A NEW APPROACH TO LOGISTICS WITH REGARD TO COMPREHENSIVE SECURITY OF SUPPLY CHAINS IN DIGITIZED ECONOMICS

Galina V., Bubnova[1], Peter V. Kurenkov[2], Alexey G. Nekrasov[3]
[1]*D.Sc., Professor, Head of the Department "Economics, Organization of Production and Management", GBubnova@gmail.com*
[2]*D.Sc., Professor of the Department "Economics, Organization of Production and Management"*
[3]*D.Sc., Professor, Head of the Laboratory on Security of Supply Chains and Freight Traffic Control Systems, State Technical University (MADI), tehnologistic@mail.ru*
Corresponding author's email: petrkurenkov@mail.ru

Abstract: *The modern development of the economies of different countries in the digital industry creates the preconditions for the creation of fundamentally new types and directions of business, including international trade and economic systems and supply chains. In the article new criteria of stability of functioning of transport and logistic systems of new type, organizational and technical mechanism of management of a life cycle of a supply chain in digital transformation are offered.*

Keywords: *digital logistics, stability of economic relations, transport and logistics systems of the new format.*

I. INTRODUCTION

A digital platform for innovative economic growth as one of fundamental policies of state development in European and Asian countries draws attention of Russian specialists. British experience is well covered in International Journal of Open Information Technologies, a journal popular in Russia, which raises the questions of using digitization solutions in different subject areas [1-5]. On the Asian continent, China as a leader of the global market is carrying out the innovative program "Internet Economy".

These days, Russia has actively joined digitization of economy. On December 1, 2016, in the President's Annual Address to the Federal Assembly Vladimir Putin proposed to launch a large-scale system program aimed at the economy of a new technological generation. The presidential decree issued in December 2016 prioritized digital and intellectual production technologies, big data processing systems, artificial intelligence systems as well as intellectual transport and telecommunication systems.

The working group "Digitized economics" of the Presidential Economic Council was approved by a presidential order of April 2017. The work is underway to develop the structure of the national program. Over 40 scientists and specialists of research, educational and business organizations are engaged in these activities; competence centers in various aspects of digital transformation of economics are being established at recognized higher educational institutions.

Research in digitized economics was pioneered by the national competence center in digitized technology (Lomonosov Moscow State University), the international center of competence development in transport and logistics (Moscow State University of Railway Engineering), the research and educational center "Legal protection of business and entrepreneurship" (Kutafin Moscow State Law University).

II. MAIN CONTENTS

Active development of economics in various countries in the format of digital industry paves the way for groundbreaking types of business integrated in international trade and economic systems and production supply chains. This situation determines large-scale use of the common digital environment, global Internet with minimal restrictions for businesses to access and use data in order to manage and control manufacturing, supply and services provided to businesses and individuals on the territories of two and more countries.

It should be noted that digital transformation of economics actualizes a number of priorities including efficient interaction of all elements of the business system and security of doing business. In this context the importance of innovative logistics - logistics in the digital transformation of economics – cannot be overestimated [6, 7].

Digitization, intellectual transport and telecommunication systems, new technological platforms using bigdata to give the best real-time offer to the customer (connecting outside providers), as well as Uber, car sharing and drones make it possible to achieve a number of significant effects. Among them are:

- optimization of procurement, manufacturing, logistic chains and transaction settlements, eliminating intermediaries [8];
- price equalization (across regions, countries of consumption);
- relevant economic output (manufacturing according to demand, order, requirement);
- reduction of manual labor and red tape through robotization and automation of most functions.

As a result, companies will be oriented towards getting profit not through price difference but through innovations in manufacturing and logistics.

Eurasian region has a tremendous potential for a radical change of the technological manufacturing platform, the system of business processes management, the technology of building optimal supply chains. There is every condition to boost this process – the rapid development of production technologies in Russia and China, the introduction of cyber-physical systems (CPS) into manufacturing processes, the development of genetic engineering, quantum processing, etc.

It is obvious that the products of the so called 4.0 digital economics (ecosystem – digital-

organization [9], new logistics, blockchain technologies) will be available and in great demand only by ensuring confidence and online-security. Of special importance are blockchain technologies building the new digital environment, which integrates digitized big data bases and guarantees security and confidence of their use.

In this case emphasis in logistics will be shifted from solving traditional problems - searching for losses, bottlenecks, dead expenses and the ways to reduce the costs (smart technologies of digitized economics are to solve these tasks automatically) – to *determining the conditions* for sustainable supply chains, as well as sustainable functioning of transport logistic systems (TLC) and their qualitative modernization [10-12].

The strategic block of functional objectives is being actualized. Unfortunately, building the strategy on the entrepreneurship level does not imply the "technological" factor – most of the time it is simply overlooked. Thus, when setting their targets in developing the governance models in railway transport, Russian Railways (RZD JSC), one of major Russian companies, practically neglects the tendencies of global digitization. The company's strategy is the long-term plan drawn up on the basis of the transport development strategy up to 2030. At the heart of the plan are the predicted cargo base and existing technology of managing the transportation process and interaction between transportation and logistics organizations.

In the business targets and business objectives of the RZD JSC development strategy there is not a single item oriented towards innovative development of this infrastructural organization connecting various regions of the country and playing a vitally important role for the national economy. This also applied to the organizations of different economic branches with total Wi-Fi coverage.

We strongly believe that the working strategy of the "natural" monopolist RZD JSC is to take into consideration strategic decision taken by European and Asian businesses. Thus, when predicting the volumes of cargo base it is necessary to consider both the EU strategy (fig. 1) and the bi-lateral decisions between China and Russia on digital interaction (fig. 2), which are to change transportation logistics and the technology of managing the transportation process. Consequently, the structural and functional model of RZD JSC will be changed.

The protocol of the joint Russian-Chinese working group on strategic cooperation in navigation signed on April 27, 2017 gives a strong impetus to establishing a unified pilot zone on transborder crossings, on motor vehicle crossing points:

- Ussuriysk (Pogranichny) (Russia) - Suifenhe (China), a part of the international transport corridor Phimorie-1;
- at the cities of Khabarovsk (Russia) and Fuyuan (China) (Bolshoi Ussuriysky Island);
- at the cities of Blagoveshchensk (Russia) and Heihe (China).

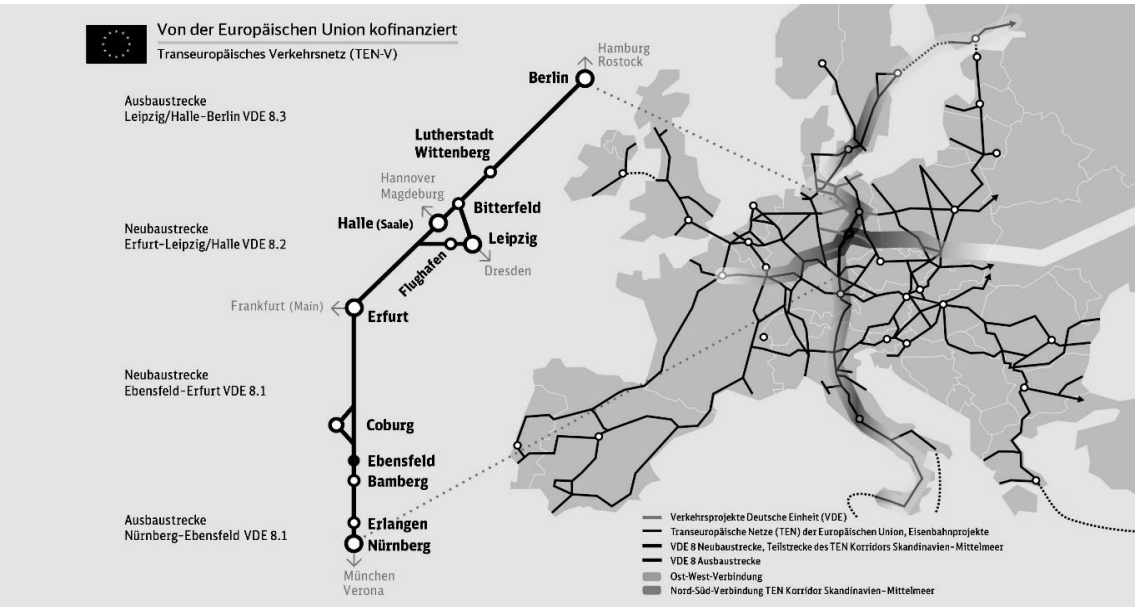

Figure 1. *Development strategies of the transport infrastructure in Europe*

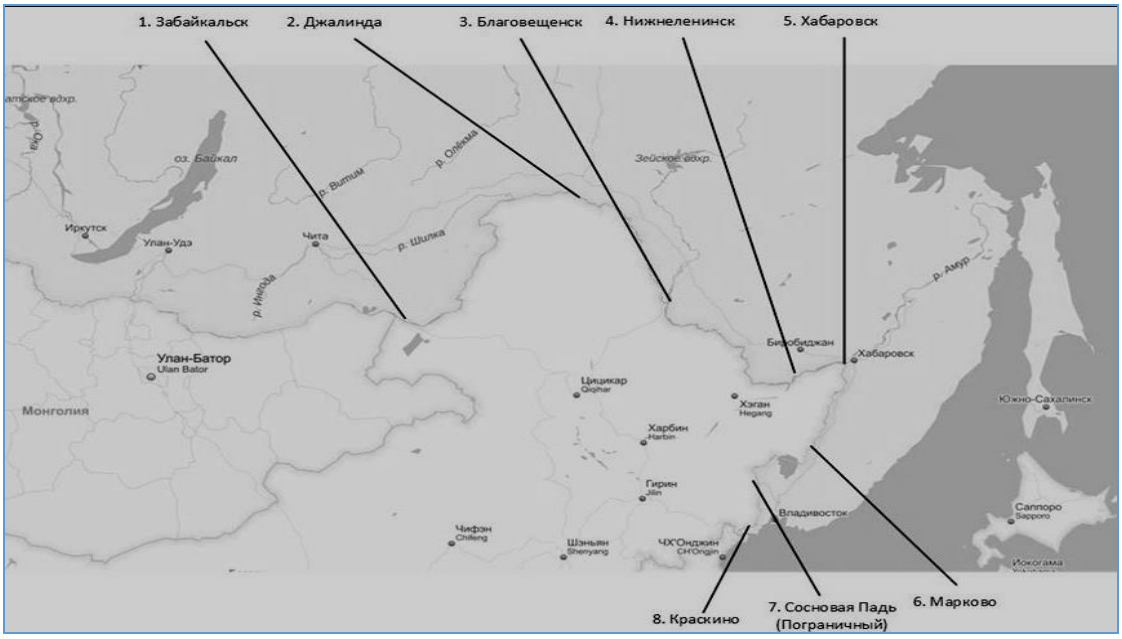

Figure 2. *The test ground of digital interaction between Russia and China with the satellite navigation systems GLONASS (Russia) and BeiDou (China).*

The expansion of this cooperation technology into other member areas of the Eurasian Economic Union is expected to provide transparency, greater efficiency of government control over transshipment, the development of commercial functions and services to all players involved as well as qualitative changes in logistics and approaches to building and evaluating transport and logistics strategies.

For these purposes we consider it appropriate to use new indicators of evaluation of strategic initiatives and approaches to supply chains. These are the sustainability index of transport and logistics systems and the methods of managing the systems life-cycle [14].

Based on the results of theoretical analysis and generalization of definitions we suggest the following criteria (indexes) of transport and logistics systems sustainability:

1. ACCESSIBILITY (physical) to the markets and employment; accessibility to basic social services; accessibility to international trade.

2. ACCESSIBILITY (economic) - affordable access to education and employment, to basic transport and logistics services, long-term investments in the transport infrastructure.

3. SAFETY – safe transportation of cargo, baggage, passengers, human and property security through the life-cycles of transportation facilities and transport and logistics technologies; minimization of consequences of road accidents and manmade disasters related to the transportation activities.

4. SECURITY of individuals, of human and cultural capital, protection against negative transportation impact; protection of transportation facilities and transport and logistics technologies against emergencies (and losses) of social and technogenic character.

5. ECOLOGICAL SUSTAINABILITY - transport and logistics systems are sustainable with regard to energy use, standard level of environmental pollution and land use; the transport infrastructure is sustainable to emergencies and catastrophes.

TLC development strategies prove that they are getting more integrated, comprehensive systems functioning on the basis of infrastructure integration, links and resources of the supply chain as well as integrated support of the processes through all life-cycles of this system. TLC functioning should be considered at the following stages of the life-cycle: planning (creation), performance, recycling. The life-cycle model forms the framework of the TLC new generation functioning within the supply chains and interacting according to the principles of transport links self-regulation with the unified resources, which provide highly efficient interaction on the basis of IT technologies and uniform standards of processes management. At every stage of the life-cycle it is required to determine **what** should be done (activity W); **in what way** it should be done (activity H) and the performance **per ce** (activity D). See table 1.

Table 1. *The interaction between the life-cycle stages and the types of activities*

Stage	W activity (what should be done)	H activity (in what way it should be done)	D activity (the performance per ce)
Planning and creation	Identifying and formulating the targets, the strategy and the needs in the TLC processes.	Development of requirements. Definition of the concept. TLC service design. Technology planning. Planning of service provision.	Definition of components. Service provision. Testing. Service supply.
Performance	Identifying the needs in IT. Identifying the targets of IT use.	Identifying the requirements for TLC operation. Identifying the requirements for logistics support.	System operation. Logistics support of the processes/
Recycling and utilization	Identifying the needs in recycling.	Identifying the requirements for recycling.	Service recycling. Decommissioning.

Getting information at different life-cycle stages in digital logistics makes it possible to achieve higher integration of the processes and improve performance quality. Process integration would be the movement of TLC to its optimal, i.e. sustainable state. As a universal mechanism we suggest the organizational and technical model consisting of five interlinked modules:

- the module of the standard processes oriented towards the quality management system institutionally supported by ISO 9000 standards;
- the module of the logistics production support integrating the processes of logistics support analysis, maintenance and repair, material support, electronic product documentation;
- the module of managing the functional logistics cycle that integrates the resources within the logistics supply cycle, material support and physical distribution;
- the module of managing the processes of the whole system life-cycle that provides adaptation on the basis of system engineering methods and production open coding;
- the strategic module of life-cycle management (planning, sourcing, manufacturing, maintenance and return flows).

Fig. 3 shows the hierarchical levels of managing the supply chain life-cycle.

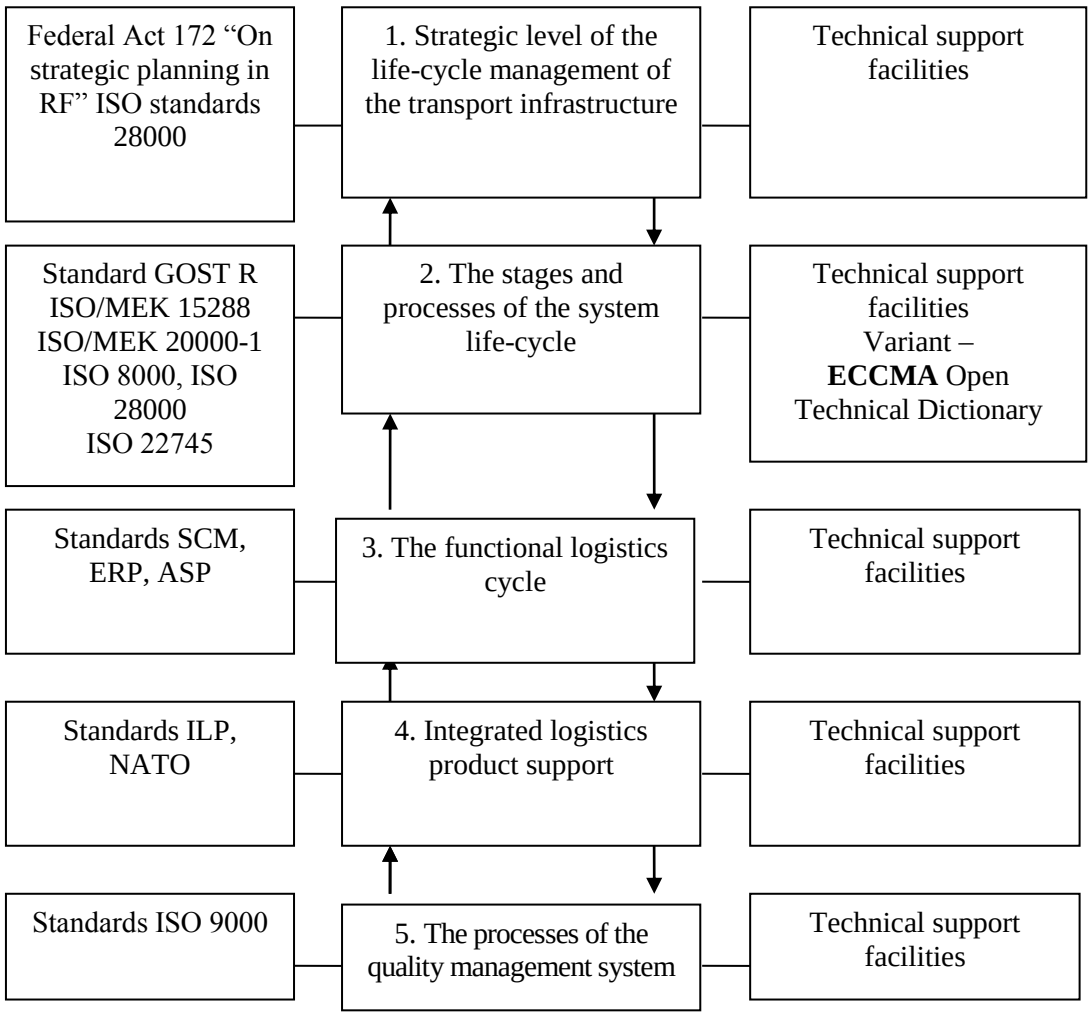

Figure 3. *Organizational and technical mechanism of managing the supply chain life-cycle.*

The bottleneck in the supply chain life-cycle is the integration of material support and operation with transportation on the basis of compatible logistics technologies, electronic document management within the uniform information environment. Sustainability and economic efficiency of management processes are to be evaluated within the system "design-manufacturing-service-transportation/warehousing-operation-additional services". To identify technological capabilities of risk mitigation and securing TLC sustainability let us consider the basic trends of their technological development.

According to experts, the basic trends of the vehicle and transport infrastructure development will primarily determine [14, 15]:

- ✓ autonomous movement of vehicles in the transport flow (Automated) – ADAS systems;

- ✓ IT technologies (broadband Internet 4G, 5G), the possibility to be connected to your vehicle anytime from anywhere using Connected Car (V2V, V2I, V2P);
- ✓ digital road infrastructure (BIM-technologies), Internet services providing adaptation of the freight forwarder in the transportation and communication environment;
- ✓ electric traction drive of personal and commercial vehicles (Electrified).

The trends mentioned above can lead to serious social and economic consequences:

- car makers will integrate with IT companies and cargo companies (the delivery service but not the vehicle is sold);
- information and communication services will be sold for individuals, drivers, service and dealer centers of consigners and consignees;
- ADAS systems will be further developed. Safety features are designed to avoid collisions and accidents by offering technologies that alert the driver to potential problems, or to avoid collisions by implementing safeguards and taking over control of the vehicle;
- self-driving trucks and ADAS equipped motor vehicles are expected to eliminate economic risks for cargo companies due to faster goods delivery, reduction of losses and cargo theft, lesser stock levels in warehouses.

Implementation of these trends is sure to adapt the transport and logistics system to the information and communication environment offering an opportunity to create a new culture of the interaction between an individual and environment (human-automobile, human-urban environment, human-human, human-natural environment, human-means of production and consumption). One day we may speak not about *homo sapience* but about *home connected.* It is of great importance to make transport and logistics technologies fit in and harmonize with the natural, social and economic environments.

III. CONCLUSIONS

To implement the abovementioned strategies in various regions of the Russian Federation and in Eurasia fundamentally new scientific and practical tasks are to be set. Among them are:

1. The development of new international ecological and social standards of human life and economics including mobility of goods, services and people taking into account pervasive global IT technologies.

2. The development and introduction of traffic control intellectual systems; increased use of motor vehicles equipped with robotics and mechatronic systems as well as neural networks.

3. The introduction of supercalculation technologies and information storage systems to estimate and forecast the development of integrated TLC, to monitor road traffic online, to forecast the state of natural and social environments, to anticipate natural and manmade disasters, the effects of climate change for the transportation process and transport infrastructure objects.

4. Taking tougher measures to reduce the negative impact of transport on the natural environment, to cut 'carbon footprint' of transport operations through modernization of motor car fleet (introduction of hybrid-electric vehicles and vehicles running on alternative ecologically friendly fuels).

5. The development of the integrated approach to manage logistics processes of freight and passenger traffic and goods supply on the basis of adaptive systems of risk management and big data.

There is no doubt that in digitized economics there will be completely new information communication environment with safety and reliability of supply chains being the 'pillar' of passenger and freight traffic securing sustainability of transport and logistics system.

A fundamentally new approach to security of transport and logistics systems and supply chains in digitization of economics and logistics will make it possible to reconsider the very nature of transport and logistics business: the digital platform will provide not a separate service but a completely new high-quality omni-product.

References

[1]. *Nikolaev D.T.et al.* A digital railway – innovative standards and their role (using the example of Great Britain) // International Journal of Open Information Technologies.- 2016.- V.4.- No.10. – Pp.55-61. 2307-8162 vol. 4, no.10, 2016.

[2]. *Kupriyanovsky V.P., Kurenkov P.V., Bubnova G.V.* Economics of innovations of a digitized railway. British experience // International Journal of Open Information Technologies.- 2017.- V.5.- No. 3.- Pp.79-99. 2307-8162, vol.5, no.3, 2017.

[3]. *Kupriyanovsky V.P., Sinyagov S.A., Dobrynin A.P. et al.* Retail business in digitized economics //

International Journal of Open Information Technologies.- 2016.- V.4.- No.7.- Pp.1-12. 2307-8162 vol. 4, no. 7, 2016.

[4]. *Kupriyanovsky V.P., Sinyagov S.A., Namiot D.T. et al.* Industry transformation in digitized economics - design and manufacturing // International Journal of Open Information Technologies.- 2017.- V.5. - No.1.- Pp.50-70. 2307-8162, vol.5, no.1, 2017.

[5]. OAGi/NIST Workshop on Open Cloud Architecture for Smart Manufacturing http://nvlpubs.nist.gov/nistpubs/ir/2016/NIST.IR.8124.pdf Retrieved: Dec, 2016.

[6]. *Bubnova G.V., Lyovin B.A.* Digitized logistics – an innovative mechanism of the development and efficient operation of transport and logistics systems and complexes //International Journal of Open Information Technologies.- 2017.- V.5.- No.3.- Pp.72-78. 2307-8162 vol. 5, no.3, 2017.

[7]. *Bubnova G.V.* Digital transformation of logistics (logistics in Industry 4.0) // Proceedings of the International scientific-practical conference "Logistics: current development trends", St.Petersburg, April 6-7, 2017. St.Petersburg, **Admiral Makarov State University of Maritime and Inland Shipping, 2017. P.55-59.**

[8]. *Smith, J. Walker.* "The Uber-All Economy of the Future." The Independent Review 20.3 (2016): 383.

[9]. *Lu Y., Morris K. C., Frechette S.* Current Standards Landscape for Smart Manufacturing Systems. – 2016.

[10]. *Bubnova G.V.* Mesologistics as an instrument of building international production systems // Railway economics – 2015. – No. 4. Pp.13-21.

[11]. *Bubnova G.V., Kurenkov P.V., Kotlyarenko A.A., Sechkaryov A.A.* Competition between Eurasian east-west routes (Northern Sea Route, Trans-Siberian Mainline, TPACEKA, etc.) // Competitiveness in a global world: economics, science, technology.- 2016.- No. 8 (part 3). Pp. 37-41.

[12]. *Bubnova G.V.* A new paradigm of managing economic security of transport and logistics systems. // Collection of scientific works of the International scientific-practical conference "Transport systems: development trends", September 27, 2016. Moscow: MIIT, 2016.- Pp.522-526.

[13]. *Wang, Mingfeng, et al.* "The Making of a Sustainable Wireless City? Mapping PublicWi-FiAccessinShanghai." Sustainability 8.2 (2016): 111.

[14]. *Kartashev A.V., Nekrasov A.G., Ataev K.I.* Management of the life-cycle of sophisticated knowledge-intensive products in the integrated supply chains. A monograph.- M.: PrintUp, 2016.- 324 p.

[15]. *Drozhzhinov V.I., Kupriyanovsky B.P., Namiot D.T., Sinyagov S.A., Kharitonov A.A.* Smart cities: models, instruments, rankings and standards. //International Journal of Open Information Technologies. – 2017.- V.5.- No.3.- Pp.19-47. 2307-8162. Vol. 5, no.3, 2017.