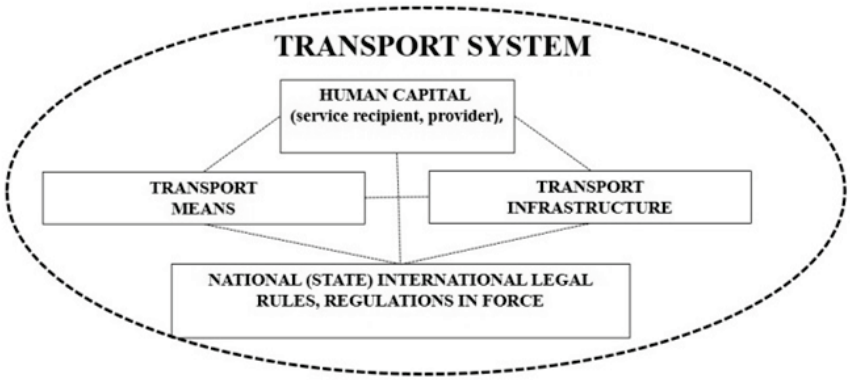

Fig. 1. The essential elements of the transport system [own compilation].

As in the case of the transport term, in the subject literature there are many definitions of the transport system, which is due to its complexity and dynamics of changes in its closer and further environment. One of the more accurate ones indicates that it is a set of objects (road network, transport mass, transport investments, transport processes of all transport modes), including the links existing between these objects and between their attributes, which are used by transport policy being a nexus joining the transport system into one piece with the help of the co-ordinating actions being implemented[4]. From the perspective of these deliberations, what matters is the functional classification of the transport system, according to which it is possible to single out four subsystems: the technical one, the organizational one, the economic and legal one, and the information one. **The technical subsystem** is created by: transport infrastructure, transport means, transport equipment and handling, technical means of transport facilities, equipment of the transport points, ports, combined transport terminals, railway stations, airports, logistical centres. **The organizational subsystem** represents formal and informal structures managing the given transport process according to the intended purposes. **The economic and legal subsystem** comprises elements such as tariffs, the financial, fiscal, legal system of the entities of the real transport sector. **The information subsystem** is a link between all the elements of the transport system by ensuring the free, unimpeded flow of reliable information necessary for the planning, execution and control of transport process in all its stages.

From the perspective of the proper functioning of the transport system it is particularly important to precisely define their goals, which are considered to be achieved if the given transport service is implemented as planned, satisfying to the maximum extent the expectations of the customer, and at the same time allowing to achieve measurable benefits to the carrier, transport/shipping company. An important influence on achieving the set out objectives have the conditions in which the service is to be provided. In this case, both closer and further environment of the transport system should be kept in mind. **The closer environment,** also called a micro-environment, has a direct impact on the transport system elements functioning and includes mainly[5]: all users of the services provided by the system components; all entities providing the elements of the system with the resources needed to continue operations; entities seeking to win over the same customers as the system components; all the entities which, in accordance with the law,

[3] W. Rydzykowski, K. Wojewódzka-Król (red.), *Transport,* PWN, Warszawa 2002, p. 11.

[4] F. Tomala, *System transportowy a ogólna teoria systemów*, „Zeszyty Naukowe" nr 33, Sopot 1966, p. 73.

[5] M. Lisiecki, *Metody i techniki organizatorskie i kierownicze*, WSZiM, Warszawa 1998, p. 15.

have the right of ownership of the system components; the entities that can control and regulate legally the policies and operation of the system components, or otherwise act on them; individual organizations or groups of organizations that the system elements co-operate with. While **the further environment,** called a macro-environment, includes several dimensions, which include, among the others.[6]: **the economic dimension** - an economic system in which the given element operates; **the technological dimension** - the technologies used; the ways to enable the transformation of resources into certain services; **the socio-cultural dimension** - the applicable standards, values, habits and customs; **the legal and political dimension** - a set of standards and regulations; **the international dimension** - the activities and cooperation in the international arena. It is worth noting that the division of the transport system environment into the closer one and the further one is rather conventional, since the precise division is impossible due to the interpenetration of many elements.

3. KEY RISKS TO THE CORRECT FUNCTIONING OF TRANSPORT SYSTEMS

In the modern world the natural elements of the functioning of all systems, including in particular transport systems, are risks. According to the literature, a risk is a subjective (depending on the perception) or objective (independent of the perception) occurrence of the danger to the values relevant to the subject, belonging to its safety zone. The dangers are aimed at specific values which are the subject of protection. The starting point of danger is the emergence of some phenomenon, disparities in resources that cause concern[7]. Based on this, it can be said that a threat to the proper functioning of the transport system are potentially all human actions or inactions, and force majeure, which relate directly to this system and can (using susceptibility) cause significant losses as a result of the resulting interference. Threats exist in different spatial scales (global threats or local ones) and temporal (many years of war or few minutes hurricanes). It is worth remembering that some of the risks have existed for a long time but as a result of changes in the environment their frequency, intensity and consequences of occurrence also change. On the other hand other threats are only just forming. Currently, due to the computerization of processes the number of threats related to the processing of information in the operating systems, is rapidly increasing. There are new threats such as cyber-terrorism, spyware, phishing (impersonating banks, obtaining passwords to access online accounts).

Generally, risks can be divided into two main groups:

- hazards due to human activity,
- hazards due to the forces of nature (the environment).

Despite such defined risks criterion divided into two groups, in the literature it is possible to find deviation from this rule. And so, in the document "Axiology of threats", the authors accepted the premise that natural hazards related to climate and water resources, as well as volcanic eruptions, earthquakes, tsunamis, will be considered as a threat dependent on people, because humans have a direct or indirect impact on the course of some geophysical variables. Additionally, the area of the possible occurrence of natural extremes is possible to predict, and therefore the formation of potential losses and building a system of preparation and protection is in people's hands[8].

Trying to generalize presented views, and refer them directly to the transport systems, for the correct indication of the main threats it is necessary to specify the context, i.e. closer and further environment in which the transport system operates. Analysing the context o0ne should take into account:

- legal regulations (can the unfavourable legal regulations occur?)
- political situation (can the restrictions be placed on an access to the market?)
- social situation (will unfavourable demographic changes occur?)
- economic situation (if there is a possibility of new competitors to appear, will there be a slower growth in the market?)
- cultural and religious norms (will the change in the needs and tastes of buyers occur?)

[6] Ibidem, pp. 14–15.

[7] R. Zięba, *Nowe wyzwania i zagrożenia dla bezpieczeństwa międzynarodowego: aspekty metodologiczne,* [w] Świat wobec współczesnych wyzwań i zagrożeń, Wydawnictwo Naukowe SCHOLAR, Warszawa 2010 pp. 335-361.

[8] J. Kwaśniewski, Z. Kundzewicz, K. Juda-Rezler, *Aksjologia zagrożeń,* „NAUKA" 4/2010, pp. 19-22.

– natural conditions (will there be a significantly change in the weather?)
– applicable procedures (will there be unfavourable systemic solutions introduced?)
– available resources (will there will be a migration of workers?)
– adopted culture of the company (will the brutalization of relationships between employees occur?)
– relationships with customers and other stakeholders (will there be an increase in the bargaining power of buyers or suppliers?).

Conducting analysis on the above levels is performed mainly to prepare the directory of the main threats (the most likely ones). Given the contemporary national and international conditions of the implementation of transport services it should be noted that a group of human risks should primarily include:
– barriers for widely understood law regulating the operation of transport services, labour law, environmental protection, taxes, etc.,
– education and training requirements for professional drivers,
– retiring executives with high qualifications and the lack of professional drivers on the labour market,
– traffic accidents,
– diseases of civilization,
– aggressive competition,
– low demand for the products and services offered,
– demographic factors,
– global crisis,
– limited access to external sources of financing (the delays in the Horizon 2020 framework program),
– cybercrime,
– industrial espionage,
– organized terrorism,
– armed conflicts, wars,
– socio-cultural changes,
– pathologies in the relations between people,
– erroneous actions of the employees (conscious or unconscious).

In contrast, the group of environmental hazards can include:
– climatic phenomena such as strong winds, frost and heat waves,
– floods and droughts,
– seismic phenomena,
– air pollution,
– extensive failures,
– electromagnetic radiation,
– fires,
– epidemics.

The most likely hazard classes for transport systems are shown in Figure 2.

For transport systems the risks should first be considered from the view point of the effects they cause. Spectacular threat of the last months was undoubtedly the political situation in Ukraine. The developments in consequence led to a complete prevention of the transit, by Russians, of the agro-food products to other countries. Since the introduction of the embargo in August 2014 till March 2015 the Polish transport sector losses amounted to approx. 22 million Euros[9]. An example of risks arising from legal changes may be the introduction, by the German government, of the minimum wage to all drivers passing through the country, which, according to the Polish owners of transport companies, has a bad impact on competitiveness.

TRANSPORT SYSTEM THREATS	
HUMAN	**ENVIRONMENTAL**
- legal - technological - educational - competence - random - illness-related - pathological - intentional	- climatic - seismic - epidemiological - radioactive - other

Fig. 2. The most likely hazard classes for transport systems [Own compilations].

[9] www.polskieradio.pl/42/3168/Artykul/1395829,Rosyjskie-embargo-polski-sektor-transportowy-stracil-22-mln-euro. – as of 20.11.2016.

Since the threats cannot be eliminated one should handle them in a conscious way, which effectively minimizes their negative effects. The richer and more developed society, the greater the awareness of existing threats and more activity, readiness and more resources both for reducing risks by eliminating vulnerabilities as well as for reducing their impact. The same applies to companies providing transport services, which should act in a conscious and comprehensive way in the context of diagnosed threats. The occurrence of hazards directly increases the costs of business and significantly worsens the service. One of the tools that will help to counteract the effects of dangers in transport systems is the concept of business continuity management.

4. BUSINESS CONTINUITY MANAGEMENT IN TRANSPORT SYSTEMS

The origins of the concept of business continuity management date back to the late 60s of the twentieth century in the United States of America when, taking into account the widespread use of information technology, the contingency plans began to be developed for information systems[10]. With time, business continuity management found many supporters among the managers of key business processes. And so in the 80s and 90s of the twentieth century the business continuity management was necessary in the face of natural disasters, and the wave of terrorist attacks. Consequently, this led to the development of normative documents of the ISO 22000 series of thematically associated with business continuity. The ISO 22301: 2012, standard - *Societal security - Business continuity management systems - Requirements* is the result of international co-operation and a compromise reached. The standard specifies requirements for planning, establishing, implementing, operating, monitoring, viewing, maintenance and continuous improvement of a documented management system, the aim of which is to prevent any situation that could lead to disruption, loss, emergency or crisis. Additionally, it improves the ability to prepare for such situations, respond appropriately when they arise and return to normal functioning if they occur. These requirements are general in nature and are intended to apply to all organizations, regardless of type, size or nature of the business. Business Continuity Management is a holistic management process that identifies potential hazards and the effects that these risks may have on the business in the event of their occurrence, which provides a framework structure to build resistance of the organization and enables an effective response in order to protect the interests of its key stakeholders, its reputation, brand and the activities that create value[11]. It is therefore a natural response to the needs of companies implementing processes in transport systems, which consciously want to manage risks and minimize their effects. The fact this standard is gaining an increasingly popularity shows, among the others, support the certificates issued in 2014 prepared by ISO (International Organization for Standardization). In total there were 1,757 certificates of compliance with the ISO 22301 standard issued in 2014. An undisputed leader is India with a total of 480 certificates, representing almost 30% of the total number of certificates issued. Next is the United Kingdom - 345 certificates, and Japan - 200 certificates. In Poland last year 20 implementations ended in certification[12].

The essence of business continuity is primarily a proper preparation of the organization to continue at the earlier specified level, acceptable by the client, in the event of disruptions. In transport systems these will be quantitative as well as qualitative requirements (e.g.: punctuality of the service, the number of operations, the safety of entrusted property and data). To this end, one should perform the following actions:

- determine the internal and external context of the activities of the company that will help identify areas of the potential hazards occurrence,
- perform business impact analysis, i.e. evaluation of the effects of disruption of business and establish and choose strategy of business continuity, and identify processes which should have business continuity plans developed,
- carry out the risk assessment process consisting of identification, analysis and evaluation of risk,

[10] E. Dębicka, T. Jałowiec, *Zarządzanie ciągłością działania we współczesnej logistyce*, „Gospodarka materiałowa i logistyka" nr 5/2015, Warszawa 2015, pp. 67-79.

[11] Standard PN-EN ISO 22301: 2014-11 General safety. Continuity Management System. Requirements.

[12] www.iso.org *The ISO Survey of Management System Standard Certifications -2014. Executive summary.*

– establish business continuity plans which is a set of documented procedures, which prepare organization for the appropriate response, resumption and restoring the functioning at the predetermined level after the disruption.

Due to the general nature of the requirements of the normative document, the possibility of their implementation among companies involved in transport processes is high. It seems that in order to ensure high standards of the market customer service in the entire transport system to ensure business continuity at the level of each process implemented is essential. Even more so in the face of new threats (embargo, legal changes, growing anxiety in Europe, cybercrime) one should consciously and comprehensively prepare for their possible consequences, so that there is no interruption of the processes. The key benefits of business continuity management include the following:

– minimizing the costs associated with the termination of the processes being implemented,
– gaining competitive advantage,
– increasing confidence among customers and business partners,
– meeting legal, regulatory and business requirements in terms of ensuring the continuity of the processes being implemented,
– informed decision making,
– strengthening the organization's resilience to threats,
– monitoring and early detection of new threats,
– rational and adequate choice of solutions to resume and restore processes functionality at a established level.

On the other hand, one should think about it why, for example, in Poland, this standard is still so underrated. It seems that the financial aspects and the low awareness of the issues are the fundamental premises. The barriers to use the concept of business continuity management in the transport systems may further include:

– labour-intensity at the implementation of the business continuity management system,
– the costs involved in the certification process,
– providing the necessary resources to test business continuity scenarios,
– difficulties in meeting the regulatory requirements,
– low awareness on issues related to business continuity,
– lack of specialists in this area,
– narrow range of subjects of the training offered,
– lack of specialized publications,
– immaturity of the organization,
– resistance of the employees to the implementation of new systems,
– number of processes in the transport system,
– complicated nature of the processes functioning in transport systems [13].

Despite the difficulties encountered, it seems that the benefits, described in this part, of using the concept of business continuity management in transport systems are of paramount importance and therefore this concept should be applied in practice. Such an approach is confirmed by the results of empirical research presented in the next section.

5. BARRIERS AND USABILITY PRINCIPLES OF THE CONCEPT OF BUSINESS CONTINUITY MANAGEMENT IN TRANSPORT SYSTEMS - THE RESULTS OF EMPIRICAL RESEARCH

Given the multifaceted character of the phenomenon studied, in order to scientifically confirm the research assumptions, the authors have decided on a qualitative research using the method of diagnostic survey, conducted by an interview technique. As a research tool an interview sheet has been prepared containing 4 specific questions aimed at getting to know the opinion of experts on the barriers and opportunities for the use of assumptions of the concept of business continuity in road, air and sea transport. The study began in September and was completed by the November 2016. To ensure cross-cutting nature of the results, 18 experts were asked to fill in the prepared research tool. They represented both the scientific community (universities and research institutes) and the transport sector (representatives of companies operating both on the national and international transport market). Two of the experts had the title of professor, four of the assistant professor title, seven doctor's degree, remaining

[13] K. Ficoń, *Analiza identyfikacyjna logistycznych makrosystemów transportowych,* „Zeszyty Naukowe AMW" nr 2 (181) 2010, pp. 51-80.

ones master's degree. Most of the study participants (13) had more than 10 years of work experience, the two had worked in the transport sector for 8 years and three for approx. 9 years.

The first question to the experts was: *Which elements, according to you, currently play a priority role in the transport system?* Due to the nature of the sample research the scope of the research was limited to the road, air and sea transport. The experts mostly agreed to such posed question, that nowadays this role falls on infrastructure. They also pointed to its technical level and the need for coordination of infrastructure investments determining growth of the effectiveness of measures implemented under the inter- and multimodal transport. The respondents in their opinions also emphasized that consistently over the years people are the most important element of transport systems. Trying to generalize the positions presented it should be noted that distinguishing somebody from the elements of the transport system does not seems to be reasonable, but above all, one should pay attention to the improvement of relationships and dependencies between them.

The second question of the interview sheet was to obtain the views of the experts on the risks, which in their opinion, can, to the greatest extent, negatively affect the proper functioning of transport systems. Synthetic depicting of the presented views is shown in the Table 1.

Table 1. Opinions of the experts on the threats that, to the greatest extent, can negatively affect the proper functioning of the transport systems.

Road transport	Traffic congestion, poor infrastructure, rapidly growing number of vehicles, vehicle condition
Air transport	Insufficient and not fully correlated with the real needs, nodal infrastructure development, technical condition of the aircraft
Maritime transport	Weather conditions, lack of correlation with other modes of transport

[Own compilation]

Directly related to the second question was the third question, in which experts were asked to specify what kind of measures should be taken, in their opinion, to eliminate to the maximum extent the potential risks disrupting the efficient implementation of transport services. Among the proposals, the most popular one referred to "constantly improving staff qualifications"; "conduct integrated, on the national and international scale, extra-modal development of transport infrastructure"; "invest in new technologies"; "the key to the success is innovation"; "not to conduct short-term politics, but to work out a long-term vision for the transport system development". Based on the views presented it can be concluded that the particular rank is given, in the area, to the long-term planning issues as well as to technological and organizational aspects.

The last question posed to the respondents referred to making the ranking of factors relevant for ensuring the continuity of transport systems operations. The research team, based on the pilot studies proposed in this part of the study 9 factors attributing to them the six-point-scale (1 - the least important, 6 - the most important). A summary of the results is presented in Table 2.

The results obtained have been ranked in accordance with accepted weights of the individual scale (number of responses x weight scale). The resulting ranking has been shown in the last column of Table 3 and 4. After compiling the proposals the experts it is possible to see, that there is certain specificity of the perception of the studied factors in the individual modes of transport. The group of factors that were most often mentioned include: the state of the infrastructure, possibility of flexibly responding to emerging crisis situations and the modernity of the transport means.

Summing up the empirical part it must be noted that the collected research material confirms the complexity and multi-face aspect of the problems of ensuring the continuity of transport systems operations. The study conducted, due to the existing restrictions, only showed a further need for a scientific research of this important but also extremely complex problem.

Table 2. Opinions of the experts regarding ranking of the factors relevant for ensuring the continuity of transport systems operations.

Road transport								
Factors	not important (1)	least important (2)	partially important (3)	important (4)	very important (5)	the most important (6)	total number of points	ranking
Modernity of the transport means	**-**	**-**	**-**	**2**	**11**	**5**	**93**	**2.**
The state of infrastructure	**-**	**-**	**-**	**-**	***2***	***16***	***106***	***1.***
Training and experience of the staff	-	-	-	3	12	3	90	4.
Efficient flow of information between all participants in the transport process	-	-	6	3	4	3	68	7.
Sufficient financial resources	-	-	8	6	2	-	58	5.
Precise identification of potential threats	-	2	4	5	5	2	73	6.
Possibility of flexibly responding to emerging crisis situations	**-**	**-**	**-**	**2**	**11**	**5**	**93**	**2.**
Confidence among customers and business partners	1	6	4	3	1	-	42	9.
Resistance of the organization to threats	-	2	-	6	6	4	82	5.
Air Transport								
Factors	not important (1)	least important (2)	partially important (3)	important (4)	very important (5)	the most important (6)	total number of points	ranking
Modernity of the transport means	**-**	**-**	**-**	**-**	**6**	**12**	**102**	**3.**
The state of infrastructure	-	-	-	3	9	6	93	4.
Training and experience of the staff	**-**	**-**	**-**	***1***	***7***	***10***	***111***	***1.***
Efficient flow of information between all participants in the transport process	-	-	-	2	12	4	92	5.
Sufficient financial resources	-	-	4	8	6	-	74	7.
Precise identification of potential threats	-	-	-	5	5	6	81	6.
Possibility of flexibly responding to emerging crisis situations	**-**	**-**	**-**	**-**	**4**	**14**	**104**	**2.**
Confidence among customers and business partners	2	4	6	4	2	-	54	9.
Resistance of the organization to threats	-	6	5	3	2	2	61	8.
Maritime Transport								
Factors	not important (1)	least important (2)	partially important (3)	important (4)	very important (5)	the most important (6)	total number of points	ranking
Modernity of the transport means	-	4	8	2	2	2	62	7.
The state of infrastructure	**-**	**-**	**-**	***9***	***4***	***5***	***86***	***1.***
Training and experience of the staff	-	-	10	6	1	1	65	5.
Efficient flow of information between all participants in the transport process	-	2	6	4	4	2	70	4.
Sufficient financial resources	-	3	7	4	4	-	63	6.
Precise identification of potential threats	**-**	**1**	**3**	**9**	**3**	**2**	**74**	**3.**
Possibility of flexibly responding to emerging crisis situations	**-**	**-**	**6**	**6**	**3**	**3**	**75**	**2.**
Confidence among customers and business partners	2	6	4	6	-	-	50	9.
Resistance of the organization to threats	1	3	11	2	1	-	53	8.

[Own compilation]

6. SUMMARY

Numerous risks negatively affecting the normal course of transport processes translate into increased interest in activities allowing transport companies to prevent them. One of the measures taken is to use assumptions of the business continuity management concept. Helpful in this regard is the ISO 22301 standard which is

recognized in all countries and raises the mutual trust among partners. Unfortunately, it is still not very popular among players of transport systems. It seems that high costs involved in implementation of the requirements of the standard into all of the processes, and relatively low awareness among entrepreneurs, are the main reasons. However, recognizing many benefits of being able to ensure continuity of operations in transport systems, it is justified to follow further the subject.

The results described in the article which are the results of the research procedure carried out, have identified the key threats to the orderly functioning of a transport system and indicate the potential use of the BCM concept assumptions in transport systems which was in line with the established target.

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