

GCPMED 2018
**International Scientific Conference "Global Challenges and
Prospects of the Modern Economic Development"**

**EVALUATION METHOD OF EMBEDDEDNESS OF INDUSTRIAL
ENTERPRISES IN THE GLOBAL REPRODUCTION CHAINS**

A.V. Streltsov (a), G.I. Yakovlev (b), J.D. Ermakova (c)*

*Corresponding author

(a) Samara State University of Economics, 443090, Soviet Army St., 141. Samara, Russia, E-mail:
dmms7@rambler.ru

(b) Samara State University of Economics, 443090, Soviet Army St., 141. Samara, Russia,
E-mail: dmms7@rambler.ru; tel: +79179452608

(c) Samara State University of Economics, 443090, Soviet Army St., 141. Samara, Russia,
E-mail: ermjul@yandex.ru; tel: +79270069443

Abstract

Nowadays, global economic relationships between different countries are changing rapidly. New centres of economic power among the former developing countries, expansion of additive technologies are forming the new spatial structure of international economics. In addition, the growth of protectionism, trade and economic confrontation, promoting countries economic interests by political methods, has become a widespread phenomenon. At the same time, the participation of national enterprises in global value chains considers as more important, enabling countries to optimize the structure of payment balance, in order to generate hard currency revenues and to ensure the technical development of their enterprises. It is important to determine the success factors of national enterprises, participating in world economic relations. The purpose of this study is: a) to analyse the results of the national economic complex development and regional characteristics as conditions, providing the entry of enterprises in the global reproduction chain; b) to study the factors, influencing the rate of enterprise success to enter the global value chains: the production dynamics, shipment, export, fixed assets renewal, etc.; c) to develop recommendations, enhancing enterprises fortunes in foreign economic activity. The overall results of production output, especially for "machine-building" activities, shipments and exports, including the assessment of the inflation on considered indicators, has been analysed in detail for 12 years in a row. The results have shown big problems with the renewal and replacement of existing fixed assets, which hamper their technical development, in matters of ensuring the participation of Russian enterprises in the global value chains.

© 2019 Published by Future Academy www.FutureAcademy.org.UK

Keywords: World trade, value chains, cooperation, value added, reshoring, capital maintenance.



1. Introduction

Currently, there is a clear insufficiency of the existing methodological support and practical application of traditional economic laws for a satisfactory explanation of the on-going changes in the international economic relations. It became necessary to substantiate the new principles and directions of international cooperative production activities associated with the phenomenon of the "Fourth industrial revolution" and the natural emergence of new centres of economic power on the world stage.

It is clear that the age-old dichotomy of liberal and directive ideology is not limited to the victory of one over the other, but there are a number of alternatives based on different types of markets, economic models, social and cultural traditions, the special characteristics of the policy carrying out by the ruling classes of some countries and the implemented level of technologies "Industry 4.0". It is no coincidence that today as the dominant agenda in the world media reflects the growth of nationalism, protectionism, the transfer of previously withdrawn from the West work placement at industrial enterprises back to the developed countries (reshoring), as well as the strengthening of global wealth inequality and the transformation of the world's reproductive value chains.

2. Problem Statement

The main focus of the study is to analyse the problems to involve Russian industrial enterprises in the global reproductive chain, the existing potential, limiting and stimulating factors. It is necessary to analyse the existing trends and the scale of participation for industrial enterprises in the global reproductive chains in order to assess, on the research basis the reproductive characteristics of the production apparatus at industrial enterprises, the opportunities and prospects for increasing the role of domestic enterprises in international integration processes. At the same time, this analysis should reveal not only the current state of affairs, but also to explore trends in the change of this process over time, to outline the main directions of its improvement on the basis of the proposed method of the state and prospects analysis to increase the supply of export products.

The importance of the research in this area is confirmed by the scientific conclusions set out in the works of different scholars (Varnavskiy, 2018; Sapir, 2016; Reznikov, 2014; Kashbraziev, 2015; Clarysse, Wright, Bruneel, & Mahajan, 2016; Bremmer, 2014; Strange & Magnani, 2018; Laplume, Petersen, & Pearce, 2016). Modern researchers have focused on such problems as structural changes in cross-border production chains, value creation and multinational production, which required appropriate clarification of methodological and categorical apparatus. The importance of these issues was recognized by the United Nations Organization, which published the Guide to measuring Global production (2015).

2.1. Research objective

Contemporary world economy began to experience a slowdown in the processes of globalization, which can be particularly clearly seen in the dynamics of international trade, which grew by 35% from 1960 to 2008, and only 0.2% over the past five years, noted in the study *The New Globalization*, 2017. At the same time, if a number of experts put forward a hypothesis about the end of globalization under the influence of unprecedented growth of protectionism, rising labour costs in developing countries, reshoring and new industrialization of developing countries, Kondratyev says about the new model

according to forming new proportions in forces among the main players, the disintegration of the material component in the value chains, stimulated by technologies of “ industry 4.0”, the growth paths differentiation of developed economies and the increase of services share in international trade (Kondratyev, 2018). Modern companies need to find new drivers for growth, as their participation in the previous global value chains is cancelled due to the phenomena of decentralization and exclusivity of goods and services production processes (Los, Timmer, de Vries, & Gaaitzen, 2016).

It is important to find new segments for potential growth in the goods and services production that are potentially found primarily in developing countries, where production growth has begun to exceed similar ones in developed countries. Nowadays digital and additive technologies, robotics and high communication allow building enterprises of any scale as close as possible to consumers, minimizing the problems of cost savings due to the production scale.

3. Research Questions

An integral part of analysing the problems associated with the participation of domestic industrial enterprises in the global reproductive chains should be the trends study of industrial development as a whole, investment and reproductive aspects, which are understood as a movement study of fixed capital, a more detailed assessment of the characteristics, developing "machine-building economic activities". The latter is particularly important, since it is machines and equipment that occupy a large share of imports (55-60%), represent rather complex innovative and capacious products of manufacturing industries, and indirectly characterize the level of scientific and technical development of the country's economy. Also it should be considered that machinery and equipment make up a large part of the exports for industrialized countries, and in order to ensure international cooperation of domestic industrial enterprises on an equal basis, it is necessary to develop machinery and industries that produce products with high added value as it's noted by Zhang & Fang (Zhang & Gallagher, 2016) based on the materials of Chinese enterprises.

4. Purpose of the Study

Considering the current state and the development of globalization processes, the advent of new centres of economic power on the world stage, it is important to take into account:

- theoretical and methodological substantiation of purposeful activity, forming and developing productive and foreign economic potential of enterprises for successful participation in the world reproductive chains.
- substantiation of methodological approaches to assessing the contribution in economic growth both the results of enterprises' production base development and the conditions of the regional economic complex, the launch of large investment projects, increasing the volume of non-resource exports, providing both localization and import substitution for industrial products, and cooperation with firms from leading countries in the competitive products production.

5. Research Methods

Based on the principles, applying complex and comparative analysis, a wide range of aspects have been covered, dealing with the dynamics of different countries industrial development, the state of the

national Russian economy and its foreign trade complex; a systematic approach in determining the measures taken in solving the problem to increase the efficiency of domestic enterprises participation in the global value chains, assessing the state of their reproductive apparatus. The study is consistent with the methodology of Porter (1993) that the competitive advantage of enterprises in individual countries grows out of the whole system of its activities and success is determined not so much by the presence of production factors, but also by the degree of their productive use, especially in the manufacturing sectors.

Experimental base of the research: state statistics of foreign economic relations, industrial enterprises turnover data and international organizations research. Stages of the research: theoretical substantiation of the necessity to improve the mechanism, involving in the world economic relations to problem-solving process in industrial development, monitoring the competencies of competitors and assessing the current state of their own potential, forming the conditions for international competitiveness among enterprises, that were made from 2007-2017 (Yakovlev, 2007).

As a (method) algorithm for analysing the participation of enterprises in the global reproductive chains, it seems appropriate to choose the following sequence of stages that are represented in Figure 01.



Figure 01. Methodological approach to study the embeddedness degree of industrial enterprises in the world reproductive chain

At the end of 2017, the GDP growth was only 1.5%, with its nominal volume at current prices of P92 trillion. P81.9 billion and in the near future more growth is not expected. This figure is much lower than the world economic average, considering that in 2018-2019 the International Monetary Fund (IMF) predicts an increase in the growth rate of the world economy to 3.9%, which reveals an even greater backlog of the domestic economy. The economic development of the Russian Federation continues to depend on the efficiency of its fuel and energy sector, primarily the oil and gas complex (FEC), whose product prices are subject to strong influence of unstable international environment.

The second stage of the analysis concerns the most important indicator of foreign economic activity of the Russian Federation- Export commodity composition of the Russian Federation that is represented in Table 01.

Table 01. Export commodity composition of the Russian Federation

	2009		2010		2014		2015		2016	
	min. US share	%	min. US share	%	min. US share	%	min. US share	%	min. US share	%
Export, total	103 093	100	397 068	100	497 359	100	343 512	100	285 674	100
Among them										
Food and agricultural raw materials (except textile)	1 623	1,6	8 755	2,2	19 982	3,8	16 215	4,7	17 070	6,0
Mineral product	55 488	53,8	271 888	68,5	350 266	70,4	219 167	63,8	169 167	59,2
Chemical industry products, rubber	7 392	7,2	24 528	6,2	29 246	5,9	25 405	7,4	20 814	7,3
Leather raw materials, furs and their products	270	0,3	305	0,1	417	0,1	311	0,1	263	0,1
Wood and pulp and paper products	4 460	4,3	9 574	2,4	11 583	2,3	9 845	2,9	9 806	3,4
Textiles, textiles and footwear	817	0,8	764	0,2	1 101	0,2	873	0,3	912	0,3
Metals, precious stones and their products	22 370	21,7	50 343	12,7	52 275	10,5	40 760	11,9	37 706	13,2
Machinery, equipment and vehicles	9 071	8,8	21 257	5,4	26 495	5,3	25 422	7,4	24 432	8,6
Other goods	1 603	1,5	n/d	n/d	6 996	1,4	5 513	1,5	5 507	1,9

Describing the presented data, it can be noted that for 16 years the volume of exports in Russia increased 2.77 times to \$285674 million. At the same time, it is noteworthy that in recent years there has been a decrease in exports for almost all commodity groups, most strongly for the "mineral products" group. Taken into consideration its importance in exports, this decline in 2015 and 2016 played a decisive role in the overall negative growth. For example, if we add the volume of decline in exports for the "mineral products" group to its total value for the Russian Federation, we get that the possible value of exports, while maintaining the values for the "mineral products" group at the level of 2014, in 2015 it could reach \$474.6 billion (350266 – 219167 – 343512), in 2016. - \$466.8 billion. These values are 95.4% and 93.8% of the 2014 level, respectively.

The commodity composition of exports allows us to draw preliminary conclusions about the place of Russian industrial enterprises in international trade. By 2016, about 80% of the commodity

composition of exports is commodity groups that sell certain resources, and about 60% - mineral products. Machinery, equipment and vehicles exported by Russian enterprises in the commodity composition occupy only 8.6%, while in the exports of industrialized countries they occupy a leading place.

It should also be noted that these ratios have remained almost unchanged for 16 years. Fewer metals, more food and agricultural raw materials have been exported. But in General, these ratios are stable.

The next stage of the analysis is based on the regional section of the studied topic. Table 02 represents the indicators of foreign trade in the Volga federal district and its subjects in 2016.

Table 02. Indicators of foreign trade in the Volga federal district and its subjects

	Total		Including			
			With CIS countries		With distant foreign countries	
	Export	Import	Export	Import	Export	Import
Total for Russia million\$	285 674	182 267				
Volga federal district	31 468,4	10 321	6 923,3	1477,4	24 543,1	8 843,7
Republic of Bashkortostan	5 712,5	629,7	854,1	147,0	4858,3	482,8
The Republic of Mari El	220,9	50,6	65,6	4,8	155,3	45,8
Republic of Mordovia	158,4	129,3	63,3	8,9	95,1	120,4
Republic of Tatarstan	9 316,3	2 687,2	1229,3	244,3	8087,0	2442,9
Udmurt Republic	511,8	270,7	67,5	16,1	444,3	254,6
Chuvash Republic	145,8	232,8	99,1	55,8	46,7	177,0
Perm Region	4 183,2	713,3	407,3	111,6	3 776,0	601,7
Kirov Region	710,4	192,0	113,2	15,1	597,1	176,9
Nizhny Novgorod Region	2 761,8	2 056,3	1 108,2	231,4	1 653,6	1 824,9
Orenburg Region	2 152,8	405,1	948,8	320,1	1 204,0	85,0
Penza Region	204,7	157,2	120,8	26,4	84,0	130,8
Samara Region	1 136,0	475,1	366,1	63,3	770,0	411,9
Ulyanovsk Region	424,8	437,9	84,7	57,0	340,1	380,9

In the total volume of Russian exports, exports of the Volga federal district are slightly more than 11%. Most of this volume (78%) is exported into distant foreign countries. The volume of exports by subjects of the district is distributed very erratically. Most (almost 30%) of the total volume is exported to the Republic of Tatarstan, moreover 86.8% of this value the Republic's enterprises are sent to distant foreign countries. The Chuvash Republic exports only 0.46% of the total exports of the district.

Samara region is among the leading regions within the district in terms of exports (12.2% of its size in the district), behind the Republic of Tatarstan, the Republic of Bashkortostan, the Perm region, at the same time ahead of such industrialized areas as Nizhny Novgorod, Orenburg, Saratov, among the total exports of the region 63.5% goes to distant foreign countries (<http://samarastat.gks.ru>).

The fall in exports occurred both in relation to distant foreign countries and CIS countries. Describing the dynamics of indicators as a whole, it can be seen that it is unstable. For 10 years there has not been a single period for at least three years, when there was not a steady increase in the indicators' values, but more or less stable values.

To identify the main trends, we will analyse the foreign trade indicators of the Samara region 2006-2016 as this region has significant and developed industrial potential throughout the country. The results are displayed in Table 03.

Table 03. The foreign trade indicators of the Samara region 2006-2016

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Export	7 798,5	6 909,5	9 726,2	5 220,6	7 934,4	6 893,0	6 596,9	9 008,3	10 017	6 736,3	3 826,8
Imports, million \$	1 102,6	1 627,9	1969,3	1 191,5	1 630,8	2 314,1	2 603,7	3 551,1	3 584,5	2452	1 883,9
Balance	6 695,9	5 281,6	7 756,9	4 029,1	6 303,6	4 578,9	3 993,2	5 457,2	6 432,5	4 284,3	1 942,9
including export with the distant foreign countries	6 537,6	5 232,1	7 550,6	4 344,7	6 944,9	5 159,9	4 382,8	6 253,3	7 033,8	4 607,2	2 431,6
Export to the CIS countries	1 260,9	1 677,4	2 175,6	875,9	989,5	1733,1	2 214,1	2 755,1	2 983,2	2 129,1	1 395,2
Growth rates (basic), %											
Export	100	88,6	124,7	66,9	101,7	88,4	84,6	115,5	128,4	86,3	49,1
Import	100	147,6	178,6	108,1	147,9	209,9	236,1	322,1	325,1	222,4	170,9
Export to the distant foreign countries	100	80,0	115,5	66,5	106,2	78,9	67,0	95,7	107,6	70,5	37,2
Export to the CIS countries	100	133,0	172,5	69,5	78,5	137,4	175,6	218,5	236,6	168,9	110,7

Describing the presented data, it can be noted that for 10-years period of studies the absolute value of exports decreased more than 2 times and amounted in 2016 only 49.1% of the level of 2006. Import's, on the contrary, increased 1.7 times. The attention is drawn to a trend similar to the all-Russian, a sharp drop in exports in 2015-2016. Previously, it can be noted that the reasons for this are similar to the above-mentioned the example - the export indicators dynamics for the Russian Federation as a whole.

The next stage of the analysis, according to the proposed algorithm of the study represents the indicators of industrial development in the region in conjunction with the dynamics of exports. One of the main indicators characterizing the development of industry and presented in detail in the official statistical collections is the volume of shipped goods of own production, works and services. It shows the dynamics in the aggregate of economic activities such as "mining", "manufacturing", "production and distribution of electricity, gas and water", which seems to be very positive. The volume of shipped products in 2016 exceeded the level of 2004 more than 3 times. Noteworthy is the decline in the same period in 2009, and in 2015, 2016 studied period. The first can be recognized as a consequence of the crisis trends in 2008-2009, and the second period of decline coincides with the introduction of sanctions restrictions.

In order to assess the dynamics of shipped products more reliably, it is advisable to analyse its level, "cleared" of inflation. At the same time, weak positive dynamics of indicators attracts attention. Level 2016 is already not exceeding 3.1 times, and a total of 130.8 %. The decline is observed not only in 2009, 2014, but in 2007. So, to called dynamics of the shipped products volume stable, is hardly possible. It is impossible to call positive and the size of the final growth of the shipped products volume -for 12 years only 30.8%.

If we compare the dynamics of exports and changes in the volume of shipped products, we can conclude that they largely correspond to each other. Similar to the volume of goods shipped, the decline in exports was observed in 2007, 2009, and 2015.

Surely, some fluctuations in the level of exports were in other years, as, for example, a decline was noticed in 2011-2012. It can be concluded that the dynamics of exports in general corresponds to the dynamics of shipped products. Moreover, it can be hypothesized that there is a certain more or less constant ratio (which to some extent can be called a share) between the values of exports and the volume of shipped products. According to the ratio that does not take into account inflation (p.3), it can be seen that for the period 2004-2008 (5 years) the value of about 0.014 was observed three times (2004, 2006, 2008), twice – about 0.011. For the period 2009-2016 (8 years) twice in 2014-2015 there were observed almost similar numbers (0,0085 0,0083 and, respectively) and quite similar values 0,0098 (2009) and 0,0074 (2011).

In this dynamic according to our reckoning, we can distinguish three periods: pre – crisis – 2004 – 2008; post – crisis – 2009 - 2014 and sanctions-2015-2016. In each of them, we can distinguish the predominant values of this ratio. In the first period, close values of 5 years were observed 3 times, in the second within 6 years-4 times.

Based on the ratio "cleared" from inflation (p. 6) we can made approximately similar findings; however, the boundaries of periods will change. The first period with the most repeated value of 0.0014 will be 2004 – 2009, the second, with close values to 0.016 -0.017 will be 2010 - 2014, the third – 2015 – 2016. In terms of inflation, the fluctuation in production output is higher, but also for a number of years there are generally similar values.

The dynamics of this ratio in "machine-building" types of economic activity is of great interest, including the production of machinery and equipment, electrical equipment, electronic and optical equipment, vehicles and equipment, as the products of these industries are complex and science-intensive ones, and it is no coincidence that in developed countries they dominate in exports (step 5 of the research algorithm).

The dynamics of Russian machinery and equipment exports in general repeats the general-purpose industrial grade. There is also a decline in 2009-2010, followed by growth and decline in the final years of the studied period. As for 2016, exports of machinery and equipment amounted only 46.9% compared to 2005.

There is also a generally positive trend in the volume of shipped products, excluding inflation. Total shipments of engineering products in 2016 amounted 190, 5% in 2005. And the growth is in all "engineering types of economic activities.

If we study the volume dynamics of shipped products, "cleared" from the influence of inflation – we get a completely different picture. Growth for 11 years is observed only in the production of electrical equipment. There is a decline in other activities. And the trend is similar. The decline is observed in 2007, in 2009-a significant decline, then unstable growth and since 2014 for the production of machinery and equipment and for the production of vehicles and equipment – a drop in the values of the indicator. Taking into consideration the scale of recent activity, that caused the recession on the amount of "engineering" types of economic activity.

Describing the values of the calculated ratios, we can also see a clear division into these periods: pre-crisis (2005 - 2009) with close to three of the five years values, post – crisis (2010 – 2013) and sanctions (2014-2016). Of course, the boundaries of the period slightly shifted in each case, but not more than a year. And in each of them you can select your most frequently repeated values of this ratio.

The next stage of the study, according to Figure 01, is the study of reproductive aspects of industrial development. To do this, it is advisable to analyse the traditional indicators used in the study of reproduction problems, specifically: the coefficients of renewal and disposal (liquidation) of fixed assets, the change in the average annual cost, as well as a number of indicators characterizing the investment aspects.

At present, the fixed asset renewal rates are quite low, especially for manufacturing and for the production and distribution of electricity, gas and water. For 8 years (2005 – 2012) the average value of the coefficient of renewal for manufacturing was 7.1%. Accordingly, if new fixed assets were introduced in the year 7.1% from their total value, by the end of the year, it is necessary more than 14 years for the full renewal of fixed assets without any expansion. If we take into account their increase, the period of renewal increases.

For the machinery production and equipment within the same period, the average renewal rate was 6.7%, for the production of vehicles and equipment – 3.7%. Almost all indicators are less than one (with a number of exceptions). For manufacturing, the input coefficient in 2016 is 10.7%, and the disposal rate is 0.9%. It can be concluded that there are big problems with the renewal, replacement of existing fixed assets. It is clear that if the retirement rate is 0.9%, the existing fixed assets will be decommissioned only after 111 years.

This factor makes it extremely difficult to produce high-quality and competitive products, and consequently, the participation of domestic enterprises in global value chains.

Stage 7 (final) of the proposed research algorithm provides for developed measures for the organizational and technical enterprises development, forming the strategy of expanded participation in the world reproductive chains. It is important to create an appropriate mechanism for the effective participation of industrial enterprises in the global reproductive chains in modern conditions. It is obvious that there is a need to develop a coherent and balanced industrial policy of the country, based both on the rise of national productive forces and international production cooperation. It is necessary to find and use new methods to organize production, increase efficiency using resources of digital transformation of the enterprises which are essentially different from traditional forms and methods of interaction with subjects of the international market activity.

6. Findings

The analysis of the specific but the most important series of industrial development and its efficiency, as well as reproduction indicators, allows us to draw a conclusion about the state and dynamics of the material and technical base of industrial enterprises for participation in the global reproductive chains. Its degree of Russian enterprises in global production chains directly depends on the state of the productive facilities, the production output of "machine-building" products, export dynamics, the state of the production facilities and its renewal degree.

7. Conclusion

The performed analysis has found that there is a certain relationship between the quantitative indicators of production, shipped products and the value of exports.

The method presented in this study allows to fully assess the trends and involvement problems of Russian industrial enterprises in the world reproductive chains, as well as to determine stable exports ratios and shipped products volume, to lay the foundation for forecasting the most important parameter, affecting the involvement of enterprises in global economic relations – the required amount of investment.

The approbation of the technique on the materials of the industry in the Samara region showed that in general, the value of the most important indicator characterizing the foreign economic activity of enterprises – the level of exports is largely determined by the dynamics of the macroeconomic conditions in the industry of the Russian Federation as a whole, in accordance with which it is possible to allocate relatively stable periods.

References

- Bremmer, J. (2014). The New Rules of Globalization. *Harvard Business Review*, 2, 4-10.
- Clarysse, B, Wright, M, Bruneel, J., & Mahajan, A. (2016). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7), 1164-1176. <https://dx.doi.org/10.1016/j.respol>
- Kashbraziyev, R, (2015). The Basic contradiction of international industrial cooperation, *Actual problems of Economics and law*, 4, 188-198.
- Kondratyev, A. (2018). New stage of globalization: features and prospects, *World economy and international relations*, 62(6), 5-15.
- Laplume, A, Petersen, B., & Pearce, J. (2016). Global value chains from a 3D printing perspective, *Journal of International Business Studies*, 47(5), 595-609.
- Los, B, Timmer, M., de Vries, A., & Gaaitzen, J. (2016). How global are global value chains? A new approach to measure international fragmentation. *Journal of regional science*, 55(1), 66-92. <https://dx.doi.org/10.1111/jors.12121>
- Porter, M. (1993). *International competition*. Moscow: International relations.
- Reznikov, S. (2014). Imperatives and determinants of modern and future restructuring of global supply chains: conceptual aspect. *Vestnik vevu* 5. 38-49.
- Sapir, E, (2016). Integration model of the Russian region: methodological bases, stages of formation. *Bulletin of the Udmurt University*, 26(6), 65-78.
- Strange, R., & Magnani, G. (2018). Outsourcing, offshoring and the global factory/in Cook G. and McDonald F. (Eds.). *The Routledge Companion on International Business and Economic Geography*, Routledge, London, The new Globalization, Going beyond the Retic.

- Varnavskiy, V. (2018). International trade in value added categories: methodological issues. *World economy and international relations*, 62(1), 5-15.
- Yakovlev, G. I. (2007). Managing the competitiveness of industrial enterprises in the context of globalization. Samara: *Publishing house of Samara state University of Economics*.
- Zhang, F., & Gallagher, K. S. (2016). Innovation and technology transfer through global value chains: Evidence from China's PV industry. *Energy Policy*, 94, 191-203. <https://dx.doi.org/10.1016/j.enpol>