

## Telecommunication traffic: global disparities and international flows

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**Abstract.** New information and communication technologies (ICTs) have shrunk geographical space and time more than ever. But do people fully use the opportunities provided by the newest ICTs? How intensively do they communicate with each other on the international level? And what are the global disparities in the level of telecommunicativeness and international communicative openness? To answer these questions a study of global telecommunication traffic and the specificity of its spatial organisation has been undertaken based on the official statistics on different types of ICT traffic (postal service, fixed telephone, mobile phone and the Internet) over the last two decades. Indicators in the sphere of telecommunicativeness and international communicative openness are presented. This study expands the understanding of international integration and globalisation processes in their communication aspects.

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## 1. Introduction

There is a widespread idea, that today the world is globalised and integrated as never before. However, globalisation (as well as informatisation) arose in the 19<sup>th</sup> – beginning of the 20<sup>th</sup> centuries, in the period of the first wave of humanitarian globalisation (1846-1913) or the ‘golden age’ of international economy (1870-1913). At that time the world economy was hardly less integrated than today, and the globalisation process was developing with an even higher pace in 1870-1913 than during the last 40 years (Sintserov, 2000, 2004). The key role in its development was played by the ‘the Victorian Internet’ – the telegraph – an innovation in the ICT sphere, which opened the epoch of direct communication ‘at the speed of thought’ and started ‘dematerialisation of long-distance information flows’ (Standage, 1998; Wenzlhuemer, 2012). Later, after the period of global disintegration (1914-1945) the second wave of world integration began. And, since the 1980s, under the influence of scientific-technical and information revolutions, a stage of economic globalisation has begun as the highest stage of internationalisation, the key component of which is the informatisation of society.

Understanding the spatial structure of telecommunication flows and their relationships to the socio-economic spatial structure becomes more and more critical in the information economy (Guldmann, 2004). New information and communication technologies (ICTs) enable information – a key resource of the modern world – to overcome easily any physical barriers and state boundaries. ICTs form the global information space, where from almost every place on the Earth it is possible to communicate with almost any other place. But despite all the evident technological achievements do people fully use opportunities provided by the ICTs? Are there any differences between countries in the level of telecommunicativeness and international communicative openness?

To answer these questions a study of the global information traffic flows has been undertaken. A traffic flow was estimated by the volume of information carried over an ICT network per unit time. In the framework of the research traffic flows of three ICT types have been considered: the newest (Internet traffic), the oldest (postal service traf-

fic) and one combining new and old technologies (telephone traffic). Based on analysis of the official statistics on ICT traffic received from international organisations (International Telecommunications Union, Universal Postal Union) and research agencies (Telegeography Research, Cisco) over the period of the last two decades, the following results have been obtained.

## 2. ‘Communicativeness’ level

An average person in the world makes 1,072 minutes of telephone calls a year and sends 52 postal letters. But countries differ greatly: from almost 9,000 minutes of telephone calls per capita in Monaco and the Cayman Islands to just 1 minute in Vietnam, Niger and Bangladesh. The highest level of ‘telephone communicativeness’ (more than 2,000 minutes per capita a year) is demonstrated by the majority of developed countries and also by Mexico, Russia, Belarus and small oil-exporting countries. Countries with a high telephone communicativeness (1,000-2,000 minutes per capita a year) are China, Turkey, Saudi Arabia, the United Arab Emirates and the majority of Latin American and Central-Eastern European states. A low telephone communicativeness (300-1,000 minutes per capita a year) is typical for the less developed counties of Latin America and Central-Eastern Europe, some states of Central Asia and Northern Africa – Kazakhstan, Morocco, etc. And the lowest level of telephone communicativeness (less than 300 minutes per capita a year) is demonstrated by the least developed countries of the world: Pakistan (253), Ethiopia (4), etc.

The spatial contrasts in postal service usage are from 6,600 letters per capita in the Vatican and over 400-500 letters in the USA, Canada, small nations of Western Europe, Japan, Australia and New Zealand to less than 1 letter per capita in the less developed countries of Africa, the Middle East, Asia-Pacific and Latin America (Fig. 1).

The analysis of the global telephone traffic (fixed and mobile), covering 158 countries (International Telecommunication Union, 2011), and global letter-post traffic, covering 154 countries (Universal Postal Union, 2011), proved that the average level

of a country's 'communicativeness' is largely determined by the level of its socio-economic development (1). The higher a country's development level is, the more actively telecommunications are used. (Fig. 1). In general, in highly developed countries with a GDP per capita of 20,000–35,000 USD an individual makes 3,340 minutes of telephone calls a year and sends 172 postal letters a year. In countries with a GDP per capita of 10,000–20,000 USD

a person talks half as much (1 500 minutes a year) and sends almost 3 times fewer postal letters (62.5). In states with a GDP per capita of 5,000–10,000 USD a person talks 3 times less by telephone (1,040 minutes) and sends 5 times fewer letters (35 letters). And in countries with a GDP per capita of less than 5,000 USD an average person talks 6 times less by a phone (570 minutes) and sends 14 times fewer postal letters (12 letters a year).

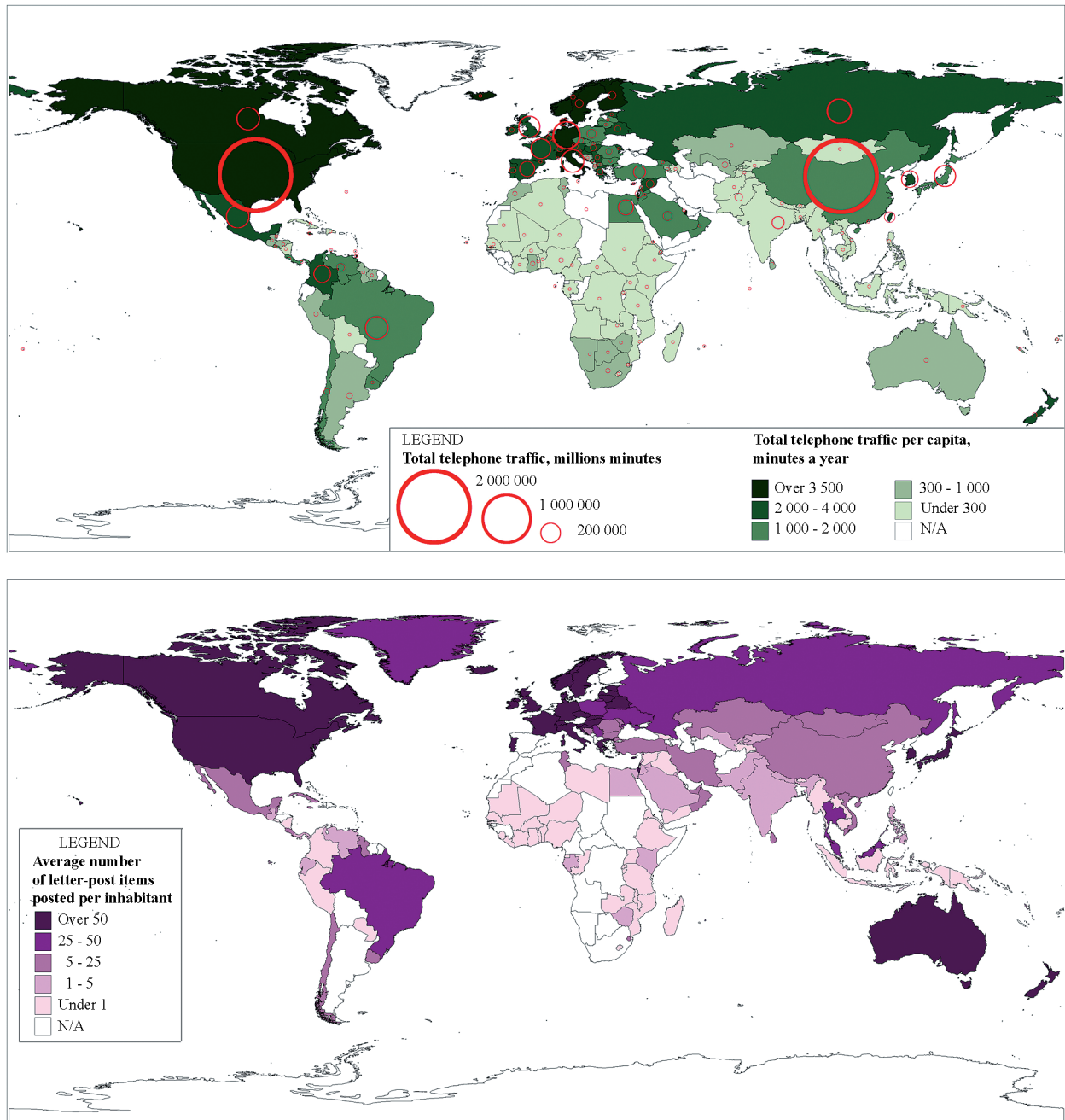


Fig. 1. Telephone and postal communicativeness by country, 2007/2011

Source: Own elaboration on the basis of International Telecommunications Union, 2011; Universal Postal Union, 2011

Thus, we can see that the global gap in telecommunications usage shrinks when going from traditional to the newest kinds of telecommunications. This is another proof for the fact that the newer and more universal ICTs can compensate for the lack of diffusion of telecommunications previously and make the global information space more uniform (Nagirnaya, 2013).

### 3. International telephone traffic flows' spatial organisation

In the framework of the research the following indicators have been defined as important determinants of the information and communicative organisation of the global socio-economic space: volumes of different ICTs' international outgoing traffic (total and per capita), geography of traffic routes, and a balance between domestic and international traffic.

By volumes of international outgoing telephone traffic the leaders are the USA (70 billion minutes), Japan (43 billion minutes) and Germany (15 billion minutes). Also large generators of telephone traf-

fic (1-10 billion minutes per year) are the Southern European states, small highly developed European countries, and also Canada, Mexico, Russia, India, China, Saudi Arabia, the United Arab Emirates, Israel, the Republic of Korea, Hong Kong, Taiwan, Singapore, the Philippines, Malaysia and Australia.

The analysis of the outgoing international telephone traffic per capita gives another picture. An average person on the Earth makes 39 minutes of international telephone calls a year. The disparities are from 3,370 minutes in San-Marino to 1 minute in Cameroon and Vietnam (Fig. 2). The largest volumes of outgoing international telephone traffic per capita (more than 250 minutes a year) are registered in small countries and microstates which are actively involved in the global economy – Monaco, Ireland, Switzerland, Hong Kong (China), Singapore, Qatar, the Bermuda Islands, etc. Small volumes of outgoing international telephone traffic per capita (less than 40 minutes a year) are typical for the less developed and/or most populated countries of Central and Eastern Europe (Russia, Romania, Poland and others), Central and Latin America (Argentina, Brazil, Mexico, Costa Rica, Panama and others), Asia (China, India, Laos, etc.) and African countries.

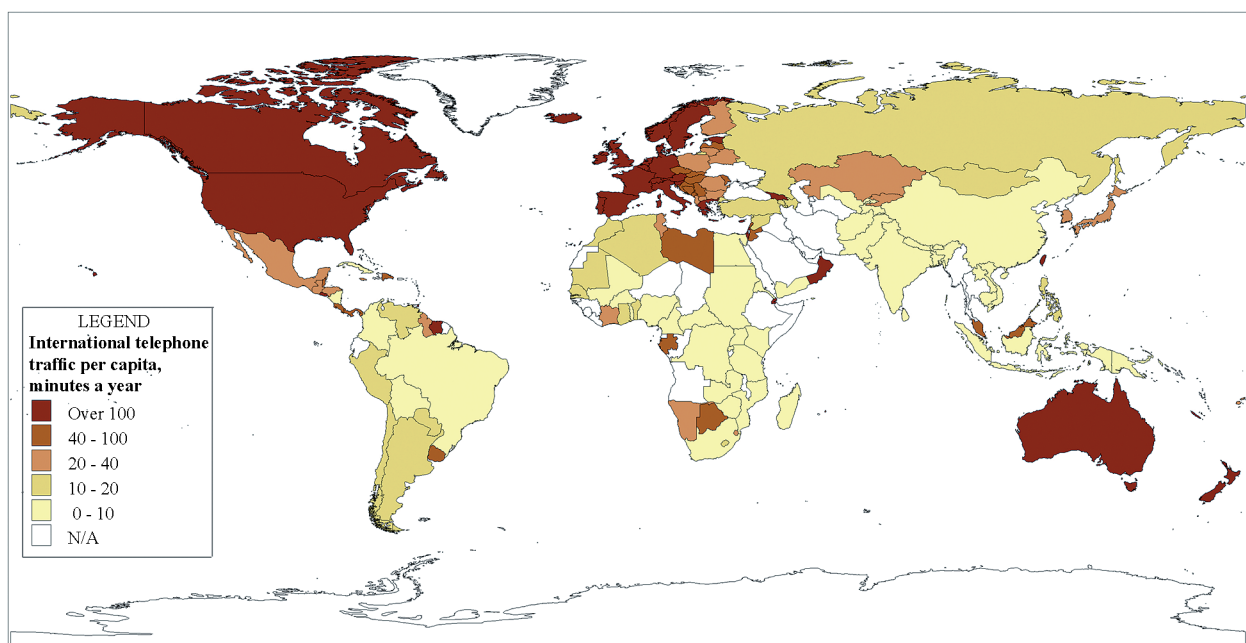
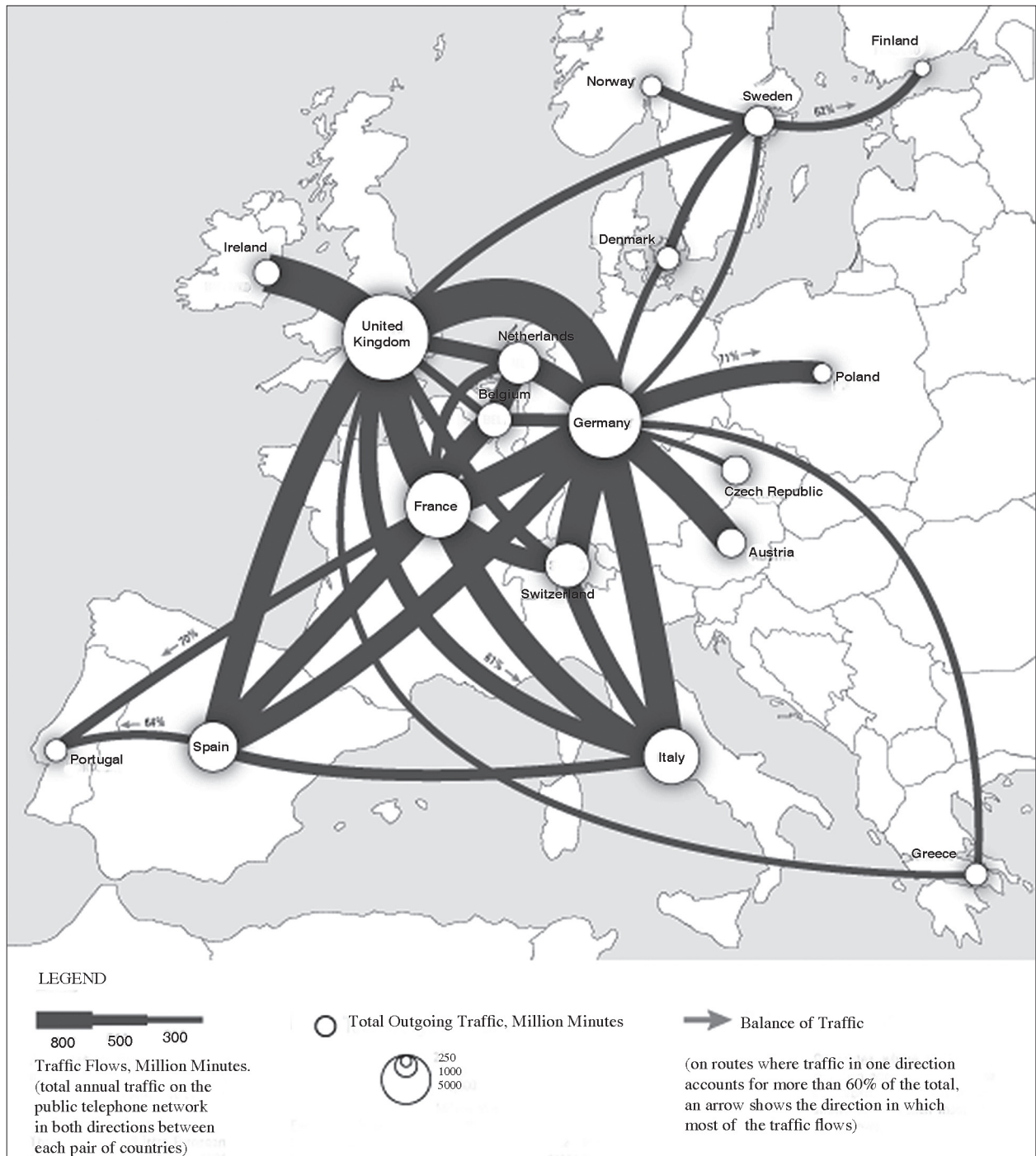


Fig. 2. Outgoing International Telephone Traffic Per Capita, 2007

Source: Own elaboration on the basis of International Telecommunications Union, 2011

By the example of Western Europe, the Asia-Pacific region, the Middle East and South Asia, the specificities of the spatial organization of telephone traffic flows within the world's macroregions have been analysed. Western Europe differs from the other world regions by the relatively even distribution of the telephone traffic flows between countries. The reason is the high level of regional integration. The

main nodes of European telephone communications are Germany, the United Kingdom (UK), France, Italy, and also Spain, Switzerland, the Netherlands and Sweden (Fig. 3). The largest telephone traffic routes link the main economic centres (European G8 states) and also countries united by a deep historical relationship and language (UK and Ireland, Germany and Austria, etc.).



**Fig. 3.** Geography of the European regional telephone traffic, 2005

Source: Telegeography Research

In the Asia-Pacific region the main producers of international telephone traffic are Hong Kong, Taiwan, Australia, Singapore, Japan and China (Fig. 4). The biggest traffic flows, comparable with the largest European flows, connect mainland China with its territories Hong Kong and Taiwan. Large traffic flows link Japan with China, the Philippines and the Republic of Korea, and also Singapore with Malaysia, Australia with New Zealand. International communication patterns of different countries (2) demonstrate different types of their communicative specialisation. For example, in such countries and

territories as China, Hong Kong, Taiwan and New Zealand, the main (and in some cases the most) part of international telephone communications are made within the regional borders and, moreover, with the neighbouring countries. On the other hand, there are such countries like Singapore, the Republic of Korea and Japan, where, as can easily be seen in Fig. 4, the major part of their telephone communications go beyond the limits of the region. Thus, there are different types of international communicativeness – of regional and of global scope.

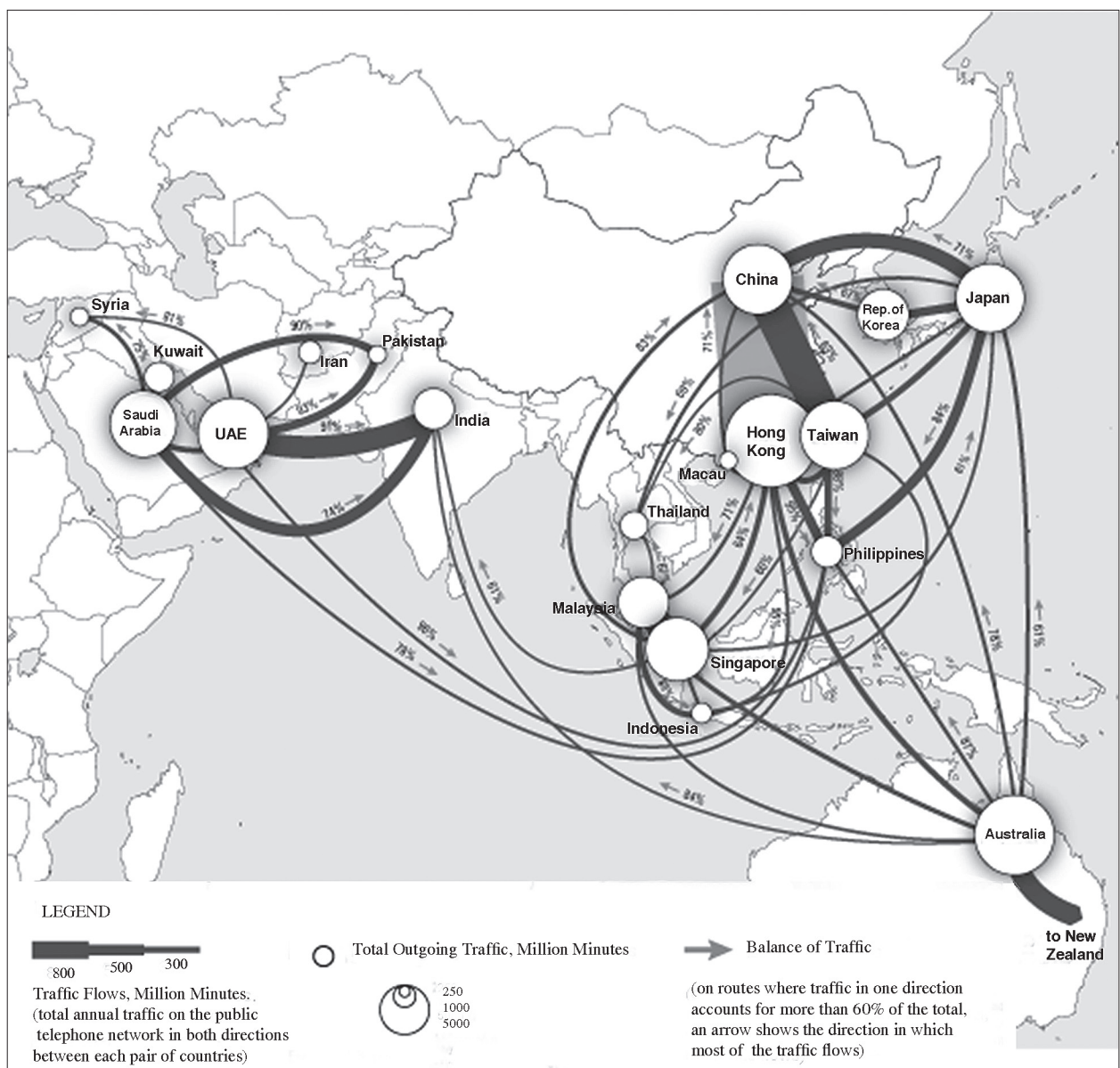


Fig. 4. Regional telephone traffic routes of Asia-Pacific, South Asia and Middle East, 2005

Source: Telegeography Research

In the Middle East and South Asia the main producers of international telephone traffic are the United Arab Emirates and Saudi Arabia, and also India. The largest traffic routes connect these countries between each other. Apparently, the communicative fields of Saudi Arabia and the United Arab Emirates go beyond the regional borders (Fig. 4).

#### 4. International communicative openness

International traffic flow analysis could help to assess the level of a country's integratedness in the global economy and the world socio-economic space in terms of information interactions. As an important indicator of international communicative openness, the share of international traffic in the total traffic volume has been defined and studied by the example of telephone and postal traffic flows (Fig. 5).

It has been found that the lowest level of 'telephone openness' is typical for large developing countries – China and Brazil – where the share of international traffic is just 0.2%. The comparison between China and Taiwan revealed interesting contrasts: these territories have comparable total volumes of outgoing international traffic (5-6 billion minutes per year); however, if in China its share in the total traffic is only 0.2%, then in Taiwan it is more than 10%, and in Hong Kong it reaches 32%. In Russia 7% of telephone traffic is international. It is caused by historical relations with the former USSR states and with a high share of migrants from these countries in the population of Russia – 8.5% (in Brazil and China immigrants' share in the population is less than 0.3%).

Telephone openness reaches its highest levels in small and micro economies, many of which are islands. For example, in Saint-Vincent and the Grenadines 76% of telephone traffic is international, in the Dominican Republic and Djibouti, 52-53%. Among the microstates with high international traffic special attention should be paid to 'tax havens' – offshore with hypertrophied international specialisation. Examples of tax havens, besides Saint-Vincent and the Grenadines, are the Bermuda Islands, where the share of international traffic is 49%, Belize, 25%, etc. High international openness is often usual for small countries with a spe-

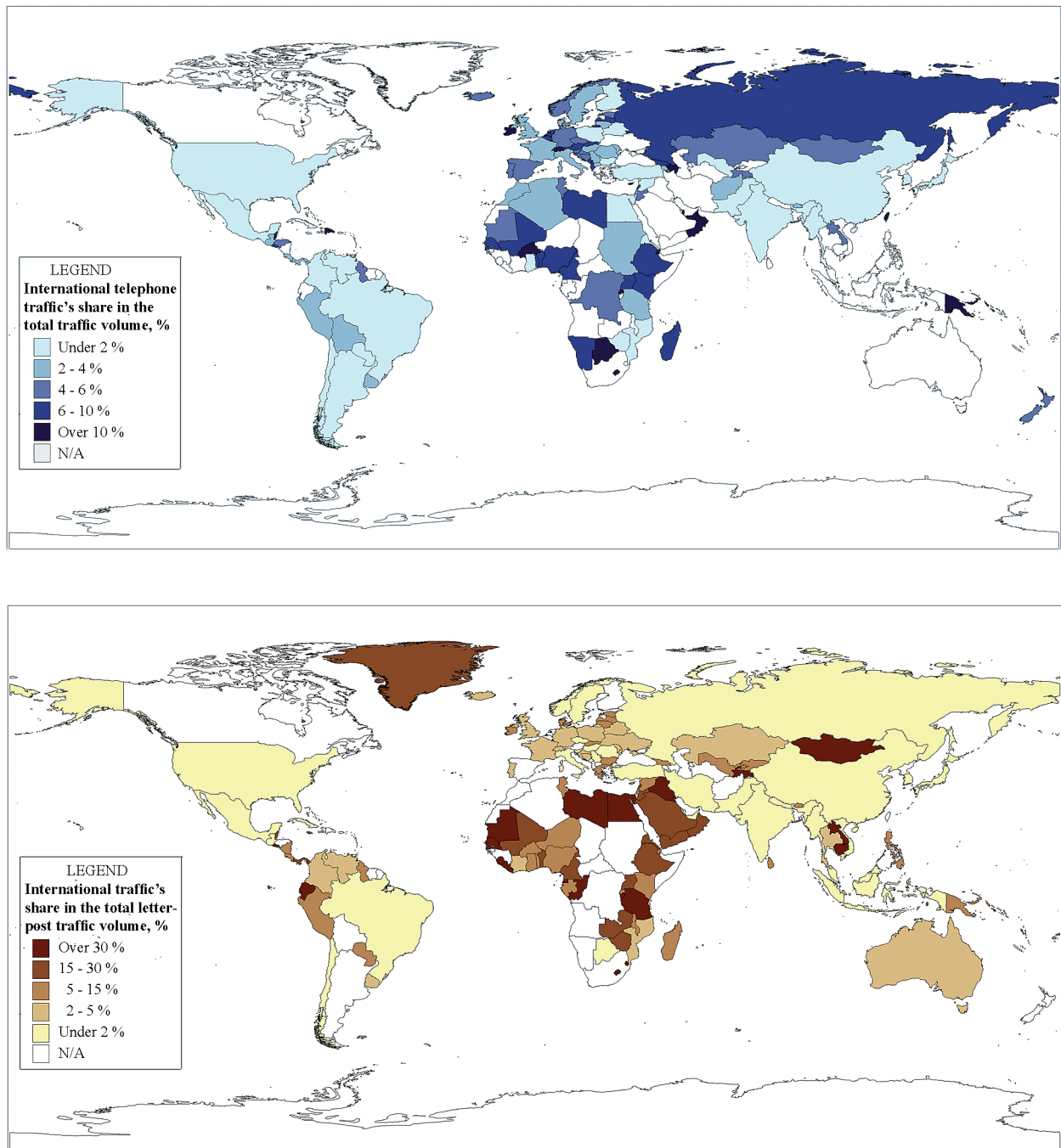
cific geographic location (Lesotho, 28%; Rwanda, 39%; etc.), and also for a number of less developed countries with a large territory and poor infrastructure, and, as a result, with small volumes of domestic traffic (Mauritania, Ethiopia, Mali, Madagascar, etc.). Among the less developed countries the lowest share of international traffic is typical for closed economies, such as Myanmar (0.3%).

According to the conducted statistical analysis, in the modern world only 4% of the global telephone traffic is international, so 96% of traffic is domestic. It is an important feature of the organisation of global information, social and economic space. However, the telephone traffic dynamics over the first decade of the 21<sup>st</sup> century shows that the international traffic volume grows at priority rates, and its share in total telephone traffic is increasing in a majority of countries.

The structure of the world's traditional letter post is similar: only 1.3% of it crosses international borders. The volume of international mail is decreasing at the global level: from 8.7 billion letters in 1980 to 8.5 billion in 1990, 7.5 billion in 2000 and 4.7 billion letters in 2011 (Universal Postal Union, 2012). The regions resisting this trend are Latin America and the Caribbean and Asia-Pacific. The share of international letters in the total number of letters has reduced more than two-fold over the period of 1980-2008: from 2.8% to 1.3%.

The highest level of international postal communicative openness (over 50% of total letter-post traffic) is demonstrated by microstates (the Vatican, Monaco, Lichtenstein, Gibraltar), territories with an isolated geographic location (Lesotho, the Maldives, Greenland, etc.), and also for a large number of less developed countries with very small volumes of total postal traffic and a low level of postal communicativeness (Liberia, Sierra Leone, Mauritania, Iraq, Cambodia, etc.). The low level of international postal openness is usual for large countries (USA, Russia, China, Japan, etc.).

Regarding the comparison between telephone and postal openness, let us say that generally the global disparities in the level of international communicative openness are similar for different kinds of telecommunications. However, there are some exclusions. Some countries have a high level of telephone openness, but a low level of postal openness (Russia, Botswana); other countries have a low lev-



**Fig. 5.** International communicative openness of countries, 2007/2011

*Source:* Own elaboration on the basis of International Telecommunications Union, 2011; Universal Postal Union, 2012

el of telephone openness, but a high level of postal openness (Egypt, Mongolia, Tanzania, etc.).

Thus, in general the international communicative openness of a country is determined by the economic and demographic size of a country, the

level of its socio-economic development and the type of its political regime, and also by the level of its involvement in the international division of labour and in international migration and investment processes (Table 1).



**Table 1.** Different determinants of international openness

	A		B	C	D
	a	b			
USA	1.2%	1.3%	8%	13%	10
Japan	1.6%	0.3%	15%	1.6%	1.6
Germany, UK, France, Italy	3-5%	1.6-2.5%	15-30%	4-12%	7-18
European small countries*	5-15%	2-23%	30-70%	7-37%	24-226
European microstates**	22-38%	58-63%	160-180%	35-77%	N/A
World	4%	1.3%	25%	9%	2.6

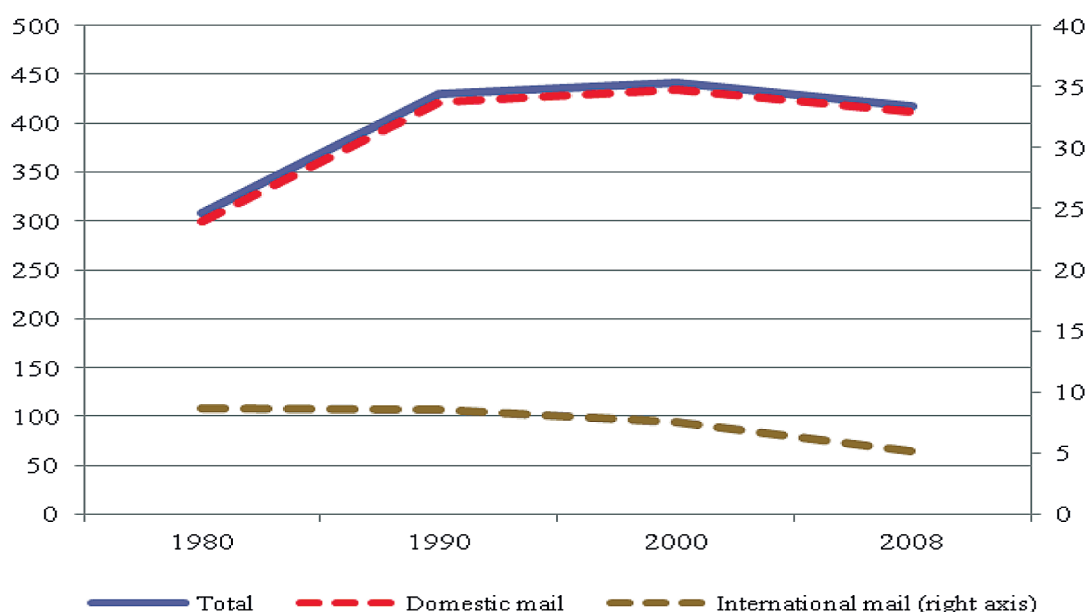
Explanation: \*Sweden, Norway, Switzerland, Ireland, Belgium, Netherlands, Luxembourg; \*\* Andorra, Monaco, Lichtenstein; A – International traffic's share in the total traffic, %; a – telephone traffic, 2007; b – letter-post traffic, 2011; B – ratio of goods exported to GDP, %, 2007; C – Immigrants share in population, %, 2006; D – cumulative foreign direct investments per capita, thousands USD, 2009

Source: Own elaboration on the basis of International Telecommunications Union; Universal Postal Union; CIA World Factbooks; World Bank; United Nations; International Monetary Fund

## 5. Specifics of the global Internet traffic organisation

Other trends have been discovered in the Internet traffic organisation. About 46% of global Internet traffic is international (Fig. 6) and its share is growing rapidly (3). Moreover, the structure of the international Internet traffic is changing very fast. The

share of regional traffic – traffic flowing within the borders of a macroregion – is constantly growing, and today it makes up more than three quarters of total international traffic. For example, 75% of European international Internet traffic flows within the regional borders (it is the highest value among all the world regions); in Asia and Latin America – about 30%; North America – 15%; in Africa – near 1% (Telegeography Research, 2011).



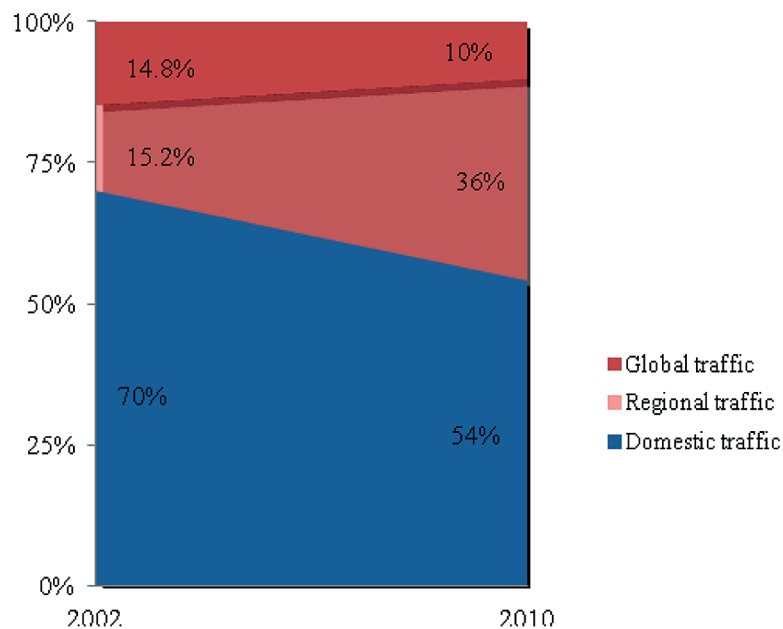
**Fig. 6.** Number of letter-post sent, thousands of millions, 1980-2010

Source: Own elaboration on the basis of Global Postal Union

The share of the global (i.e. interregional) Internet traffic has decreased more than two-fold over the last 10 years. While at the turn of the 20<sup>th</sup> and 21<sup>st</sup> centuries half of international traffic circulated between different macroregions of the world, today it is less than a quarter. It was caused by a high concentration of the global Internet infrastructure: initially all the technical capacities for storage and creation of web sites were situated in the USA. However, it generated the obvious threat to the information security of other countries and regions. In 2001 the European Union published a Report on the 'Echelon' system of information interception, which belongs to the USA (90%) and also the UK and Australia. After the publication of the Report, European and other countries started taking measures to ensure their information security, and in particular to direct their Internet traffic routes in such a way as to avoid the USA. As a result, over one decade a great decentralisation of the global Internet infrastructure happened. In all the regions

except Latin America the share of international Internet bandwidth connected to the USA has declined significantly (4).

Nevertheless, the USA remains the hugest intercontinental Internet hub today. As at the end of the last century, the largest interregional traffic flow connects North America and Europe (Fig. 7). However, the share of this route is decreasing rapidly. If 10 years ago it composed almost three quarters of all the interregional Internet bandwidth, then now it is already only 39%. It is caused by the rapid growth of other traffic routes: North America – Latin America (22% of total interregional Internet bandwidth); Europe – Asia-Pacific (10.7%); and North America – Asia-Pacific (22%). The largest interstate Internet traffic routes link the USA with the UK (almost 1000 Gbit/s), France (about 700 Gbit/s), Canada (near 800 Gbit/s) and Japan (about 500 Gbit/s). Large Internet traffic routes are situated in Western Europe (about 700 Gbit/s each) and connect the UK, France, Germany and also the Netherlands (Fig. 8).



**Fig. 7.** Shifts in the global Internet traffic structure over the first decade of the 21<sup>st</sup> century

*Source:* Own elaboration on the basis of Cisco, 2012; Telegeography Research, 2012; the author's calculations

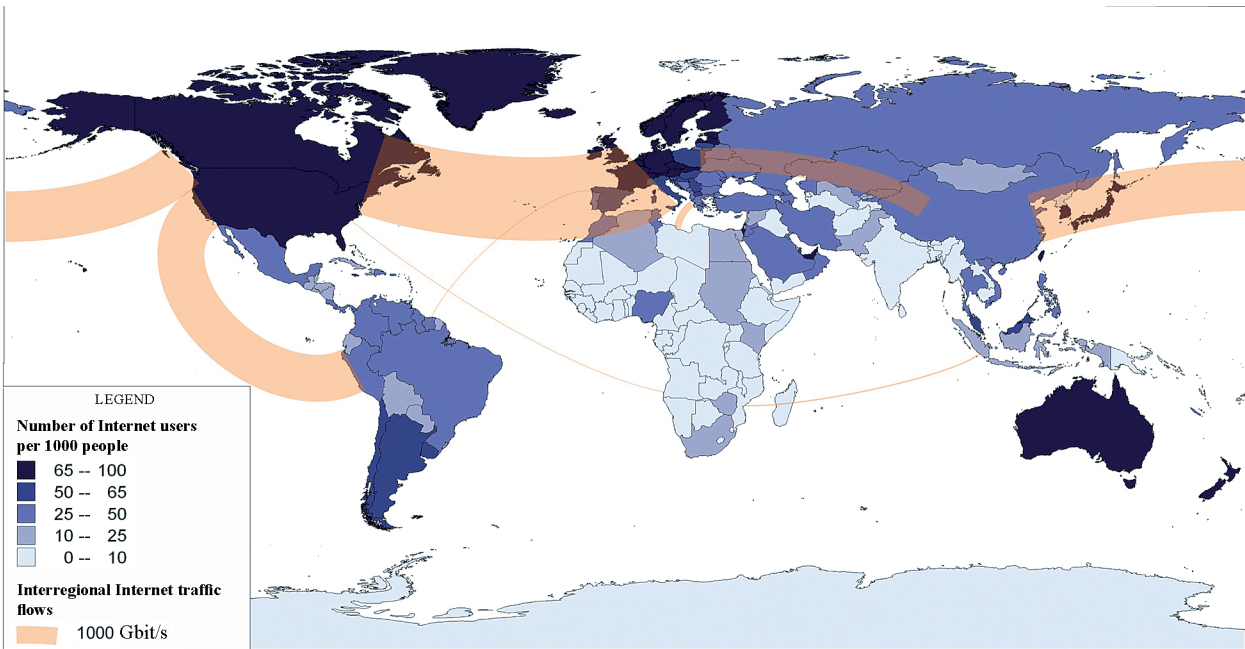
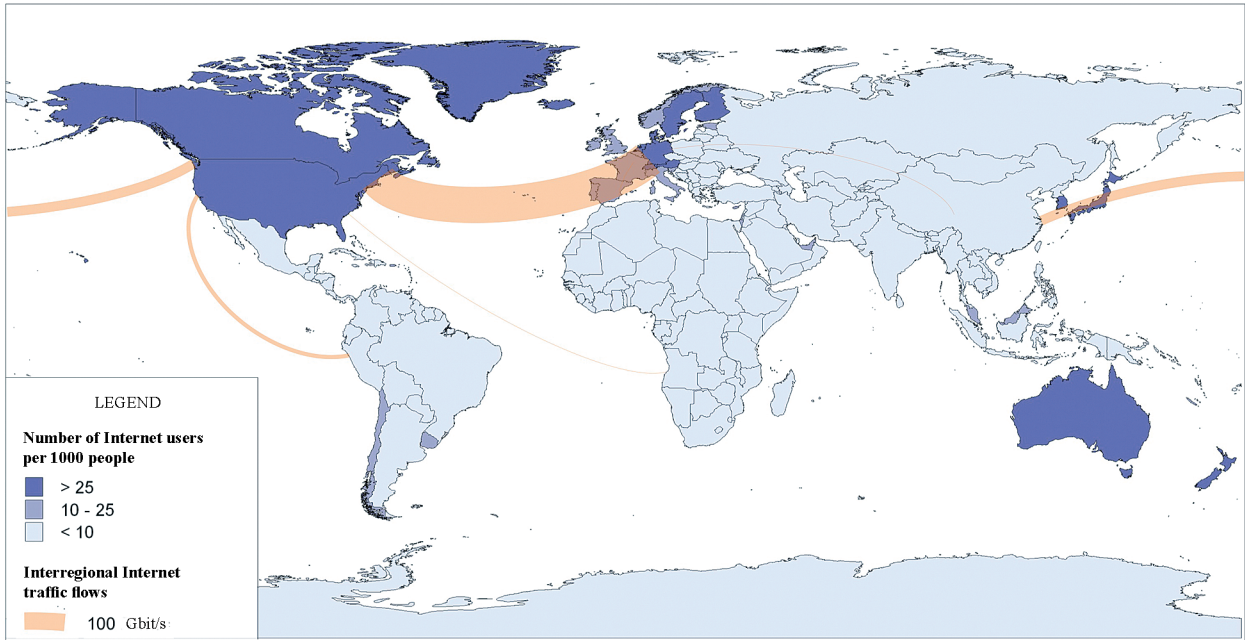
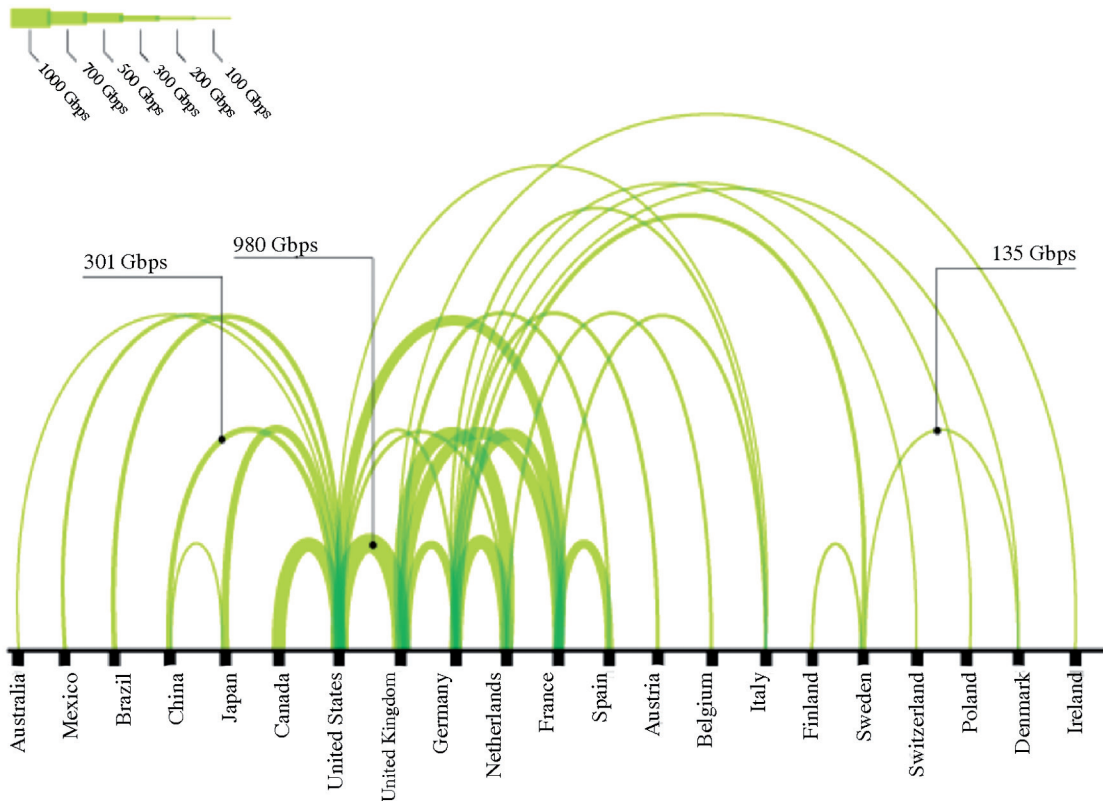


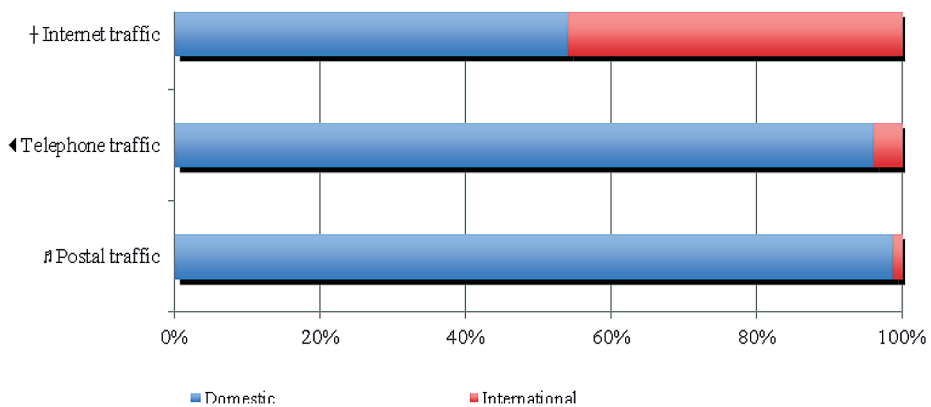
Fig. 8. The global Internet diffusion and the largest interregional Internet traffic routes, 2000 and 2011

Source: Own elaboration on the basis of International Telecommunications Union; Telegeography Research; <http://www.InternetWorldStats.com>



**Fig. 9.** The largest interstate Internet traffic routes, 2009

**Source:** Telegeography Research



**Fig. 10.** The share of international traffic in the total global traffic volume by different types of ICTs by the end of the 1<sup>st</sup> decade of the 21<sup>st</sup> century

**Source:** Own elaboration on the basis of Telegeography Research; Cisco; International Telecommunications Union; Global Postal Union

## 6. Conclusions

According to the conducted statistical analysis, each next generation of ICT innovations provides more and more communicativeness and international communicative openness. While in the total volume of the 'paper' mail in the world only 1% crosses international borders, in contrast international traffic composes 4% of the world telephone traffic and 46% of the global Internet traffic. The last point is largely caused by the multicomponent structure of Internet traffic, special features of the organisation of the World Wide Web and the territorial gap between producers and users of Internet content (5). Nevertheless it reflects clearly the globalisation tendency of the modern age.

The obvious trend of the last decades is a rise in the share of international traffic in communicative interactions conducted by the newest telecommunications, and a decline in the share of international traffic in traditional ICT traffic flows. For example, the share of international letters in the total volume of letter-post has reduced more than two-fold over the last 30 years. And the Internet's international traffic share is growing rapidly. Thus, it could be concluded that when moving from traditional to the newest telecommunications, the spatial scale of communication grows from mostly local to international. The international traffic is constantly migrating from traditional to the newest telecommunications.

Herewith there are also significant global disparities in telecommunicativeness and international communicative openness of countries (Fig. 9, 10). And they are caused by a number of factors: socio-economic, administrative and geographic. Telecommunicativeness is mainly determined by the level of socio-economic development. International communicative openness of a country results from its size, the level of socio-economic development and the type of political regime, and also by the level of its integratedness in the global economy and in the international investment and migration processes. The proposed indicators in the sphere of telecommunicativeness and international communicative openness help to assess the level of a country's integratedness in the global economy and the world socio-economic space in terms of information interactions.

## Notes

- (1) Due to a lack of available statistics on the Internet traffic per capita by country, the Internet usage has not been considered in this part of the study.
- (2) A country's international communication pattern could be described by a comparison of the total outgoing international telephone traffic volume and the country's role in the inter-regional traffic flows.
- (3) In the global Internet traffic structure video dominates (more than 50%), and according to Cisco forecast, its share will reach 90% in 2014.
- (4) In Asia and Europe the share of international Internet bandwidth connected to the USA decreased from 90% to 40% and from 25% to 15%, respectively due to the increase in the regional traffic share. In Africa the connectivity to the USA has been substituted by the connectivity to Europe. As a result, the share of Africa's international Internet bandwidth connected to the USA has declined from 70% to less than 3%. Latin America due to its geographical location until now does not have many opportunities for the development of international Internet bandwidth with any other developed region except North America, which still accounts for 80-90% of the region's international Internet bandwidth.
- (5) Today the majority of the Internet users are from developing countries (more than 60%). However, more than 62% of all the web sites (country code Top-Level Domain) belong to the USA, and more than 87% of web sites to developed countries as a whole. Thus, despite the rapid shrinkage of the quantitative gaps in the Internet penetration between developed and developing countries, the qualitative gap still remains. There is still the developing countries' dominance in the sphere of Internet content creation.

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