Economic development of housing infrastructure of regions based on formation of building materials cluster

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Abstract: There is a shortage of research dedicated to the economic link between building materials cluster and efficiency of regional housing cluster development. Our motivation lies in the scientific interest to fill this gap using the example of Kazakhstan as a country with significant volumes of construction. The purpose is to identify problems related to the economic efficiency of the clustering system implementation to ensure the development of housing infrastructure in regional economies and to justify the efficiency of its use. The research framework comprises graphical models of cluster-based development in the construction industry and typologies of associated problems that adequately reflect market conditions in Kazakhstan. The results demonstrate the possibilities of employing a cluster model into the regional strategies for the construction industry development and prove the importance of implementing the clustering system in solving narrower social problems such as housing problems and economic development of urban infrastructure.

Keywords: building materials cluster; clusters; clustering potential; clustering of regional economies; housing market infrastructure; regional development.

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1 Introduction

Clusters are a relatively new form of organisation for both the global and regional economies, sharing risks and profits and increasing competitiveness. The central advantages of the cluster development model reside in its considerable potential, and most importantly, in that it has been tested in many developed countries of the world. Notwithstanding the fact that the state policy in the field of cluster support is determined by many national characteristics (Raines, 2017; Islankina and Thurner, 2018), the world practice confirms that the functioning of the most prosperous economies is almost entirely ensured by the advantages in modern production technologies and management. Therefore, the development of any level is possible with the integrated use of modern strategic management concepts (Günther and Meissner, 2017; Ramesh and Ravi, 2017).

Clusters act as a tool to enhance the competitiveness of regional economies of any country, create conditions for a high-value-added production process, contribute to the formation of mutually beneficial relations between enterprises, research, educational, financial organisations and institutions and authorities (Anufriev et al., 2019). The innovation of the clustering system is due to the fact that it attaches special importance to the territorial and social aspects of the development of regional economies, becoming a microeconomic component (Baulina, 2015). In addition, the system provides the most effective tools for stimulating the development of regional economies, in terms of improving the competitiveness of regional production, promoting employment and increasing budget revenues (Islankina and Thurner, 2018).

1.1 Literature review

1.1.1 Cluster approach to regional development

According to Isaksen (2018), clusters must meet four criteria:

1 clusters are composed of geographic groups of similar and related economic activities

2 these activities are linked through various forms of local cooperation and competition

3 the subjects realise that they are part of the cluster, and they have developed some kind of mutual understanding and common actions to strengthen the cluster

4   clusters are successful because they stimulate innovation and competitiveness of
     their member enterprises.

The US economist and scientist, Michael Porter made a key contribution to the
development of cluster theory. The problems of improving the organisational-economic
mechanism of management of innovative development at the level of individual
industries, regions and enterprises scientifically cluster arrangements and initiatives,
identifies priority research areas related to the management of innovation processes and
building innovation systems in his work *Competitive Strategy: Techniques for Analyzing
Industries and Competitors* (Porter, 2011). Relying on his findings, Herlinawati et al.
(2019) explored regional economic development issues. Lea (2020) analysed the state of
the construction industry and put forward a thesis about the cluster-based industrial
development as a strategy that fits the global market the best. Specialised studies
(Tokbolat et al., 2018; Akhanova et al., 2019) convey an idea that the means of research
to assess the effectiveness of the implementation of the clustering system of regional
economies contributes to the competitiveness of the economy as a whole. Clusters, which
are usually region-bound, are becoming increasingly important as they are thought to
produce knowledge spillovers that occur in different forms and intensities between
cluster members and outside the cluster itself. Regional clusters and cluster initiatives are
also considered instruments to support the internationalisation of small and medium-sized
enterprises (Günther and Meissner, 2017).

According to a study by Yoon and Nadvi (2018), cluster-based collective action can
achieve eco-collective efficiency that can lead to circular production, environmental and
economic benefits across the cluster. At the same time, local social affiliation, cluster
institutions and coordinating bodies are of decisive importance. The scale of the cluster
allows a systematic approach to reduce unit investment costs and achieve cost-optimality
in energy planning, taking into account such factors as modernisation and implementation
of technologies/strategies to improve energy efficiency and minimise carbon emissions
(Zhang et al., 2018). The focus on cluster scale also allows differences in energy
consumption patterns between different types of cluster facilities to be exploited and load
transfer coordinated to improve the use of renewable energy sources (Vigna et al.,
2018). In a study of the energy flexibility of building clusters, Camporeale and
Mercader-Moyano (2021) also concluded that, in terms of economies of scale, a cluster
design approach can help reduce investment costs and achieve optimal value with a focus
on energy-efficient retrofits, which, in turn, minimises carbon emissions. Cabeza et al.
(2021) came to the same conclusions in their study.

After analysing 3,500 investment cases in Canada and China, Li and Bathelt (2018)
concluded that companies operating in a knowledge-based manufacturing environment
with significant business experience are particularly inclined to focus their investments in
clusters. Focusing on the subnational rather than the national scale, the researchers found
that the effects of the cluster of origin are more important than the effects of the country
of origin in explaining the investment choices of firms in clusters. Thus, diversified firms,
especially multinational corporations, use local knowledge pools by strategically locating
branches in clusters (Li and Bathelt, 2018). Clusters are one of the main sources of
competitiveness not only for multinational corporations but also for medium and small
enterprises. Cluster-based SMEs are characterised by increased productivity and
inclusion in global distribution networks (Foghani et al., 2017). However, studies
reflecting the economic effect of the introduction of clustering are not fully presented in

the research literature (Stryabkova, 2017; Agarkov, 2019; Tarasenko, 2019), so they require additional study and improvement.

1.1.2 Construction clusters and their contribution to regional development

These days, the cluster model is widely recognised as one of the most effective forms of achieving competitive advantages. The effective functioning of cluster structures in the construction industry depends on a number of factors, the central of which encompass the development of construction in a given region, the presence of demand for construction products, the initiative from heads of construction enterprises and government agencies regarding the search for new forms of cooperation, the level of economic sustainability, stability and reliability of construction enterprises' functioning, the presence of leading enterprises that could form the core of the construction cluster, the presence and concentration of labour resources, human resources of existing enterprises in the construction complex, availability of educational institutions of the corresponding profile, investment attractiveness of the region, and the level of development of industry and the social sphere (Gordon and Kourtit, 2020).

The formation of a construction cluster in the region is able to become a driver for its development, thereby leading to:

- Creation of infrastructure for innovation, which will ensure an increase in the competitiveness of construction products and materials (Domański and Gwosdz, 2010).

- Effective implementation of innovations in the construction industry insofar as merging enterprises into a construction cluster will allow creating new innovative types of construction products and services and implementing large-scale investment and construction projects (Ofori, 2019).

- Organisation of consulting, legal, and engineering services for the effective development of the construction enterprises at a highly professional level.

- Facilitated development of the building materials industry due to the availability of a significant amount of own raw materials on the one hand and the growing demand for local building supplies from the construction enterprises on the other (Vigna et al., 2018; Cabeza et al., 2021).

- More promising investment projects for the region, implementation of which is impossible without combining the efforts of the authorities, the public and business.

- Increased investment attractiveness of the region, which will result in a notable rise in the energy efficiency of the used technologies (Zhang et al., 2018; Camporeale and Mercader-Moyano, 2021).

- Growth in investment in construction, which will contribute to the renewal of the material and technical base of the construction complex and ensure the entry of the production of the building materials industry into foreign markets, primarily through the development of transport infrastructure (Rokicki and Stępniak, 2018).

- Adaptation of the education system (modification and upgrade of construction-related training programs) to the needs of the current labour market,

providing the basis for the employment of graduates in the relevant enterprises of the construction cluster (Khasan and Nofan, 2018).

1.1.3 Cluster development

Over the past decades, the idea of creating building clusters has found its application in almost all countries of the world, including not only the USA, Japan, or members of the European Union but also the countries of South America, Eastern Europe and Africa (Tengan and Aigbavboa, 2019). In concurrence with this, one of the most profound social issues in today's top 10 is the matter of housing for the population of Kazakhstan. For example, per inhabitant comes about 40 sq.m. in Europe, 65 sq.m. in the USA, while in Kazakhstan, this figure is only 21.6 sq.m. per inhabitant (Mottaeva et al., 2016). In this regard, the construction of housing remains the main direction of solving the problem of meeting the needs for housing in the regions of the republic. At the same time, the construction industry and the building materials industry are closely interrelated from the point of view of the existing technological links. Stable economic development of the country's regions usually requires regional enterprises to produce building materials according to the available raw materials. However, despite the general distribution of large reserves of natural resources in the republic, no region can fully meet the needs for construction materials at the expense of products produced only with the use of local raw materials (Tokbolat et al., 2018). In this regard, regional clustering of industries to solve the housing problem and the formation of its infrastructure in the regions can become an effective measure of interaction, integration and cooperation of business and government structures (Rokicki and Stępniak, 2018). Construction clusters are rightfully believed to denote the drivers of economic development since the rise of construction is closely linked to the advancement of other industries, the introduction of new technologies and increased labour productivity (Abdelalim et al., 2019). In the meantime, the particular scientific interest arises when the matter stands for the factors of success of large infrastructure projects in developing countries (Tengan and Aigbavboa, 2019).

Despite numerous studies dedicated to clusters, there is a shortage of research dedicated to the link between building materials cluster and efficiency of housing cluster development. The purpose of the study is to identify problems of economic efficiency of the clustering system implementation to ensure the development of housing infrastructure in regional economies and justify the efficiency of its use, and to provide practical recommendations on development of regional clusters.

2   Methods

The study moves from lesser to greater and therefore primarily focuses on the niche of building materials. The proportion of domestic building materials in production was calculated by categories and data on imports was presented. Subsequently, changes in the quantity of construction work by regions over the period 2014 to 2018 were examined. The article also tests the assumption that the construction industry has become a driver of the development of Kazakhstan. For this, a regression model in the form of $GDP = f$ (construction volumes) was built according to statistical data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan.

The results enabled the assessment of the general trend for each region. Such a detailed analysis of the performance of the construction industry enabled a schematic representation of possible clusters that most adequately reflect the existing infrastructure and interactions in the construction industry of Kazakhstan. The typical problems in cluster development were categorised by using the results of the synthesis of data from earlier. This allowed making specific proposals and recommendations for construction industry clustering at the macro and regional levels with higher accuracy.

3   Results

The increase in the volume of construction in Kazakhstan, increasing requirements for the quality of housing and other facilities, stricter environmental requirements, as well as increased competition encourage builders to use the latest technologies and building materials. There are about 1,700 enterprises in the construction industry in Kazakhstan today (Ministry of National Economy of the Republic of Kazakhstan, 2020b). To date, many construction materials are imported into Kazakhstan due to the lack of production of materials such as sheet glass, heat insulation materials based on basalt, as well as plumbing from ceramics, linoleum, reinforcement, rods, elevators of passenger, roofing materials based on polymers, furniture for windows and doors. For example, linoleum and floor coatings were imported completely, ceramic tiles – by 92.4%, fibreglass – by 96.4%, particle boards – by 80.8% in 2018 (Ministry of National Economy of the Republic of Kazakhstan, 2020a). Domestic production prevails only in construction materials that are natural raw materials (Figure 1).

Figure 1   The major building materials in Kazakhstan and their origin as of 2018 (see online version for colours)
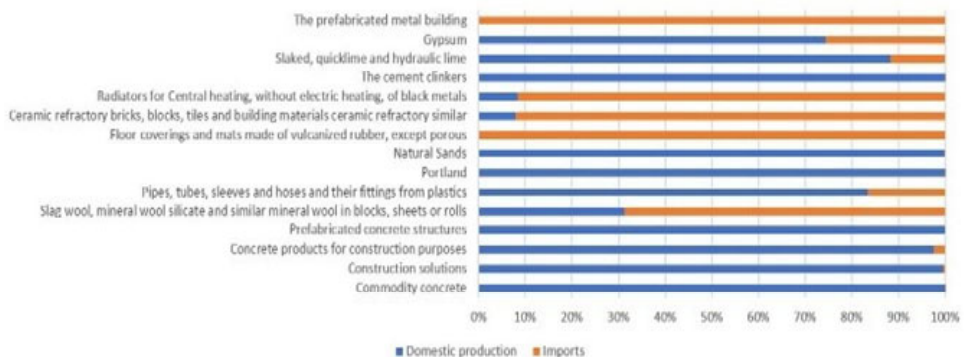
Source: Calculated by the authors on the basis of data from Committee on Statistics (2020)

Despite the above-mentioned power plants for the production of building materials and the remaining capacity of existing enterprises of the construction industry, they are used far not completely, and their opportunities are constrained mainly because of limited funds for modernisation and the lack of long-term preferential loans for development of production technologies of building materials, products and structures (Akhanova et al., 2020). Among the main problems in the construction industry can be identified shortage

of capacity for the production of basic materials, low technical level due to moral and physical deterioration of fixed assets, low solvency of demand for products of the construction industry.

As a result, the following equation was obtained: GDP = 21,219 ∗ construction volume – 60,392, where $R^2 = 0.9736$.

When building the regression dependence model, a linear dependence was also created for the period from 2015 to 2019 (with a time lag of one year). The precise focus on this time can be explained by the fact that no relationship was found between the volume of construction and the GDP of Kazakhstan for 2014 and earlier.

Table 1   Statistical data on Kazakhstan GDP and construction volumes

| Year	GDP, billion dollars	Year	Volume of construction works
2015	184.36	2014	2,667,183
2016	137.28	2015	2,896,877
2017	159.4	2016	3,258,031
2018	170.54	2017	3,509,296
2019	181.67	2018	3,862,995

Figure 2   Dependence of Kazakhstan's GDP on construction volumes, for 2015–2019 (see online version for colours)
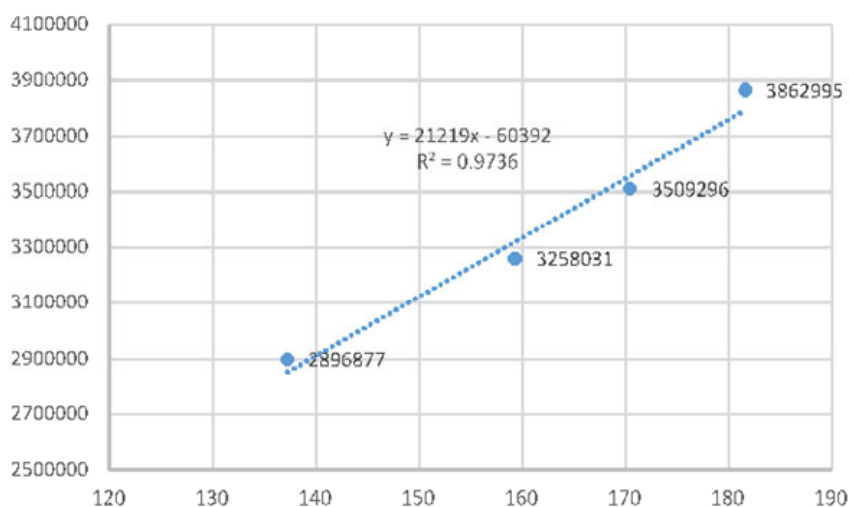
All these factors led to the development in the Republic of Kazakhstan of the sectoral Program of Development of the Building Materials Industry for 2010–2019 (Government of the Republic of Kazakhstan, 2020). Since 2005, the regions with the involvement of development institutions, enterprises' own funds and loans of banks of the second level introduced production facilities for production of building materials, in particular of ceramic bricks, dry construction mixtures, glass-plastic pipes, concrete blocks, aggregates, manufacture of windows and doors made of wood, ready-mixed concrete, and concrete products. The presence of unique mineral deposits in Kazakhstan, the development of the oil and gas complex create conditions for attracting potential
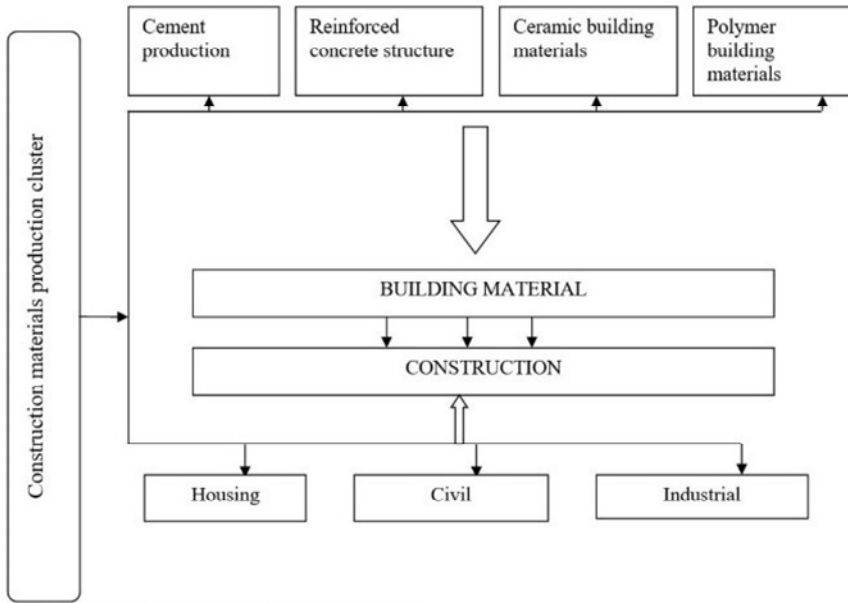
investors to participate in the implementation of investment projects to develop the base of the construction industry. In our opinion, the main obstacle is the opacity of construction companies and the construction sector as a whole. But the scale of funds involved in the construction sector can be judged at least by the multiplier effect: according to analysts, for every tenge invested in construction, related industries received three times more (Kodur and Harmathy, 2016). However, there appear to be some objective prerequisites for development in the residential construction industry, which have manifested in a positive dynamics of building activity indicators in almost all regions of Kazakhstan over the recent years (Figure 3). Among the most obvious is the shortage of living space in Kazakhstan. This is primarily due to the fact that the construction of new houses is often made on the site of demolished old ones. Secondly, a certain number of people will definitely need new apartments by a certain date.

Figure 3 Dynamics of the volume of construction works by regions for 2014–2018 (see online version for colours)
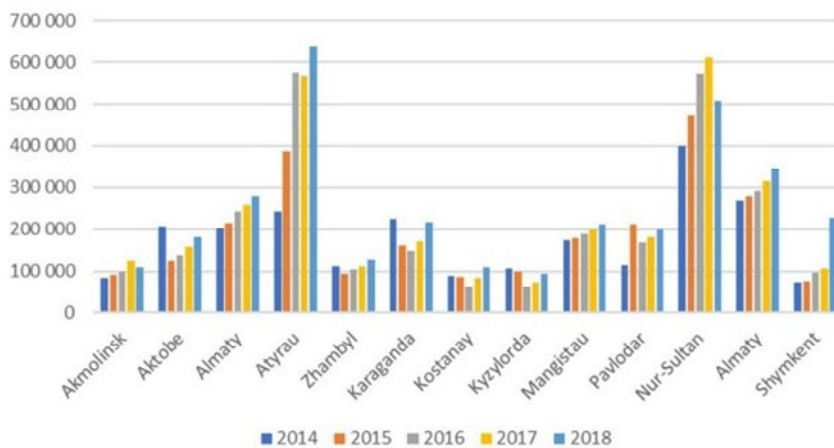
Source: Developed by the authors on the basis of the data from Committee on Statistics (2020)

The formation of clusters in the field of construction materials production differs from other types of associations in that it has a more extensive chain of participants and more ambitious goals. The building materials cluster brings together all components of the production process, from raw material suppliers to final product consumers, as well as the service sector and specialised infrastructure. For the construction, we need a variety of building materials: primary a brick, cement, etc., a lot of high-tech materials-metal and plastic products, glass and concrete, plumbing products, finishing materials of high quality, electrical materials, household appliances, etc. The building cluster can specialise in the construction and installation works, production of building materials, architectural design, design and provide the complete cycle of construction works with the delivery of objects 'turnkey' (Figure 4).

Figure 4   A schematic representation of clusters in building-material production

However, it should be noted that the construction materials industry faces a number of serious problems (Table 2). Most building materials companies use outdated technology in brick factories, in the production of reinforced concrete products and in the extraction of non-metallic materials. There is no technology for the production of chemical and petrochemical components important for the production of many building materials, which are still imported and account for a significant share of the cost of production. The level of physical wear of machinery and equipment in the construction industry is 55%–65% (Garkin, 2014). Production is carried out using outdated technologies with a high level of energy consumption, without compliance with environmental requirements. Certain types of products are uncompetitive both in quality and cost. It worth noting that if the production of building materials and construction are considered as a single system, which for this area is actually the only correct approach, it turns out that the technological chain of construction production is a network structure, including many intellectual, information, organisational, technological, marketing, real estate, financial and social flows. Such flows arise between individual cluster enterprises, stationary or non-stationary, changing over time.

Relationships within the construction cluster are such that in some periods of the construction process, they do not depend on each other: builders for a long time do without the direct participation of science, the design link can also use old scientific data and therefore also do without the participation of science. Moreover, builders can function for some time without design and development. However, the construction cluster will never be able to do without the production of building materials and products. At the same time, if you ignore and do not develop at least one component, it will inevitably lead to a deterioration in the quality, quantity or price increase of construction products. The peculiarity of the construction cluster is also the fact that being essentially

a complex system, it can realise the synergistic effect of the emergence of a stable state of a complex system called an attractor. Only the development of stable links between all enterprises of the cluster can bring the system to the attractor point.

Table 2 Problems of construction cluster and ways of their solution
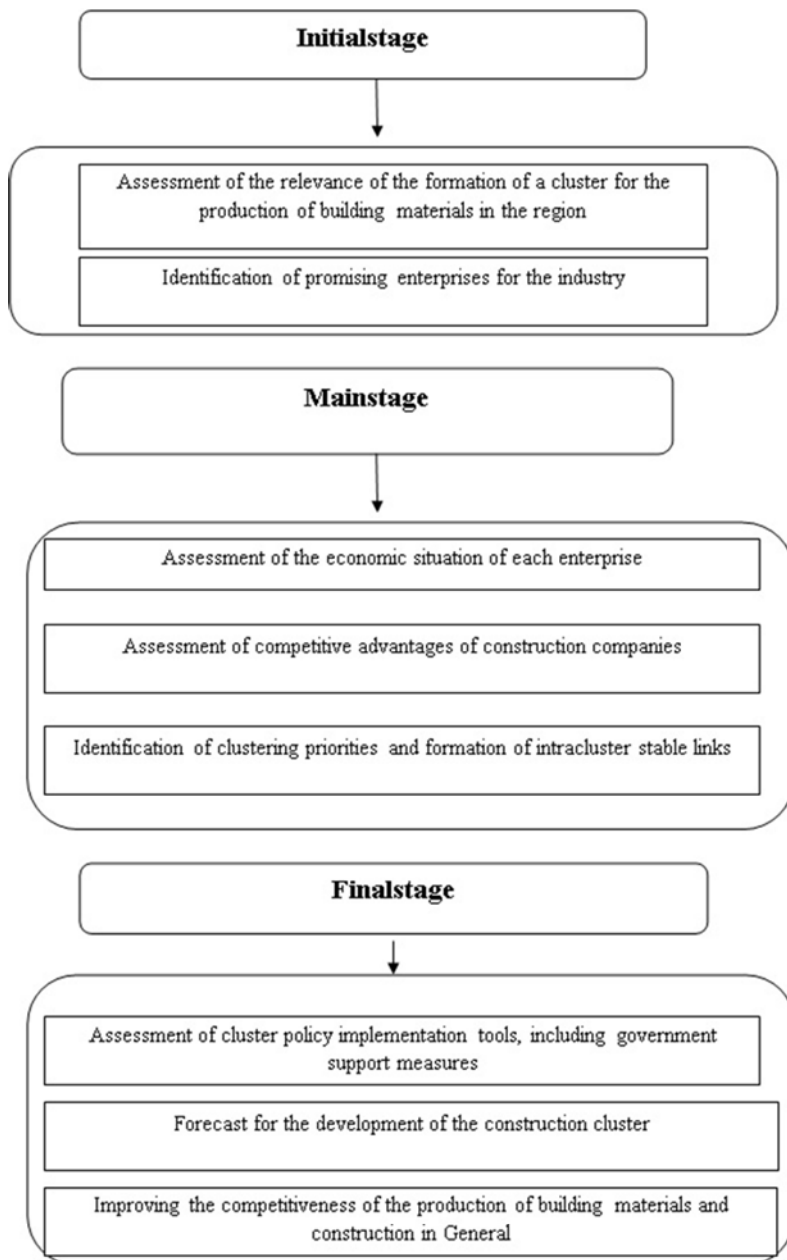
Basic problem	Suggested solutions
Lack of access to capital	Development of a mechanism for the use of funds from various financial funds (pension funds, etc.)
Administrative barrier	Formation of an industry pool for the participation of the cluster in the financing of projects for the production of building materials and the development of new technologies
Lack of information on building materials markets	Creation of an electronic database on construction materials with the involvement of foreign consultants
Lack of skilled workers	The participation of the cluster in the development of the state program on development of vocational and technical education for the industry
Insufficient development of logistics, transport infrastructure, high tariffs	Creation of technoparks within the cluster
Lack of domestic technologies and scientific developments	Annual competitions for the development of technologies for the production of building materials are held by state bodies

Thus, the formation of a cluster for the production of building materials can be presented in the following form Figure 5.

The implementation of the tasks in the construction industry of Kazakhstan is recommended to be done through:

- Creation of knowledge-intensive technologies ensuring effective use of available raw materials, using modern technical solutions, application and introduction of new knowledge in the field of achievements of modern technical and humanitarian science.

- Creation of projects for the production of competitive in price and quality products taking into account modern requirements for safety and environmental friendliness.

- The creation of regional development programs and structural reforms on the organisation of industry for the production of building materials, including the reform and development of the existing infrastructure, creation of new infrastructures aimed at creating new innovative products based on innovative technologies.

- The use of modern new technologies that can replace or reduce the use of natural resources, using as raw materials industrial and household waste, which will preserve the ecology of the environment of the region.

- Carrying out research and design work to reduce the weight of structures, structures, materials, which will reduce the costs of the industry.

- Creation and development of new technologies to replace imported building materials with Kazakh analogues of materials and products, for example, composite materials.

Figure 5   Formation of a cluster in building-material production

Initialstage

Assessment of the relevance of the formation of a cluster for the production of building materials in the region

Identification of promising enterprises for the industry

Mainstage

Assessment of the economic situation of each enterprise

Assessment of competitive advantages of construction companies

Identification of clustering priorities and formation of intracluster stable links

Finalstage

Assessment of cluster policy implementation tools, including government support measures

Forecast for the development of the construction cluster

Improving the competitiveness of the production of building materials and construction in General

4   Discussion

Although the construction market of Kazakhstan showed a stable upward trend in terms of the sales of construction products during 2014–2018, this quantity was still not enough

to enlarge the very country's GDP or at least increase the percentage share of construction in GDP structure. In general, the development of the construction industry inevitably causes economic growth and may even be the solution to many social problems. However, even though at the regional level there is a clear trend for the supremacy of Kazakhstani construction organisations in central regions and large cities due to their capacities and investment attractiveness, globally, the construction industry of Kazakhstan lags significantly behind due to the lack of necessary financial and organisational transformations.

The construction boom gives rise to a huge demand for building materials for both main use (cement, brick, etc.) and finishing and roofing. Modern requirements to the quality of construction of residential buildings predetermine the use of new and effective construction materials that meet world standards. However, today the Kazakh industry of construction materials does not meet the needs of construction production (Akhanova et al., 2019). All this shows that with the existing level of technical and technological equipment of most enterprises, it is almost impossible to organise the production of domestic construction materials that meet world standards (Anufriev et al., 2019).

A special focus is the cluster-enterprise relationship system, as the lack of necessary contacts between clusters and enterprises can lead to a failure, a slowdown, and a shutdown of the entire process. The particular instability of the 'construction production' system is due in no small part to the fact that only builders most often consider themselves participants in the construction process, without being aware of the significant dependence of the cluster for the production of construction materials on others, sometimes completely inconsistent with them, with which the links are not directly visible (Islankina and Thurner, 2018).

The main task facing the construction industry is to organise the production of high-quality materials, products and structures capable of displacing similar imported products in the domestic market and being competitive in the world market (Herlinawati et al., 2019; Abdallah and Ayoub, 2020). Among the factors conducive to the growth and development of the industry, the following can be distinguished:

- overall improvement of the economic situation in the country

- increasing domestic demand as a result of improved living standards of the population

- availability of mineral resources used in the production of building materials

- enterprise development

- favourable conditions in selected commodity markets

- availability of cheap and sufficiently skilled labour (Tokbolat et al., 2018).

The development of the construction industry market corresponds to the goals and objectives of the national economy as a whole, as a necessary part of the general concept of economic development along the path of innovative changes in the long-term. Foreign experience in practice confirms that the development of small and medium-sized enterprises in the construction industry is one of the most important factors in raising the level of the regional and national economy as a whole on the basis of subcontracting and specialisation of production activities (Yoon and Nadvi, 2018).

Any country shall design its development programs for the construction industry to fulfil a double task (Akhanova et al., 2019):

- Improve the quality of construction products, ensuring high consumer characteristics, improving their reliability and safety.

- Improve functional and aesthetic comfort in economical operation, transformation of architectural and construction component of innovative transformations in the industry, which will meet modern requirements of comfortable life at the level of prosperous and highly developed countries.

At the meso-level (regional level), attempts to reach an intensive market development, in our opinion, should include (Günther and Meissner, 2017; Yoon and Nadvi, 2018):

- In order to implement programs for the introduction of housing in the regions on the basis of safe and environmentally comfortable technologies and engineering solutions to carry out the introduction of new housing, including low-rise construction, accessible to the population.

- Development and implementation of new technologies and creation of new competitive building materials, components, engineering structures, finishing, thermal insulation materials, polymeric materials for the production of affordable housing for the population.

- Use of natural resources, raw materials, production infrastructure available in the region when creating housing commissioning programs taking into account regional natural and climatic features of the region.

- Creation of complex programs on structural reorganisation of production capacities for the purpose of introduction of new technologies on full-assembled housing construction as competitive production in the housing market.

- Creation of programs on development and introduction of new energy-saving and resource-saving technologies for maintenance of a residential complex on the basis of application of innovative materials of the construction industry.

A prerequisite for the innovative development of the building materials industry is the availability of technologies for economical and safe waste processing. Currently, the creation of a system for the use of industrial and household waste is becoming more urgent and paramount (Rodionov, 2016). To successfully cope with this task, it is necessary to develop a comprehensive system of ecological and climatic assessments taking into account regional characteristics, the nature of man-made pollution (Vigna et al., 2018).

The development of mutually beneficial cooperation of industrial enterprises is one of the important tasks to overcome the weak competitiveness of the industry for the production of building materials. The natural and expedient step for the development of the construction complex of the economy is the formation of the industry of the cluster of construction materials, which will include large construction enterprises, small and medium-sized enterprises of the construction industry, which, by synergising common efforts, optimising the use of existing infrastructure and the availability of necessary resources, by reducing production costs, will be able to ensure the effective development of the construction industry of the region, creating new competitive products and

services, expanding the range of services provided (Li and Bathelt, 2018; Chaudhary et al., 2020).

A cluster must embrace enterprises and infrastructure institutions that provide trade, legal, audit, marketing, information, education and research services. Stabilisation and development of the construction industry will lead not only to the rise of the entire construction industry but also to the activation of related enterprises producing metal structures, electrical equipment, plumbing and furniture (Camporeale and Mercader-Moyano, 2021).

If we consider the natural process of formation of a cluster for the production of building materials, it will look as follows. For example, in the economy, prices for cement – the basic material for the production of almost all types of construction work – have risen sharply. Accordingly, the impact of the price of cement has become noticeable in all intermediate externally independent enterprises of the building materials cluster. The development of the system led to the only right way out: innovation was required. Objective conditions first caused an information flow between science and construction. This flow in turn provoked a financial flow from the construction industry – to science. This in turn revived the ties between related structures of science: there were contacts between construction scientific units and chemists, geologists and marketers. There were information flows between the structures forming the cluster 'science' and representatives of informatics - increasing the supply of software for science. In order to minimise the negative consequences of the rise in the price of cement, the scientific unit can take advantage of three options for information flows: either old, previously unused developments can be in demand, or you can use the experience of world science and technology, or you can start a new search, try to find innovative solutions to the problem. In this case, there are the following options: to build new cement plants on the basis of ready-made technologies; to implement imports of cement; to develop substitutes for cement. This in turn will lead to various kinds of reactions in science-related industries, etc. (Isaksen, 2018; Tarasenko, 2019). The main goal of combining the construction cluster, as well as any other, is to achieve a specific economic result-the production of competitive products (Foghani et al., 2017).

The general management of the cluster, as follows from various theoretical and empirical studies (Do Carmo and Christensen, 2016; Abdyrov and Toktogulov, 2017; Jena and Sun, 2018), should be carried out by a public non-profit organisation, the founders of which should be members of the cluster, public organisations, state bodies both at the national and regional levels. The cluster should also include enterprises and infrastructure institutions, public organisations, business structures, construction organisations engaged in design, production of construction materials, construction, provision of services in the construction complex, technical operation, reconstruction and major repair of infrastructure facilities for housing, civil and industrial purposes.

In the field of construction materials, the following objectives are to be addressed (Lea, 2020):

• cooperation of construction companies should reduce the cost of work and improve the quality of construction products

• development of new types of construction products, projects, building materials and technologies, equipment and means of small mechanisation, automation and production processes, environmental safety of production, etc.

- implementation of international quality management system standards in the construction sector (Akhanova et al., 2020)

- growth of commissioning of construction objects of housing infrastructure with improvement of its quality.

The creation of a cluster in the production of building materials will be able to provide network participants and the economy as a whole a certain number of different advantages. First, the cluster is able to significantly expand the possibilities of attracting financial resources to the production of building materials. This effect is achieved by combining the financial capabilities of all participants of the cluster, attracting investments from the outside, joint participation in project competitions, which are financed in the form of grants, combining financial capabilities to ensure guarantees for obtaining credit resources. Secondly, the creation of the cluster increases the possibility of reducing the cost of construction products and services of organisations belonging to the cluster. The presence of own production on the basis of local raw material base helps to reduce the cost of transportation, storage of products, trade services, which in turn reduces the cost of production work. Moreover, there are no problems with the sale of products – it is fully used within the cluster. Thirdly, the union of enterprises in the construction sector will provide an opportunity for cluster participants to effectively defend their interests at the level of local authorities and local self-government (Karyakina, 2015). Fourth, the implementation by the cluster members of various construction programs (for example, housing or industrial) will be able to ensure the constant workload of organisations of the construction industry and related industries. Fifth, the union of organisations at the regional level forms a fundamentally new level of relations, which is based on decency and trust between the cluster members, creates, we can say, a new way of thinking (Zhang et al., 2018; Cabeza et al., 2021).

5   Conclusions

The present research aimed to test the hypothesis that the construction industry represents one of the key drivers promoting the economic development of Kazakhstan. In the course of the investigation, this hypothesis was confirmed only for the period from 2016 to 2019. Correspondingly, it can be inferred that Kazakhstan lags behind the developed countries of the world in terms of innovation activity, which negatively affects its competitiveness and economic growth. The major reasons for such an outcome can be poor investment and innovation opportunities, lack of effective management mechanisms at all stages of project implementation, limited budget funding, no uniform methods for assessing the projects' effectiveness, insufficient experience in managing innovations in market conditions, and inadequate practical and theoretical base for managing innovation and investment activities.

The need to increase the efficiency of production of construction materials is due to a number of reasons, the main reasons of which are the low competitiveness of products caused by the high level of its cost. The search for reserves to increase the efficiency of enterprises will ensure improvement of quality and increase of output volume, renewal and expansion of the product range, improvement and development of production technology. Therefore, the success of the development of a territory in each individual country is possible through the finding of those growth points (unique goods, services,

deposits, know-how, sectoral and territorial advantages) that could bring the economy of the country to the highest borders and ensure the growth of national well-being.

The sector of the construction industry of Kazakhstan is a priority for clustering and is closest to the formation of a cluster structure. At the present stage, it is necessary to create specific regional and economic conditions to ensure its development. However, there are some problems with the formation and development of the building materials cluster.

The building materials cluster, which includes products and structures, is the material basis of construction. The construction market of Kazakhstan, which has been developing dynamically for the last few years, has been experiencing difficulties related to the reduction of purchasing power. The strong growth of the market is due to two main factors-the growth of incomes and the increase in mortgage lending. The main volume of output is made by the budgetary models having a stable sale today.

Thus, the creation of a cluster on production of construction materials as one of the promising objectives of the program socially-economic development of regions, including problem-solving and economic development housing infrastructure in Kazakhstan becomes in modern conditions strategic tools for systemic transformation of the regional building complex, improvement of investment attractiveness and competitiveness of regional economic system as a whole. Summing up, the authors would like to note that one of the most important ways to stimulate and support competitive clusters is the implementation by local authorities of the cluster policy, which should include measures of regulatory support, investment, financial and budgetary mechanisms and information support.

The implementation of the tasks in the construction industry of Kazakhstan is recommended to be done through:

- Creation of knowledge-intensive technologies ensuring effective use of available raw materials, using modern technical solutions, application and introduction of new knowledge in the field of achievements of modern technical and humanitarian science.

- Creation of projects for the production of competitive in price and quality products taking into account modern requirements for safety and environmental friendliness.

- The creation of regional development programs and structural reforms on the organisation of industry for the production of building materials, including the reform and development of the existing infrastructure, creation of new infrastructures aimed at creating new innovative products based on innovative technologies.

- The use of modern new technologies that can replace or reduce the use of natural resources, using as raw materials industrial and household waste, which will preserve the ecology of the environment of the region.

- Carrying out research and design work to reduce the weight of structures and materials, which will reduce the costs of the industry.

- Creation and development of new technologies to replace imported building materials with Kazakh analogues of materials and products, for example, composite materials.

The results of the study can be applied by national and regional governmental officials for the development of strategies and policies of regional clusters development in general and development of housing infrastructure at the regional level, in particular.

This study is limited to the building materials cluster in Kazakhstan. There is room for further research based on other clusters in other countries and regions.

References

Abdallah, A.B. and Ayoub, H.F. (2020) 'Information technology drivers of supply chain agility: implications for market performance', *International Journal of Productivity and Quality Management*, Vol. 31, No. 4, pp.547–573.

Abdelalim, A.M., Elbeltagi, E. and Mekky, A.A. (2019) 'Factors affecting productivity and improvement in building construction sites', *International Journal of Productivity and Quality Management*, Vol. 27, No. 4, pp.464–494.

Abdyrov, T.S. and Toktogulov, A.K. (2017) *The Strategy for Innovative Cluster Development of the Economy*, CPI "Insanat", Bishkek.

Agarkov, A.P. (2019) *Design and Formation of Innovative Industrial Clusters*, Dashkov and K Publ., Moscow.

Akhanova, G., Nadeem, A., Kim, J.R. and Azhar, S. (2019) 'A framework of building sustainability assessment system for the commercial buildings in Kazakhstan', *Sustainability*, Vol. 11, No. 17, pp.4754–4760.

Akhanova, G., Nadeem, A., Kim, J.R. and Azhar, S. (2020) 'A multi-criteria decision-making framework for building sustainability assessment in Kazakhstan', *Sustainable Cities and Society*, Vol. 52, No. 2020, p.101842.

Anufriev, D., Petrova, I., Kravets, A. and Vasiliev, S. (2019) 'Big data-driven control technology for the heterarchic system (building cluster case-study)', in *Big Data-driven World: Legislation Issues and Control Technologies*, pp.205–222, Springer, Cham.

Baulina, O.A. (2015) *Conceptual Bases of Cluster Development of the Region*, Volgograd State University of Architecture And Civil Engineering Publ., Volgograd.

Cabeza, L.F., Boquera, L., Chàfer, M. and Vérez, D. (2021) 'Embodied energy and embodied carbon of structural building materials: worldwide progress and barriers through literature map analysis', *Energy and Buildings*, Vol. 231, No. 1, p.110612.

Camporeale, P.E. and Mercader-Moyano, P. (2021) 'A GIS-based methodology to increase energy flexibility in building cluster through deep renovation: a neighborhood in Seville', *Energy and Buildings*, Vol. 231, No. 1, p.110573.

Chaudhary, A., Singh, A.K. and Meena, M.L. (2020) 'Productivity improvement of an electrical appliance industry by implementing lean manufacturing tools and a low-cost intervention (a case study)', *International Journal of Productivity and Quality Management*, Vol. 31, No. 3, pp.390–411.

Committee on Statistics (2020) *Official Webpage* [online] https://stat.gov.kz/ (accessed 15 November 2020).

Do Carmo, C.M.R. and Christensen, T.H. (2016) 'Cluster analysis of residential heat load profiles and the role of technical and household characteristics', *Energy and Buildings*, Vol. 125, No. 1, pp.171–180.

Domański, B and Gwosdz, K. (2010) 'Multiplier effects in local and regional development', *Quaestiones Geographicae*, Vol. 29, No. 2, pp.27–37.

Foghani, S., Mahadi, B. and Omar, R. (2017) 'Promoting clusters and networks for small and medium enterprises to economic development in the globalization era', *SAGE Open*, Vol. 7, No. 1, p.2158244017697152.

Garkin, I.A. (2014) 'Construction cluster: interaction between construction organizations', *Young Scientist*, Vol. 4, pp.155–156.

Gordon, P. and Kourtit, K. (2020) 'Agglomeration and clusters near and far for regional development: a critical assessment', *Regional Science Policy & Practice*, Vol. 12, No. 3, pp.387–396.

Government of the Republic of Kazakhstan (2020) *Resolution of the Government of the Republic of Kazakhstan No. 1004 of 30 September 2010 About the Approval of the Program on Development of the Construction Industry and Production of Construction Materials in the Republic of Kazakhstan for 2010–2014* [online] https://egov.kz/cms/ru/law/list/P1000001004 (accessed 15 November 2020).

Günther, J. and Meissner, D. (2017) 'Clusters as innovative melting pots? – The meaning of cluster management for knowledge diffusion in clusters', *Journal of the Knowledge Economy*, Vol. 8, No. 2, pp.499–512.

Herlinawati, E., Suryana, Ahman, E. and Machmud, A. (2019) 'The effect of entrepreneurial orientation on SMEs business performance in Indonesia', *Journal of Entrepreneurship Education*, Vol. 22, No. 5, pp.1–15.

Isaksen, A. (2018) 'From success to failure, the disappearance of clusters: a study of a Norwegian boat-building cluster', *Cambridge Journal of Regions, Economy and Society*, Vol. 11, No. 2, pp.241–255.

Islankina, E. and Thurner, T.W. (2018) 'Internationalization of cluster initiatives in Russia: empirical evidence', *Entrepreneurship & Regional Development*, Vol. 30, Nos. 7–8, pp.776–799.

Jena, P. and Sun, Q. (2018) 'Super atomic clusters: design rules and potential for building blocks of materials', *Chemical Reviews*, Vol. 118, No. 11, pp.5755–5870.

Karyakina, L.A. (2015) *Formation and Development of Cluster Formations in the Economy*, Dashkov and K Publ., Moscow.

Khasan, S. and Nofan, F.M. (2018) 'Building synergism through cluster strategy in developing the weaving industry', *E3S Web of Conferences*, EDP Sciences, Vol. 73, p.10009.

Kodur, V.K.R. and Harmathy, T.Z. (2016) 'Properties of building materials', in Hurl, M.J. et al. (Eds.): *SFPE Handbook of Fire Protection Engineering*, pp.277–324, Springer, New York, NY.

Lea, T.T. (2020) 'The effect of green supply chain management practices on sustainability performance in Vietnamese construction materials manufacturing enterprises', *Uncertain Supply Chain Management*, Vol. 8, No. 1, pp.43–54.

Li, P. and Bathelt, H. (2018) 'Location strategy in cluster networks', *Journal of International Business Studies*, Vol. 49, No. 8, pp.967–989.

Ministry of National Economy of the Republic of Kazakhstan (2020a) *Balances of Resources and Use of the Most Important Types of Raw Materials, Products for Industrial and Technical Purposes and Consumer Goods in the Republic of Kazakhstan for 2014–2018* [online] http://stat.gov.kz/official/industry/30/publication (accessed 12 November 2020).

Ministry of National Economy of the Republic of Kazakhstan (2020b) *Investment and Construction Activities in the Republic of Kazakhstan for 2014–2018* [online] http://stat.gov.kz/official/industry/16/publication (accessed 12 November 2020).

Mottaeva, A., Zheltenkov, A., Stukanova, I., Ryabichenko, S. and Zhuk, S. (2016) 'Innovative development of building materials industry of the region based on the cluster approach', *MATEC Web of Conferences*, EDP Sciences, Vol. 73, p.07026.

Ofori, G. (2019) 'Construction in developing countries: need for new concepts', *Journal of Construction in Developing Countries*, Vol. 23, No. 2, pp.1–6.

Porter, M. (2011) *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, 4th ed., Alpina Publisher Publ., Moscow.

Raines, P. (2017) *Cluster Development and Policy*, Ashgate, Aldershot, Hants.

Ramesh, N. and Ravi, A. (2017) 'Enhancing the performance of micro, small and medium sized cluster organisation through lean implementation', *International Journal of Productivity and Quality Management*, Vol. 21, No. 3, pp.325–342.

Rodionov, A.P. (2016) 'Economic development of the region on the basis of the formation of a cluster of small enterprises of the construction materials industry', *Russian Entrepreneurship*, Vol. 17, No. 8, pp.999–1010.

Rokicki, B. and Stępniak, M. (2018) 'Major transport infrastructure investment and regional economic development – an accessibility based approach', *Journal of Transport Geography*, Vol. 72, No. 1, pp.36–49.

Stryabkova, E.A. (2017) *Improving the Competitiveness of the Region on the Basis of Cluster Policy. Theory and Methodology*, V.G. Shukhov Belgorod State Technological University, ABS ASV Publ., Belgorod.

Tarasenko, V. (2019) *Territorial Clusters: Seven Management Tools*, Alpina Publisher Publ., Moscow.

Tengan, C. and Aigbavboa, C. (2019) 'A principal component analysis of monitoring and evaluation determinants for construction projects delivery in developing countries', *International Journal of Productivity and Quality Management*, Vol. 27, No. 4, pp.420–434.

Tokbolat, S., Karaca, F., Durdyev, S., Nazipov, F. and Aidyngaliyev, I. (2018) 'Assessment of green practices in residential buildings: a survey-based empirical study of residents in Kazakhstan', *Sustainability*, Vol. 10, No. 12, p.4383.

Vigna, I., Pernetti, R., Pasut, W. and Lollini, R. (2018) 'New domain for promoting energy efficiency: energy flexible building cluster', *Sustainable Cities and Society*, Vol. 38, No. 1, pp.526–533.

Yoon, S. and Nadvi, K. (2018) 'Industrial clusters and industrial ecology: building 'eco-collective efficiency' in a South Korean cluster', *Geoforum*, Vol. 90, No. 1, pp.159–173.

Zhang, X., Lovati, M., Vigna, I., Widén, J., Han, M., Gal, C. and Feng, T. (2018) 'A review of urban energy systems at building cluster level incorporating renewable-energy-source (RES) envelope solutions', *Applied Energy*, Vol. 230, pp.1034–1056.