

Independent Terminal Evaluation

Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan

UNIDO project no.: 140116



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

**INDEPENDENT EVALUATION DIVISION
OFFICE OF EVALUATION AND INTERNAL OVERSIGHT**

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Kyrgyz Republic

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Abbreviations and acronyms

Abbreviation	Meaning
AB	Advisory Board
CU	Belarus-Kazakhstan-Russia Customs Union
ERP	Enterprise Resource Planning
EIA	Environmental Impact Assessment
EIU	Economic Intelligence Unit
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
Gosstroy	State Agency of Architecture, Construction and Communal Services under the Government of the Kyrgyz Republic
Kadam 24	Step 24 of KG National Policy (contains some information on construction)
KG	Kyrgyzstan; the Kyrgyz Republic
Kolkhoz	Collective farm
KR	Kyrgyz Republic
KRSU	Kyrgyz-Russian Slavic University
Kumtor	Gold mining enterprise, KG
SMEs	Small and Medium Enterprises
Sovkhoz	State farm
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
WB	World Bank
WTO	World Trade Organization
WUAs	Water Users' Association

Glossary of evaluation-related terms

Term	Definition
Baseline	The situation, prior to an intervention, against which progress can be assessed.
Effect	Intended or unintended change due directly or indirectly to an intervention.
Effectiveness	The extent to which the development intervention's objectives were achieved, or are expected to be achieved.
Efficiency	A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results.
Impact	Positive and negative, intended and non-intended, directly and indirectly, long term effects produced by a development intervention.
Indicator	Quantitative or qualitative factors that provide a means to measure the changes caused by an intervention.
Lessons learned	Generalizations based on evaluation experiences that abstract from the specific circumstances to broader situations.
Logframe (logical framework approach)	Management tool used to facilitate the planning, implementation and evaluation of an intervention. It involves identifying strategic elements (activities, outputs, outcome, impact) and their causal relationships, indicators, and assumptions that may affect success or failure. Based on RBM (results-based management) principles.
Outcome	The likely or achieved (short-term and/or medium-term) effects of an intervention's outputs.
Outputs	The products, capital goods and services which result from an intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes.
Relevance	The extent to which the objectives of an intervention are consistent with beneficiaries' requirements, country needs, global priorities and partners' and donor's policies.
Risks	Factors, normally outside the scope of an intervention, which may affect the achievement of an intervention's objectives.
Sustainability	The continuation of benefits from an intervention, after the development assistance has been completed.
Target groups	The specific individuals or organizations for whose benefit an intervention is undertaken.

Executive summary

The economy of the Kyrgyz Republic, with a population of ca. 6.03 million (of which over half is under the age of 25), has accumulated a range of unresolved economic and socio-economic issues, while facing additional challenges associated with sweeping changes in the global economy and the lack of sustainable development of some economic sectors.

Unemployment rate in Kyrgyzstan decreased to 2.30 % in December from 2.40 % in November of 2017; it averaged 2.64 per cent from 2000 until 2017. Underemployment is widespread, affecting 31% of rural working-age men and 54% of rural working-age women.

The industrial sector in Kyrgyzstan contributed between 14.9 and 16.8 per cent to GDP during 2006-2012 due to increased output in the gold mining, light industry, and electricity, gas and water sectors. Average industrial growth over the period was about 2 per cent, except for 2010 and 2012. Real GDP growth was estimated at 5.5% in 2017, up from 3.8% growth in 2016. Although industry represents a relatively low proportion of GDP, the sector contributes 50 per cent of budget revenues and is an important provider of employment.

Manufacturing industry is the largest contributor to the industrial growth. The textile and food & beverages sectors are the largest contributors to value added. The wood products sector grew by an average annual rate of 37.3 per cent, while textiles, food & beverages, and other manufacturing sectors showed poor growth rates. The output of the metallurgy and food processing industries, the textile and clothing industry, the energy sector, and other non-metallic mineral outputs, constitute over 90 per cent of industrial products in Kyrgyzstan.

Over half the population lives in rural areas and agriculture remains an important sector and source of employment. In 2012, agriculture employed 30.7 per cent of the population. However, salaries in the sector are low.

The services sector has significant potential, especially in the areas of tourism, communications and trade. From a share of around 20 per cent of GDP in the early 1990s, the services sector increased its share to 50 per cent of GDP in 2012 and keeps growing. This also relates to improvements to transport and communication systems.

The Government is still struggling to deliver basic services in various regions of the country. In addition, wide disparities and income

inequalities undermine the country's progress, with poverty concentrated in rural areas. Poverty levels reach 40 per cent in rural areas, where 62 per cent of the population lives.

Building materials. The building materials sector constitutes around 6 per cent of GDP. Activities of enterprises in the sector are mainly based on local raw material resources. Kyrgyzstan has natural deposits of raw materials that partially meet the needs of the building materials sector. Currently, about 200 enterprises are engaged in the production of building materials, employing 10,000 people.

Despite the efforts of the Kyrgyz Government, limited progress has been achieved in addressing the challenges of both *affordable housing* and the *rehabilitation of irrigation systems*, especially in rural areas. The lack of *cost-effective housing* remains a severe problem for the local population, negatively impacting quality of life and access to basic facilities.

Deficient low-cost construction materials also hamper timely reconstruction and repair work of *irrigation canals and drainage systems*, especially in rural areas.

Hence, it was felt necessary to enhance the potential of the country's *building material sector* to address the challenges of affordable housing and rehabilitation of irrigation and drainage systems. The local construction, manufacturing and, indirectly, agricultural sectors face the following constraints:

- Severe shortages of low-cost construction materials;
- Lack of access to energy-efficient and environment-friendly material manufacturing technologies;
- Shortage of adaptable technologies based on local resources of materials and manpower;
- Insufficient institutional support for promoting cost-effective technologies and investment in the material manufacturing sector;
- Unexploited potential for management of wastes/residues from agriculture and industry;
- Lack of employment opportunities leading to poverty.

Housing. The housing sector in Kyrgyzstan has undergone major changes since 1991, including state withdrawal from the direct provision of housing. This was accompanied by decentralization of housing functions to local government, mass housing privatization and increased involvement of the private sector in housing construction. There was a reorientation of housing policy and affordable housing was identified as a priority.

The local construction, manufacturing, and indirectly, agricultural sectors face the constraints of: severe shortages of low-cost building materials; lack of access to energy-efficient and environmentally-friendly material manufacturing technologies; shortage of adaptable technologies based on local resources of materials and manpower; unexploited potential for management of wastes/residues from agriculture and industry; and lack of employment opportunities. Deficient low-cost building materials also hamper timely reconstruction and repair work of irrigation channels and drainage systems, especially in rural areas.

The *National sustainable development strategy* was finalized in 2017, and a new development strategy was developed for the period of 2018-2023. The strategy also describes development programs for the priority sectors of economy and social infrastructure.

There is also a *national strategy for development of the construction sector, covering the 2017-2025 period*. The strategy focuses *i.a.* on the following areas:

- Energy efficiency of buildings and constructions, energy and resource efficient technologies – energy efficiency of existing buildings and constructions, introduction of efficient construction solutions for thermal protection of buildings and constructions, energy and resource energy and resource saving technologies and engineering;
- Housing development sector—development of an institutional framework for creating favourable frameworks for affordable housing—develop construction of the social and cultural facilities, reduce flow-out of the rural population, decrease energy consumption, create a decentralized heating and electric supply, improve the system of housing and communal services;
- Production of construction materials, components and engineering – introduction of best practice in the production of construction materials at existing and new enterprises, resumption of enterprises engaged in the production of local quality construction materials, components and engineering, revival of the enterprises producing equipment and materials which are utilized in construction;

Funded by the Russian Federation and benefiting from public-private partnerships and the UNIDO expertise, the present project addresses the issue of industrial and SME development in the Kyrgyz Republic by promoting affordable, state-of-the art technologies, with a view to primarily assist the rural population of Kyrgyzstan.

The overall objective of the project, “to contribute to promotion of community level job creation and income generating activities through the development and use of cost-effective building materials for housing purposes and for the environmentally sound rehabilitation of water irrigation and drainage system in the rural areas of Kyrgyz Republic”, has been met in its general outlines and as regards the general thrust of the project.

The chance of the project to be fully successful was thwarted by a number of delays, particularly in the procurement of the seven UNIDO-supplied technologies, so that by the end of the project period, some of the processes involved have not had a chance yet to arrive at full operational capability.

The common denominator of all these technologies is Insulation—against inclement weather, rainwater, rough usage, or heat insulation.

Summary of main findings.

The evaluators concluded that:

- (i) the project presently submitted to terminal evaluation demonstrates the farsightedness of all the stakeholders, primarily of the KG Government, the Donor, and UNIDO. The project design was excellent and the multiple expert reports commissioned delivered a wealth of valuable information yet to be fully utilized;
- (ii) the design of the project was highly intelligent and well adapted as to benefit local populations and SMEs by providing locally available building materials. The technologies were responsibly selected so as to maximally benefit both local populations and SMEs by providing locally available building materials;
- (iii) the implementation of the project has recorded several success stories and several tasks yet to be completed. The former included the provision, commissioning, and start-up of machinery for sheep wool deburring (most successful), and for three other technologies (judged moderately or conditionally successful). The latter included the three remaining technologies based on machinery already delivered but yet to be put into operation;
- (iv) the communication channels linking the principal project actors, *i.e.*, Gosstroy, KRSU, the Advisory Board, the UNIDO office as well

as UNIDO HQs could be improved;

- (v) the number of different technologies collected under the umbrella of one single project should be reduced. Particularly, the irrigation canal improvement technology is rather distant from the general orientation of the project;
- (vi) the Smart Build center erected on the KRSU grounds should be widely used not just for training but possibly also *e.g.*, for a conference or seminar devoted to the experience acquired with the seven technologies and with the general approach to tackling the country's needs by this UNIDO project, under the guidance of the Head of UNIDO operations in Kyrgyzstan.

The reviewers' main recommendations mainly to UNIDO and Kyrgyzstan Government but also to the other principal stakeholders of the project:

- (i) Endeavor to extend the project, albeit with a modified focus and scope, by as much as one year to fully exploit its demonstration and promotion potential, or at the least, institute a post-project monitoring period to supervise the completion of the unfinished tasks. For this purpose, re-hire the project team.
- (ii) Invite UNIDO to participate in, and/or to act as the implementing agency for, any future project expansion, extension or follow-up, owing to its wealth of experience in the field, also based on specific the experience acquired with this project;
- (iii) Assuming reasonable steps being taken to ensure that the promotional and synergy potential of the project is not lost once the project has ended, the remaining components will have an opportunity also to succeed and eventually contribute to job creation and technology upgrading at the country level.
- (iv) Impact and sustainability of the project and its various components can only be responsibly assessed after a period of undisturbed operation. That constitutes yet another compelling reason for project extension or follow-up. The thrust of the extension period or the follow-up project could be slightly adjusted though, to focus less on technology proper and more on testing and potential certification of the products manufactured, so as to make it easier for them to succeed in the local marketplace and elsewhere. Considering local manufacture in Kyrgyzstan of at least some of the machinery of the type brought in by UNIDO would be another viable follow-up option. In this

context, paying close attention to market developments in the volatile construction sector is essential. UNIDO through its regional office in Bishkek and through contacts with KRSU should maintain lively contacts with the construction industry scene, in order to foster the basis for a true nationwide and international cooperation.

1. EVALUATION OBJECTIVES, METHODOLOGY AND PROCESS

1.1 Evaluation objectives

These are listed in the reviewers' TOR (Annex 1) and their various aspects were expounded on in detail mainly in Chapter 2.2; yet it is considered worthwhile to restate here the purpose, objectives and scope of the evaluation:

The purpose of the final evaluation was to determine the degree of success of the project in providing assistance to Kyrgyzstan and particularly to its SMEs through delivery of machinery and other benefits, as part of a comprehensive strategy for managing the development of local industries.

The key duties of the International consultant included reviewing project documentation and relevant country background information; determining substantial data in a field mission; and preparing the evaluation report, with inputs from the National Consultant.

The core stage of the terminal evaluation—the field mission—took place during the course of eleven days from 2 to 12 March 2018, preceded and followed by the experts' homework and Inception report [1]. An international expert (21 days, of which 11 days on a field mission to Bishkek and environs) and a national expert (21 days on project site in Bishkek and environs) cooperated on the evaluation. They proceeded according to their respective Terms of Reference to meet the evaluation objectives as spelled out in the TOR (cf. Annex 1).

1.2 Methodology and process

The whole project was assessed from its starting date in October 2014 to its termination by the end of March 2018.

Interviews were conducted as necessary according to the Evaluation work program (Annex 2) and, to some degree, in informal discussions. Meetings were arranged with the local UNIDO representative, two Government agencies, the University

(an important stakeholder of the project), and the beneficiaries from the ranks of local SMEs. These meetings proved useful. The project (management) team members were all of them sourced as resource persons for the Evaluation. There was also a meeting with the donor.

The rating tables as per the TOR (Annex 5) were answered in great detail, not just in these tables but also in the Sections 3.8.1, 3.8.2 and elsewhere. The outcomes, outputs and activities envisaged by the project were examined and compared with the actual results observed during the terminal evaluation, always bearing in mind the previous project experts' reports and the benchmarks which offered themselves based on comparisons with similar projects.

The evaluation work program is shown in Annex 2, the list of persons met can be found in Annex 3 and the list of documents reviewed is shown in Annex 4.

2. COUNTRY AND PROJECT BACKGROUND

2.1 Country background

Population and macroeconomic context. The Kyrgyz Republic, a landlocked country in Central Asia with a population of 5.8 million recently increased to about 6.03 million (according to a 2016 National Statistical Office estimation [2]), is predominately young: over half of population is under the age of 25. Kyrgyzstan is included in the “lower middle-income” group of countries in World Bank rankings [3]. Plenty of useful information and some key indicators are given *e.g.*, in Bertelsmann Stiftung’s Transformation Index [4] and elsewhere such as the World Bank sources, annual World Development Indicators, UNDP, or Human Development Reports.

The Kyrgyz Republic declared its independence in August 1991 and a constitution was approved in 1993 [2]. The country has some oil and gas and a developing gold mining sector, but relies on imports for most of its energy needs [3].

Since the early 1990s, the economy and public services have deteriorated [5], and coupled with a fluctuating policy environment, this has led to an accumulation of unresolved socio-economic issues and increased tension in society. The country had to recover from the turmoil of 2010 and was struggling to establish a stable socio-political situation. Against this background, Kyrgyzstan faces additional challenges associated with sweeping changes in the global economy and the lack of sustainable development of some economic sectors.

On the economic front, developments have been mixed. Fewer people now live below the poverty line, and, in 2014, Kyrgyzstan was 'upgraded' in the World Bank rankings, up from its previous “low income” country listing. Despite this, poverty and economic inequality are still pronounced and increasingly structurally entrenched. Most economic opportunities are concentrated in Bishkek and Osh. Rural areas suffer from high unemployment, decreasing education rates, and declining social services. The vast majority of working-age people continue to move from rural areas to urban areas to earn a living or to Russia and Kazakhstan for seasonal labour.

Unemployment rate in Kyrgyzstan decreased to 2.30 % in December from 2.40 % in November of 2017 [6]. It averaged 2.64 per cent from 2000 until 2017, reaching an all-time high of 3.50 per cent in

December of 2006 and a record low of 2.20 per cent in August of 2015 [7]. According to a different source [8], unemployment is lower in rural than in urban areas, and labor force participation is slightly higher in rural areas. However, underemployment is widespread there, affecting 31% of rural working-age men and 54% of rural working-age women.

Kyrgyzstan's transformation process over the past years has seen a number of both positive and negative developments, but on the whole, the country has not seen any dramatic changes in its scores in political, economic or management indexes. The high levels of economic growth witnessed in the post-independence period, particularly in 2007 and 2008 when annual GDP growth rates reached 8 per cent, ended abruptly by a financial crisis, and in 2009, GDP contracted by 2.9 per cent and by 0.47 per cent in 2010. With an improving political and security situation in 2011, the Kyrgyz economy experienced broad-based GDP growth of 5.7 per cent, with all economic sectors, except the construction industry, witnessing expansion. The slowdown in 2012 was attributed to a decline in production output at the "Kumtor" gold mining enterprise.

The industrial sector in Kyrgyzstan contributed between 14.9 and 16.8 per cent to GDP during 2006-2012 due to increased output in the gold mining, light industry, and electricity, gas and water sectors. Average industrial growth over the period was about 2 per cent, except for 2010 and 2012.

The Economic Intelligence country report on Kyrgyzstan [9] estimates real GDP growth of 5.5% in 2017, up from 3.8% growth in 2016, driven by higher gold production and a recovery in remittances from Russia.

Although industry represents a relatively low proportion of GDP, the sector contributes 50 per cent of budget revenues and is an important provider of employment.

Industry consists of 17 sectors, including mining and 14 sectors in manufacturing. The mining sector represents the lion's share of national industrial value added, notably the output of the Kumtor mining enterprise, which accounted for 10 per cent of GDP in 2011 and 43 per cent of exports.

Manufacturing industry is the largest contributor to the industrial growth with its ratio of 80 per cent. The share of manufacturing value added in GDP reached 11.41 per cent in 2011. In 2010, the textile and food and beverages sectors were the largest contributors to value

added, at 24.1 per cent and 15.47 per cent, respectively. Between 2005 and 2010, the wood products sector grew by an average annual rate of 37.3 per cent, while textiles, food and beverages, and other manufacturing sectors, showed poor growth rates. The output of the metallurgy and food processing industries, the textile and clothing industry, the energy sector, and other non-metallic mineral output, constitute over 90 per cent of industrial products in Kyrgyzstan.

Over half the population lives in rural areas and agriculture remains an important sector and source of employment. In 2012, agriculture represented 18 per cent of GDP, and employed 30.7 per cent of the population. However, salaries in the sector are low, at 51.4 per cent of the national average in 2011.

The services sector has significant potential, especially in the areas of tourism, communications and trade. From a share of around 20 per cent of GDP in the early 1990s, the services sector increased its share to 50 per cent of GDP in 2012 and keeps growing. This expansion was mainly due to growth in the wholesale and retail trade, as well as improvements made to transport and communication systems.

Remittances, mainly from emigrants working in Russia (93.9 per cent of total emigrants in 2011), are a substantial source of income and domestic demand, and constitute around 30 per cent of GDP. However, the value of remittances fluctuates according to external economic factors.

The intensity of deprivation in Kyrgyzstan is 38.8 per cent. The Government is still struggling to deliver basic services in various regions of the country. In addition, wide disparities and income inequalities undermine the country's progress, with poverty concentrated in rural areas. Poverty levels reach 40 per cent in rural areas, where 62 per cent of the population lives.

The Kyrgyz labor market experiences an excess of supply of labor due to release of employees from production sites due to reduction or elimination of commercial enterprises that in 2012 resulted in excess in supply in more than 32 times. According to ILO, the overall unemployment rate for the period 2009-2011 increased from 8.4 per cent to 8.6 per cent. Women constitute 41.3 per cent of the total employed population, with the highest number of employed in the services sector. Manufacturing sector is one of major employer, providing jobs for 46.6 per cent of women. Wage gap between women and men, though, comprise 63.9 per cent of men's wages, and women generally hold lower paid positions than men.

A number of reforms have aimed since 2010 to restore economic and social stability, and to address shortcomings in public governance and investment, including international integration through trade and investment. The Kyrgyz Government has formally requested to join the Belarus-Kazakhstan-Russia Customs Union (CU), but several concerns remain, including compatibility with the country's existing membership in the World Trade Organization (WTO).

Housing. The housing sector in Kyrgyzstan has undergone major changes since 1991, including state withdrawal from the direct provision of housing [10]. This was accompanied by decentralization of housing functions to local government, mass housing privatization and increased involvement of the private sector in housing construction. Mass rural-to-urban migration and natural population growth in the late 2000's increased pressures on urban housing.

Restructuring in the housing sector was followed by a sharp reduction in housing construction and a deterioration of living standards, as well as an increase of construction costs due to a declining building-material industry. Low income households, especially in rural areas, undertake housing renovation works themselves due to limited financial resources and are unable to purchase costly construction materials. Most of the existing housing stock was built during the Soviet era and is in need of repair. Only 40 per cent of rural households have access to running water and 40 per cent are linked to public sewerage systems. Urban areas are in a better situation; 70 per cent have access to running water and sewerage systems, but most buildings are also in need of renovation.

The 2007 Country Development Strategy for 2007-2010, proposed a reorientation of housing policy and identified affordable housing as a priority. However, due to the lack of a comprehensive institutional framework and insufficient financial infrastructure, the Government failed to address the country's housing problems.

Further aggravation of the housing issue took place in 2010 mainly due to unrest in South Kyrgyzstan that destroyed many houses. In the settlements that arose as a result of the conflict and migration movements, houses are built using discarded building material. Since no infrastructure for residential use is available in destroyed settlements, people live without electricity or water supply. While some settlements resemble simple residential areas with brick houses, others are an agglomeration of one-room huts accommodating entire families. During harsh winters, the huts are heated with coal ovens and insulated with plastic bags that close the windows and the partly open roof.

In response to the housing crisis facing the country, the Government introduced a State Program of housing construction until 2010. Similarly, in 2007 a National Program of housing construction for 2008-2010 was approved by the Government. However, the goals of both programs have not been achieved and, in 2008, housing construction decreased significantly.

Thereafter, there was a construction boom in 2013 and 2014, was followed by an economic recession in 2015, when the price of building materials drastically declined. Local production of building materials is mainly centered on the national material resource base, while other building materials are imported mainly from the neighbouring countries. The building materials sector faces several challenges in terms of inefficient management. Due to a lack of financing, the Government is unable to conduct periodic inspections and provide licensing services, leading to unsustainable use of resources and unavailability of reliable sources of building materials. The local construction, manufacturing, and indirectly, agricultural sectors face the constraints of: severe shortages of low-cost building materials; lack of access to energy-efficient and environmentally-friendly material manufacturing technologies; shortage of adaptable technologies based on local resources of materials and manpower; unexploited potential for management of wastes/residues from agriculture and industry; and lack of employment opportunities. Deficient low-cost building materials also hamper timely reconstruction and repair work of irrigation channels and drainage systems, especially in rural areas.

Irrigation. In 2005, irrigation, which is vital for agriculture, covered an estimated area of 1,021,400 ha (full control irrigation). The irrigation system in rural areas of Kyrgyzstan, particularly in the mountainous regions, is mainly based on gravity-flow systems constructed in the late 19th century, although some were subsequently upgraded. During the Soviet period, responsibility for water distribution and maintenance of canals was the responsibility of collectivized landholdings and organized workers—“Kolkhozes” (collective farms) and “Sovkhozes” (state farms).

The irrigation system has undergone several upheavals in recent decades. In the early 1990s following land redistribution, the irrigation system was affected by the difficult transition and the lack of Government and farmers' capacity to cover the operation and maintenance costs of irrigation schemes. This resulted in a rapid deterioration of the water supply infrastructure, including hydraulic structures, dams, head-works and canals. The area covered by

irrigation was drastically reduced and became rain-fed because of high prices of electricity and spare parts for irrigation equipment. The deterioration of higher-order irrigation systems, coupled with a shortage of finance and professional capabilities to adequately address the challenges and develop a new irrigation system, increasingly harmed the agricultural sector.

Currently, the main systems, particularly those downstream of large storage dams are well maintained. The distribution system, though, is generally poorly designed, built and maintained. Distribution efficiency is estimated at 55 per cent, mainly due to the considerable seepage and leakage losses. Irrigation and drainage network in Kyrgyz Republic comprises 12,835 km of canals, of which 82 per cent are earthen, 17 per cent concrete and 1 per cent pipes. The irrigation schemes are subdivided according to technical features as follows:

- Engineered irrigation scheme (40.2 per cent of the area): water-inlet structures on rivers that provide silt protection; the canals are lined.
- Semi-engineered schemes (34.4 per cent): water-inlet structures, but canals are only partly lined and partly equipped with water distribution structures.
- Non-engineered schemes (25.4 per cent): no water-inlets, and canals are not equipped with water distribution structures and are not lined.

The Government is very restricted financially to address the issue while the problem may grow more serious. The main institutions involved in water resources, irrigation and drainage planning and development, the Ministry of Water Resources/Economy and the Ministry of Agriculture are unlikely to be able to maintain and operate the existing drainage system effectively, nor improve or extend it.

The current legal framework for water management in Kyrgyzstan is elaborate, and the management of most secondary canals was transferred to the newly formed Water Users' Association (WUAs).

Building materials. The building materials sector constitutes around 6 per cent of GDP. Activities of enterprises in the sector are mainly based on local raw material resources. Export-oriented products in this sector include cement, sheet glass, walling and facing tiles made of natural stone. Inflows of FDI and local investment facilitated the development of enterprises focusing on the production of import-substituting building materials such as cement, fire bricks, polystyrene concrete, dry concrete mix, and others.

Kyrgyzstan has natural deposits of raw materials that partially meet the needs of the building materials sector. According to the National Sustainable Development Strategy [11], locally available raw materials are used in three cement plants. The building materials industry also includes a number of brick factories and quarries for the extraction of sand and gravel, loam, clay, limestone, basalt and gypsum.

Lately the building materials sector has experienced a certain degree of stabilization. Currently, about 200 enterprises are engaged in the production of building materials, employing 10,000 people. From 2010, an upward trend in building materials output was observed, mainly attributed to the development of new capacities of cement production, and the launch of sheet glass production in 2012. The modernization of existing, and the establishment of new, building materials enterprises are supported by domestic and foreign investments.

Currently, the building materials sector of Kyrgyzstan faces several challenges in terms of inefficient management. Due to a lack of financing, the Government is unable to conduct periodic inspections and provide licensing services, leading to unsustainable use of resources and unavailability of reliable sources of construction materials.

Main challenges. Despite the efforts of the Kyrgyz Government, limited progress has been achieved in addressing the challenges of both *affordable housing* and the *rehabilitation of irrigation systems*, especially in rural areas.

The lack of *cost-effective housing* remains a severe problem for the local population, negatively impacting quality of life and access to basic facilities. Since centralized construction of housing decreased significantly, there is little infrastructure for residential use, with most existing housing requiring repair. Low income households, especially in rural areas, undertake housing renovation work themselves due to limited financial resources and are unable to purchase costly construction materials. The shortage of low-cost building materials negatively affects the availability of affordable housing, particularly for the low-income population in semi-formal settlements. While some semi-formal settlements resemble simple residential areas with brick houses, others constitute an agglomeration of settlements built using discarded building materials.

Deficient low-cost construction materials also hamper timely reconstruction and repair work of *irrigation canals and drainage systems*, especially in rural areas. The irrigation system in Kyrgyzstan

faces several challenges related to secondary salinization, a lack of drainage, waterlogging and erosion that are mainly caused by the low efficiency of irrigation networks due to poor maintenance, deterioration of drainage network and a lack of financial and technical resources to run rehabilitation works.

As a result of the technical consultations held with the project donor (the Russian Federation), it was requested to integrate a component addressing the country's needs in the rehabilitation of the water irrigation systems to the current project proposal on "Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan".

Hence, the potential of the country's *building material sector* to address the challenges of affordable housing and rehabilitation of irrigation and drainage systems is not fully employed. The local construction, manufacturing and, indirectly, agricultural sectors face the following constraints:

- Severe shortages of low-cost construction materials;
- Lack of access to energy-efficient and environment-friendly material manufacturing technologies;
- Shortage of adaptable technologies based on local resources of materials and manpower;
- Insufficient institutional support for promoting cost-effective technologies and investment in the material manufacturing sector;
- Unexploited potential for management of wastes/residues from agriculture and industry;
- Lack of employment opportunities leading to poverty.

National Development Framework. The National sustainable development strategy [11] was finalized in 2017, and a new development strategy was developed. The new strategy is called "*Zhany doorgo 40 kadam*" (*40 steps to new era*) and covers the period of 2018-2023. The strategy is comprised of nine programs, within which 40 steps are described. The following key areas are in the focus of the strategy:

1. Taza koom – clean society, national program on digital transformation of the country
2. Program on good governance, covering the reforms of public administration system
3. Reforms of the electoral process

4. Development of civil society institutions
5. Education and human resources development
6. Development of business, investment and export promotion
7. Quality infrastructure, including energy, city infrastructure, road and transport infrastructure, growth point cities, clean water
8. Foreign policy
9. Rule of law and systems of justice and law enforcement.

The strategy also describes development programs for the priority sectors of economy and social infrastructure:

1. Development of economic welfare – agroindustry and development of cooperatives, irrigation, sustainable tourism, development of industrial potential¹
2. Social development – health and health infrastructure, social equity, culture and science
3. Safety & security and favourable environment – cross-border security, combating terrorism and extremism, cyber security, military security, citizenship and state language policy, environmental safety and climate adaptation

¹ Kadam 24 (Step 24) contains some information on construction:

To secure stability of production in the civil construction sector, measures have to be adopted to enhance the technological level of enterprises in the industrial building materials sector and in the organization of production of high-quality materials, products, and structures capable of competition with imported counterparts (which is important under the conditions of the Eurasian Economic Community).

In order to develop the KG industry, a program of stable industrial development of KG for the 2018-2025 period will be worked out incorporating measures to establish an adequate, viable, and competitive production potential in industry. The said Program is planned to be prepared making use of UNIDO's international experts.

For the purpose of expanding the industrial base of the construction sector, the following steps will be undertaken before 2023:

- (a) increase the volumes of both residential housing and industrial construction;
- (b) modify the housing construction structure to effect a transition to new architectural and building systems, types of buildings, and modern application technologies;
- (c) secure the conditions for building investment and to meet the demand for quality materials, and
- (d) organize the production of new building materials in line with international requirements.

There is also a *national strategy for development of the construction sector, covering the 2017-2025 period*. The strategy focuses on the following areas:

- Improvement of the legal framework, including urban planning legislation, harmonization of land legislation with current regulatory legal acts, issuance of permits and licenses, housing and land legislation and mechanism for withdrawal of land plots and other real property for public needs;
- Architecture and urban planning – development of a master plan, systematizing complex schemes for urban planning and zoning, provision of urban planning documentation, development of the republican registry on urban planning, optimization of the system for state control on urban planning, improving the system of engineering infrastructure, optimization of the “single window”, improving state procurement procedures, and others;
- Research and development policy – development of research and technology potential of the construction industry, provision of seismic safety of existing buildings and constructions;
- Energy efficiency of buildings and constructions, energy and resource efficient technologies – energy efficiency of existing buildings and constructions, introduction of efficient construction solutions for thermal protection of buildings and constructions, energy and resource energy and resource saving technologies and engineering;
- Improving the system of price formation in construction;
- Housing development sector – development of an institutional framework for creating favourable frameworks for affordable housing, develop construction of the social and cultural facilities, reduce flow-out of the rural population, decrease energy consumption, create a decentralized heating and electric supply, improve the system of housing and communal services;
- Production of construction materials, components and engineering – introduction of best practice in the production of construction material at existing and new enterprises, resumption of enterprises engaged in the production of local quality construction materials, components and engineering, revival of the enterprises producing equipment and materials which are utilized in construction;
- Ecological safety and environment protection;
- Employment policy in construction – capacity development and skills improvement of experts in the construction sector.

Reasons for UNIDO assistance. On 5 April 2014, H.E. Mr. T. Sariev, Minister of Economy of the Kyrgyz Republic in his letter to Mr. Li Yong, UNIDO Director-General requested UNIDO to provide technical assistance aiming at creating new jobs, attracting advanced technologies and investment in the construction materials sector. UNIDO intends to work with national counterparts and international partners in order to provide technical assistance for the implementation of national strategies on sustainable and inclusive development, leading to promotion of affordable housing and enhanced irrigation system.

Expected target beneficiaries. The direct beneficiaries of the project would be SMEs operating in the building materials industry of Kyrgyzstan and the broader population through increased access to durable and affordable building materials for housing and agricultural (irrigation) purposes. The primary beneficiaries, thus, would be:

- SME manufacturers interested in the production of cost-effective and prefabricated building materials for housing and irrigation/drainage purposes.
- The construction industry (particularly, semi-skilled and unskilled construction male and female workers) through increased skills on how to operate cost-effective housing machinery and adoption of new building materials. The people of Kyrgyzstan through the adoption of affordable technologies for housing and the rehabilitation of irrigation systems, and related job creation in the local building materials, construction and agricultural sectors.

The following entities will also benefit from the project implementation through increased awareness of innovative, environmentally friendly, energy efficient building materials, their processing technologies and their potential to enhance the capacity of the local construction sector:

- Researchers/technologists engaged in composite materials R&D, process technologies, evaluation and testing, characterization of local raw material resources.
- Decision makers in the manufacturing sector; housing sector; agricultural sector; environment management; energy planning; human resource development for technology management; etc.

The project inception and feasibility phases will determine eligibility criteria, against which project will select a limited number of self-help

groups of entrepreneurs or local manufacturers that will benefit from the pilot transfer of technologies and knowhow for the production of cost-effective building materials. Eligibility criteria may include but not be limited to:

- Financial solvency of the enterprise,
- Being in operation for at least the last three years,
- Potential for employment creation, and
- Potential for innovation and technological spill-over.

Furthermore, in rural Kyrgyzstan, many young people, their parents and even local authorities still see migration, mainly of men, to the capital and subsequently abroad as a good option for securing work and an income for the family. Therefore, too many families in rural areas are headed by women who are dependent on remittances coming from the capital and abroad. The situation has worsened recently because of the financial crisis, as fewer remittances are received and more young workers return jobless and are unable to find a job in the local labor market, further stressing the situation of vulnerable groups. It is therefore imperative to identify alternatives for economic development of rural areas, making use of local resources and ensure sustainable use of these resources, upgrading skills, and strengthening sectors with potential competitive advantages, able to provide decent employment opportunities for young women and men.

Acknowledging this problem and recognizing that the local industries modernization and boosting new productive activities can be a powerful means to promote gender equality, therefore, UNIDO project was expected to emphasize training of women workers in the building materials production and construction industries that it works with.

Counterpart organizations. The main counterpart for the proposed project was originally meant to be the Ministry of Economy of the Kyrgyz Republic. Ministry of Economy is the Government body responsible for the implementation of the National Sustainable Development Strategy for the period 2013-2017, the State Program on Affordable Housing, and other economic policy directed towards sustainable and inclusive economic growth.

The key stakeholders for the project implementation would be:

- The State Agency for Architecture and Construction;
- The Ministry of Agriculture and Irrigation Engineering;
- The Department of Water Resources and Land Improvement;

- The State Agency for Environment Protection and Forestry;
- The State Committee for Geology and Mineral Resources under the Government of the Kyrgyz Republic;
- Water Users' Associations (WUA);
- Universities and R&D institutions dealing with construction, mining and quarrying, and related technologies;
- Business associations, operating in the construction industry, industrial construction materials, water utilities construction;
- Entrepreneurs;
- Local communities.

UNIDO will act in close cooperation with the private sector and relevant state entities, providing training on the operation of cost-effective building component machinery to semi-skilled and unskilled construction workers of local SMEs.

2.2 Project background

The project started in October 2014 and ended in March 2018.

Funded by the Russian Federation and benefiting from public-private partnerships and the UNIDO expertise, the project addresses the issue of industrial and SME development in the Kyrgyz Republic by promoting affordable, state-of-the art technologies, with a view to primarily assist the rural population of Kyrgyzstan.

One of the key strategic development priorities of the National Sustainable Development Strategy for 2013-2017, in analogy to the Medium Term Development Program for 2012-2014 is the promotion of sustainable economic growth and social inclusion. This is to be achieved through industrial infrastructure development, sustainable private sector development, advanced and resource efficient technology promotion, affordable housing provision, rehabilitation and expansion of irrigation systems for agriculture, and sustainable job creation. The Government of the Kyrgyz Republic requested UNIDO to provide technical assistance in the development of a technical assistance project aiming at creating new jobs, attracting advanced technologies and investment in the construction materials sector. The objective of UNIDO technical assistance was to facilitate the promotion of innovative and low-cost sustainable manufacturing technologies and disseminate knowledge in the area of cost effective and environmentally friendly building materials that can be easily absorbed by the local construction industry for housing and irrigation purposes. At the outset, the project was expected to conduct a

feasibility study to identify the best international and locally available technology solutions for the manufacturing of energy efficient, environmentally friendly and cost-effective building materials based on local raw materials. The technologies and know-how identified will be tested on site and used in the construction of low-cost demonstration houses and in the provision of technology solutions for rehabilitating irrigation systems. Modernization of the country's building material sector through adoption of innovative technologies and capacity building activities will facilitate community level job creation and income generating activities in the beneficiary and other related sectors, and improve livelihoods, especially in rural areas.

2.2.1 Project objectives

The development goal is “to contribute to promotion of community level job creation and income generating activities through the development and use of cost-effective building materials for housing purposes and for the environmentally sound rehabilitation of water irrigation and drainage system in the rural areas of Kyrgyz Republic”. By doing so, the project will contribute to the implementation of the National Sustainable Development Strategy of the Kyrgyz Republic for 2013-2017 as well as its follow-up for 2018-2023 [11], the State Program on Affordable Housing in Kyrgyz Republic.

This technical assistance project of UNIDO has two main aims:

1. Promoting innovative, low-cost sustainable manufacturing technologies within the Kyrgyz Republic, and
2. Disseminating knowledge about cost-effective, environmentally friendly building materials that can be easily adopted by local builders for housing and irrigation purposes.

The project was funded by the Russian Federation and is fully consistent with the needs and the priorities set out by the country's government, as per the Kyrgyz Republic's National Sustainable Development Strategy for 2013-2017.

The main project counterparts were the Ministry of Economy of the Kyrgyz Republic (which was represented on the project Advisory board but eventually, has remained inactive) and the State Agency on Architecture, Construction and Communal Services – Gosstroy (which has acted as the Chair of the project Advisory board). Within the framework of the project, UNIDO established a cooperative relationship with the Kyrgyz-Russian Slavic University, which

eventually came to host the project-facilitated Technology Demonstration and Training Center.

The broad objectives of the project cover the identification and exploitation of locally available raw materials through the development of cost-effective, energy-efficient and environmentally friendly building materials and housing technologies. The scope of the project was defined with a special focus on local raw materials, medium-scale technologies, and also skills development, in order to share the benefits to create jobs and develop skills.

For example, in the subproject focused on the production of mud blocks to be used as building materials for rural housing [12], the transfer of know-how and technology to local manufacturers was also facilitated through the establishment of partnerships with a private sector enterprise, which is a project beneficiary in terms of developing expertise in the simple operation of block making machines. The beneficiary enterprise is also expected to serve as a Technology Production Center for local skilled workers, including young experts, students, engineers, and other interested stakeholders. The same applies, with some limitations, to the other beneficiaries, including those from the ranks of SMEs.

Moreover, the project will raise awareness among policy makers, industrialists, academics and civil society about low cost materials solutions, and will serve as a basis for the development of long term objectives by the Government. The project will assist the Government of Kyrgyzstan in improving performance in the housing and irrigation sectors and, at the same time, promote inclusive and sustainable industrial development.

Expected outcome. Local populations and SMEs in building materials sector benefit from the expansion of affordable and innovative technologies for housing and rehabilitation of irrigation systems, and related job and value added creation.

2.2.2 Project justification

The UNIDO approach. UNIDO has over four decades of experience in delivering technical assistance to developing countries and economies in transition. This experience has shown that effective technology management is crucial for industrial development. The proposed approach draws upon UNIDO technical cooperation projects aimed at promotion and effective implementation of know-how and technologies for production of environmentally friendly and energy efficient materials on the basis of sustainable use of locally available resources. These UNIDO projects have helped various countries in Africa, Asia and Latin America to meet low-cost construction and housing needs for low-income populations. UNIDO, as a part of its ongoing programs in the area of materials science and engineering, particularly in the construction sector, have taken steps to support the industrialization process in developing countries by building up capacity for investment promotion and technology transfer, creating awareness among policy makers, industrialists and researchers on new materials and processing technologies.

Based on this technical knowledge and experience, UNIDO identified a number of cost-effective environmentally friendly, and energy efficient technologies that can be sustainably promoted and absorbed in the low-cost construction sector in different countries, based on the following criteria:

- Materials are based on locally available renewable raw material resources, including residues and wastes from industry, forestry, agriculture, natural plant materials and fibres;
- Pre-processing and processing activities generate livelihoods in rural areas;
- Manufacturing technologies are energy efficient and lead to skills upgrading, employment generation and quality products;
- Manufacturing performed by locally trained technicians based on short term training and use of easy to operate equipment;
- Materials and manufactured components reduce/substitute imports of materials.

Due to multiple constraints, the construction industry in the country faces the challenges of material shortages aggravated by rising prices (or market imbalances caused by falling prices). The “traditional material” based manufacturing technologies tend to consume a lot of energy and deplete natural resources of forests and agricultural top

soil. Furthermore, technological development and modernization is increasingly seen by the manufacturing sector as a tool to streamline productivity, protect the environment, enhance energy efficiency, generate employment, upgrade skills and alleviate poverty.

To address the above challenges and contribute to the Government's efforts to achieve the objective of affordable housing, the proposed project seeks to facilitate the transfer of technologies and knowhow on the production of cost-effective construction materials leading to the modernization of domestic enterprises in the construction materials sector, and quality improvement of construction materials produced by local enterprises. One of the proposed technology solutions is to use innovative composite materials based on sustainable use of local resources from forestry, agriculture, natural fibres, plant materials, other locally available sources, such as agricultural and industrial wastes, and good clay and basalt deposits. Alternative materials can also be manufactured using natural fibres as reinforcement in a binder such as cement or polymer.

Besides meeting the needs of the housing sector and irrigation system, industrial production of composite materials would contribute to environmental protection, energy efficiency and employment generation in the building materials manufacturing sector. The environmental impact and energy efficiency of the suggested project activities will be examined also during the feasibility studies to be conducted at the project's initial stage.

Most developing countries are rich in agricultural and natural fibres. Except in a few cases, a large proportion of agricultural waste is used for fuel. Kyrgyzstan's agricultural sector represents over 20 per cent of GDP, and produces large amounts of agricultural waste. Specifically, the country produces substantial amounts of cotton and wheat, and has the potential to exploit *cost-effective housing materials based on sustainable use of agricultural resources*, such as:

- a) Wheat straw boards – used for walls of low-rise buildings and partition walls of high-rise buildings;
- b) Cotton stalk composite – used for fibre boards, panels, door shutters, roofing sheets, autoclaved cement composite, paper, plastering of walls;
- c) Other building materials sourced from agricultural sector (based on a detailed feasibility study).

Natural fibres have excellent physical and mechanical properties and can be utilized more effectively in the development of composite

materials for various building applications. As a reinforcing agent in composite matrices (such as cement and polymer), natural fibres are attracting increasing attention as a cost-effective building product. Natural fibres are abundant locally and are extracted from renewable resources. This will further the objective of providing sustainable, eco-friendly, and affordable housing. Furthermore, the accumulation of unmanaged industrial solid waste, especially in developing countries has resulted in increased environmental concern. The recycling of industrial solid wastes as a sustainable construction material is a viable solution not only to pollution, but also an economical option for the design of green buildings. For Kyrgyzstan, such processes could include: a) Industrial waste that can be turned into Cellular Light Weight Concrete Blocks; b) Other building materials sourced from industrial and quarrying sectors (based on a detailed feasibility study).

UNIDO has expertise in transfer and adaptation of “casting and laying of pre-fabricated channel linings and inter-locking channels for irrigation” technologies in rural areas. The equipment identified for pre-fabricated building components can also be used for production of materials in irrigation and drainage systems when mix composition and mould design is changed. The local population will be trained to produce and use these systems as per the requirements of environmentally sound irrigation. Prefabricated water sheds for storing large quantities of water may also be constructed using proposed housing technologies. Furthermore, the technology will be provided for storage, recycling and distribution of water. The proposed machinery for use in housing construction will be supplemented with other small machinery and moulds for casting and laying of water cannel for rehabilitation of irrigation system.

UNIDO also has experience in technical and institutional capacity building in the area of environmentally friendly and energy-efficient building materials and manufacturing technologies *through the establishment of technology demonstration centers* in the framework of UNIDO national and inter-regional development programs in various countries around the world. These interregional programs have been implemented, inter alia, in cooperation with technology promotion institutions in many countries, including India, China and the Russian Federation. The project will demonstrate how technology diffusion and absorption by local enterprises can be strengthened by integrating public policy with private investment through close cooperation with local authorities and SMEs.

2.2.3 Outputs and activities

The project activities were to include:

1. Detailed technical and economic feasibility study outlining the country's resources and needs and identifying appropriate know-how and technologies for cost-effective building materials demanded by the domestic construction industry and in rural areas and communities. The feasibility study will result in recommendations for specific project activities tailored to the country's needs and technical requirements in housing and rehabilitation of irrigation and drainage systems based on locally available, affordable and eco-friendly raw materials.

Focus will be put on promoting cost-effective, locally competitive and environmentally friendly³⁰ manufacturing technologies and also those aimed at generating employment in various regions of Kyrgyzstan (depending on availability and price range of locally available materials). The feasibility study will pay a special attention to environmental protection and energy efficiency issues of the proposed solutions. This output will also make extensive use of the UNIDO database for available building material technologies. The results of the feasibility study will be shared with the Government in order to raise awareness of the problem and thus contribute to the development of national long-term plans.

o **Activity 1.1:** Visit the field, assess and select local materials such as clay, gypsum, lime stone, basalt, river sand, aggregates, natural fibres and other by-products to convert into value added cost-efficient and environmentally friendly building materials for housing and irrigation purposes. The selection of the raw materials will be also based on Environmental Impact Assessment (EIA) to be conducted in accordance with the national regulations and evaluation of its the sustainability

o **Activity 1.2:** Identify various instruments and machines available locally for manufacturing building materials and assess the possibility using them in the project.

o **Activity 1.3:** Complete a housing need assessment and identify local needs in terms of rain water harvesting, recycling of water, different methodologies for the storage and transportation of water inter alia based on samples and available information.

o **Activity 1.4:** Identify machines for the development of moulds for defining water storage, recycling, and distribution and drainage systems.

- o **Activity 1.5:** Conduct research for the regionally and internationally available advanced know-how, machinery and equipment for manufacturing building materials based on identified needs, environmental impact assessment (EIA), energy and resource efficiency, and collected samples of applicable raw materials.
- o **Activity 1.6:** Identify suitability of identified know-how and technology for the development of building products for construction of affordable housing under this project.
- o **Activity 1.7:** Assess potential for modification and use of various kinds of machines (identified for building components and housing technologies) for the provision of better water storage, recycling, distribution and drainage system.
- o **Activity 1.8:** Identify new and upcoming building materials and housing technologies, which may be adopted in Kyrgyzstan also for adoption by the local entrepreneur in future.
- o **Activity 1.9:** Review existing relevant legal and regulatory frameworks in country and regional context to address possible gaps and barriers for sustainable development of building materials and related sectors.

2. Field testing, adaptation and demonstration of technological processes for cost-effective manufacturing of building materials and components. Field testing and adaptation of equipment will ensure that any technologies transferred as part of the project will be appropriate for the end users. These technologies will provide cheaper alternatives to imported building materials and will be used by the local construction industry in Kyrgyzstan.

- o **Activity 2.1:** Procure equipment for further testing and adapt acquired technological processes to use as per local conditions (including specific properties of identified raw materials, local building materials and building systems).
- o **Activity 2.2:** Test developed building materials and building systems in the laboratory and field to verify (i) their various properties as per the requirement of the building codes and building design; and (ii) the implementation of demonstration housing building for seismic and other parameter required for the cost-effective housing.
- o **Activity 2.3:** Identify local networking partners for the dissemination of technology at the field level and its documentation.
- o **Activity 2.4:** Adapt appropriate and affordable building materials with the support of employment generating housing machines and technologies.
- o **Activity 2.5:** Adapt the same machineries for creating building components for irrigation and drainage purposes with special application requirements. The machinery will be adapted to develop

moulds for generating building components for channel lining, rain water harvesting, water recycling, distribution and drainage systems.

3. Transfer of know-how and technology to local manufacturers for production through the training of local engineers, skilled and semi-skilled workers, entrepreneurs in building materials sector, and construction supervisors from Kyrgyzstan. Training will provide both male and female skilled manpower able to operate and maintain the machinery that will be demonstrated and disseminated among participating communities as part of the project. As the machinery is relatively simple to operate – with production remaining labour intensive – technology transfer of these machines will decrease the cost of housing while creating joint employment opportunities. All training for experts from support institutions and companies will be developed and rolled out in a way that they will be accessible to men and women alike (taking into account possible constraints of female workers in the context of machine maintenance/operations and handling of heavy loads, etc.).

- o **Activity 3.1:** Establish a national capacity for technology demonstration and training of the local construction workforce for learning and adoption of identified and developed housing technologies. The training and demonstration capacity will be established within the premises of an existing vocational training institution, sectoral association or local municipality administration to be identified during the feasibility study phase of the project in close consultations with local authorities of the Kyrgyz Republic.

- o **Activity 3.2:** Identify, select and train local construction workers, engineers, and staff of local agencies and other stakeholders on the production of building materials to ensure their further participation in the construction of demonstration buildings and rehabilitation of pilot irrigation and drainage objects as per applicable codes and standards in the country.

- o **Activity 3.3:** Create a national technology information base with the 15 to 20 new and emerging technologies for housing and building material production with required technical know-how, technology providers, researchers and companies, so that further building industry growth may be maintained with the support of local agencies, technology database and local entrepreneurs.

- o **Activity 3.4:** Develop appropriate methods and techniques for various systems of rainwater harvesting, recycling of water, different methodology for storage, transportation and drainage of water.

- o **Activity 3.5:** With the support of trained experts, develop few pilot project studies for their further implementation at ground level.

4. Construction of demonstration houses and delivery of technology solutions for rehabilitation of pilot irrigation and

drainage objects using the new building technologies, aforementioned machines and production methods; and **communication of developed manufacturing practices** through the development of promotional materials and organization of advocacy events. The demonstration objects will be used in trainings to demonstrate various technologies and techniques.

o **Activity 4.1:** Based on results of Output 2, select the equipment and materials for production from the identified technologies and local raw resources considering their sustainable consumption for the required types of building components for housing, irrigation and drainage purposes.

o **Activity 4.2:** Develop pre-fabricated building components for housing, irrigation and drainage purposes and standardize as per local conditions.

o **Activity 4.3:** Conduct field level implementation through the construction of demonstration buildings at the national capacity for technology demonstration and training; and deliver technology solutions and capacity building activities on irrigation, drainage, water distribution and recycling for pilot irrigation objects as per the codes and standards applicable in the country and using identified and developed building materials.

o **Activity 4.4:** Organization of awareness and dissemination events through information briefings, seminars, and a final press-conference to communicate project results and manufacturing practices generated. The activity will also facilitate public-private dialogue as a means to strengthen policy making at the national level.

o **Activity 4.5:** Preparation a brochure, catalogue and, if possible, training module for streamlining project communication for future.

The above outputs/activities were to be implemented by the project technical team composed of international and national experts. Considering traditional economic and industrial ties between the Kyrgyz Republic and the Russian Federation, the project would also seek to benefit from qualified international expertise from the Russian Federation and to involve Russian research centers specializing in development of new low-cost building materials.

The basic ideas underlying the project are greatly bolstered by the Declaration of commitment [13] (part of the [Development Assistance Framework 2018-2022](#)), whereby the Government of the Kyrgyz Republic (GKR) and the United Nations are committed to working together to achieve the country's national vision and priorities. This GKR-UN Development Assistance Framework (UNDAF) will guide the work of the GKR, the UN Country Team (UNCT), and their partnerships until 2022. It builds on the successes of the previous UNDAF and continues the *Delivering-as-One* approach. It bolsters the

strong relationships between the partners to work in concert to achieve country strategic priorities, the Sustainable Development Goals (SDGs), and the country's human rights commitments and other internationally agreed development goals and treaty obligations.

The four expected outcomes of this UNDAF were identified jointly by the GKR, the UN, civil society and other development partners. They concern:

- I. Sustainable and inclusive economic growth
- II. Good Governance and rule of law
- III. Environment, climate change, and disaster risk management
- IV. Social sector development (social and child protection, health and education).

Of these, the outcomes I., III., and IV are directly related to the present project.

2.2.4 Organizational arrangements

The following issues were considered:

- Coordination and management of a complex system involving the distribution of seven different technologies and other benefits;
- Establishment of systems and facilities, procurement, delivery, and utilization of the technologies;
- Provision of policy, legislative, and business instruments;
- Exchange of experience and training;
- Potential synergies; and
- Monitoring and assessment of the outcome of individual actions taken.

3. PROJECT FINDINGS AND ASSESSMENT

The TOR required the reviewers to approach this basically capacity building, and management-intensive project from several fundamental angles, including

- assessing project design and execution;
- determining the relevance of the project;
- evaluating its effectiveness and efficiency; and
- taking a position regarding project sustainability.

Each of these would then break down into a number of subject areas and items to be identified, determined, documented and judged – see the following chapters and also the Rating tables in Annex 6.

3.1 Findings based on documentation

The aspects covered in this Section include (i) legislation; (ii) financing; (iii) procurement and allocation of machinery; (iv) agreement between the principal stakeholders; (v) the mission reports; (vi) the Midterm review; and (vii) the needs assessments.

3.1.1 Legislation

Sustainable construction is an emerging concept aiming at incorporating the general sustainable development concepts into conventional practices of construction industry. While knowledge in this field is continuously expanding around the world, in Kyrgyzstan sustainable construction practices are not yet widely applied in the building industry.

In the country, the building materials may fall into these categories: a) produced from local raw materials to meet the local consumers, b) produced from available raw materials to be exported, c) produced from imported raw materials for the local markets, or d) imported off-the-shelf.

Two types of certification exist: voluntary according to the will of purveyor and obligatory according to the list attached to the technical regulation, containing 16 types of building products along with their subtype materials. There are still some limitations as follows:

- Regulations are generalized and termed in a declarative manner

- Some confusions about voluntary and obligatory certifications (*e.g.* locally produced slated roof (asbestos) falls under obligatory certification, while imported metallic low quality roofing in voluntary)
- Limited technical capacity of existing labs for arranging ecological safety
- Public accessibility of information about certain certified “certain” materials is doubtful.
- Private certification or compliance centers exist in the country to a limited extent.

The State Inspectorate for Ecological and Technical Safety Supervision is in charge of supervision and oversight in the field of environmental protection.

No Government policy document specifically focusing on the development or support to building material industry is in place. Draft Strategy for construction industry development for 2014-2017 is pending approval. The draft contains very little emphasis on policy of construction materials.

Entering the Customs Union provoked the need to harmonize regulations and codes throughout the Union, with some initiatives already taking place.

Recommendations:

- Work out the parameters for environmentally preferable materials to be applied while assessing building materials. Selection criteria include a wide range of environmental issues
- Support Government in their initiatives for implementation of sustainable construction through positive changes at policy level
- Awareness raising events and seminars about sustainable construction for stakeholders. These platforms could be also used to outline technical foundations of life cycle thinking, opportunities and benefits and challenges. Further step could be support by the project to streamline laws, regulations and institutions to improve national capacities to implement laws and improve analysis and PPD in reorientation of building sector towards sustainability
- Explore possibilities for creating eco-monitor or environmental profiling of locally produced building materials to be also available in Gosstroy website.

The 2015 paper [14] by T. Usubalieva (National expert) and F. Alimdjanov (Project Manager) presents the key findings and

characteristics of the current state of affairs as at 2015 concerning the building materials sector in Kyrgyzstan with the main attributes of sustainability—in fulfilling Activity 1.9 of the UNIDO Project.

The document [14] concludes that Technical Regulations constitute the legal basis for the risk-based inspection regime that is gradually being introduced in the Kyrgyz Republic. These include:

- Law of the KR Technical Regulation Safety of Building Materials, Installations and Structures", No. 18, dated 29 January 2010
- Regulation of KR Government "Technical Regulation On Safety of Construction of Buildings for Various Purposes from Modern Pre-Fabricated Structures and Materials, No. 143, dated
- Law of the KR "Technical Regulation "Safety of Buildings and Constructions" No. 57, dated 27 June 2011

The Technical regulation on "Safety of construction materials, products and constructions" remains the main regulatory document in assuring the building materials compliance , thus in implementation of the Law No. 18 of the Kyrgyz Republic, of 29 January 2010. It calls for ensuring safety of building materials and standards and rules that are to be followed during all stages of building material life cycle.

The document [14] recommended that:

- under the project, the parameters of Environmentally Preferable materials should be worked out against which the building materials manufactured with environmental considerations under the project would be assessed. The selection criteria include sustainability in regard to a wide range of environmental issues: raw material extraction and harvesting, manufacturing processes, construction techniques, and disposal of demolition waste.
- The Project could support the government offices in their initiatives for implementation of sustainable construction in building projects.
- A series of trainings and awareness events about sustainable construction and building in general could be provided for all construction sector actors, outlining the technical foundations of life cycle thinking, opportunities, benefits and challenges, so that the project could provide inputs to streamlining laws and regulations and to reorient the public-private dialogue in the building sector toward sustainability; this could be valuable

e.g., for the staff at Gosstroy and State inspectorate for ecological and technical safety.

- The project could also explore the possibilities of eco-monitoring or environmental profiling of locally produced building materials, further to be available in the website of Gosstroy.

3.1.2 Financing

The project was financed by the Government of the Russian Federation, to the tune of USD 2,000,000. The Kyrgyzstan Government pledged a contribution in kind [59].

3.1.3 Procurement and allocation of machinery

A list of beneficiaries [15] gives details of the transfer of equipment; the following equipment supplied under the project has been included:

1. Hydroform interlocking hydraulic block making machine with integrated pan mixer (2 pcs), hereinafter "mud brick press"
2. Sheep wool processing, washing wool deburring and needle punching machine, hereinafter "wool deburring machine"
3. Thermal modification chamber, hereinafter "wood modification oven"
4. Straw mats knitting machine
5. Mobile shotcrete application machine
6. Natural stone splitting machine, hereinafter "stone splitter"
7. Roofing, flooring and siding tiles extruding machine, hereinafter "tiles extruder"

Additionally, a Toyota Landcruiser vehicle to service the seven facilities.

3.1.4 The Gosstroy–University Memorandum of Understanding

The objective of the Memorandum of Understanding between Gosstroy and KRSU [16] was to establish a common framework for cooperation and joint implementation of the UNIDO project, in an effort to undertake complementary and/or joint activities in the area of facilitation, identification and production of new and alternative cost-effective and eco-friendly building materials and related capacity building and dissemination activities. To support implementation of the MoU the Parties agreed to have direct contracts.

Key elements: training and demonstration center to be established at KRSU which is the owner of all equipment and buildings, technological documentation and facilities obtained and developed during project implementation. KRSU is to provide indoor and outdoor space, basic utilities and human resources, Gosstroy is to provide testing of the proposed and adopted technologies and materials, and to take care of drafting the normative documents and technical regulations where required; both parties are to contribute to seminars, technical workshops and training programs. The MoU was agreed for a period of 30 months, with possible renewal.

3.1.5 Mission reports

For coordination and implementation of the project activities, two project managers were assigned from UNIDO HQ. After each trip to Bishkek, the managers produced back-to-office mission reports [17-24] outlining activities and any results/achievements accomplished during the mission.

Mission report for 19-25 Oct 2014 by Farrukh Alimdjanov [22]

The tasks of the mission included i) interviews with potential candidates to be recruited by the project; ii) research into the basic needs in housing and socio-economic factors; iii) exploring possibilities for community level involvement and understanding requirements of technologies and equipment for irrigation; iv) identifying local building materials and raw materials, incl. waste; v) networking and consultations with stakeholders.

Results

Gosstroy: Willingness of Gosstroy to cooperate with the project and commitment to provide office space for the project. Information on standards and certification processes received from Certification center of Gosstroy. Ready to support fast certification system. State

institute of seismic construction and engineering design ready to support design and documentation of the commercial housing activity within the project, their outdoor premises to be considered for demo center.

Ministry of Economy: State Program on Affordable Housing for 2012-2014 drafted, possibly not yet finalized (?), inter-sectoral committee working on the state program consists of high level Government officials, the list to be shared with UNIDO.

Academicians: Information on local raw materials obtained.

Bishkek city administration: Main issues faced by the city administration were shared, particularly random housing construction in slum areas and absence of public toilets.

Government (incl. various ministries): site for the demo center to be suggested by the Government, irrigation and its maintenance and rehabilitation are the priority issue for the country. Awareness and dissemination of information on affordable and eco-friendly housing technologies are important factors. Short overview of the irrigation system and condition received from the Ministry of Agriculture.

Private sector involvement discussed.

Representatives of Russian Embassy: implementation to be coordinated with Trade Counsellor, center of expertise and assessment recommended for cooperation

Donor agencies: possible synergies and cooperation discussed, to be further explored.

Mission report for 9-12 Feb 2015 by Farrukh Alimdjanov [19]

Objectives: i) Holding the first meeting of AB; ii) exploring a potential site for TDC; iii) networking with stakeholders and partners and exploring potential synergies and complementarities; and iv) assessing potential and institutional needs for initiating project in textile and garments sector.

Results and accomplishments:

AB ToR and composition discussed and approved. AB also endorsed plan of operations for 2015.

Government: update on the project implementation and discussions of potential subprojects (support to the textile and garments sector); joint participation in Bishkek Build Expo to be explored;

Educational institutions/vocational schools: possibilities of cooperation and setting up of the demo center.

Mission report for 23-24 June 2015 by Farrukh Alimdjanov [18]

Objectives of the mission: i) second AB meeting and validation of the technologies included in 2nd tender; ii) meeting with KRSU to establish cooperation and TDC at the University; iii) networking with stakeholders and partners and searching synergies and cooperation; and iv) assessing potential and needs for initiating the project in the textile and garments sector.

Results and accomplishments

The 2nd AB meeting approved list of technologies to be procured under the 2nd tender, including fly ash blocks, agro-waste based fibre boards, permanent formwork panels, sheep wool insulation material and roofing material from recycled tires. The project planned also to study existing local production technology of burnt brick to look for opportunities for optimizing and improving their production.

MoU signed between KRSU and Gosstroy on cooperation in establishment of TDC at KRSU.

Mission report for 25-28 November 2015 by F. Alimdjanov and A. Isaksson [21]

Objective: 1) update Russian Embassy and KRSU on project progress and explore further cooperation on setting up of the Demo center at KRSU; 2) participate in 3rd AB meeting; 3) visit project beneficiary Tabysh Ltd.; and network with stakeholders and partners and searching for synergies and cooperation.

Accomplishments

Discussions with Russian Embassy and KRSU on establishment of the Demo center resulted in agreeing in-kind contribution of KRSU, which includes manpower to operate and maintain the equipment; raw materials infrastructure for accommodating the equipment; organization and delivery of the joint trainings, research activities, economic assessment studies, technical economic feasibility reports for dissemination and capacity development; support dissemination and awareness raising; elaboration of education curricular based on findings and results achieved within the project; organization of access to demo center for all interested, including private sector, university graduates, community members; necessary permissions related to health, safety and environmental regulations as per national legislation, to install and operate the equipment; all necessary arrangements for safety and security of the machinery and technologies; and support to UNIDO with required additional equipment for testing of raw materials or finished products.

Delivery of the mud stabilized block producing machine to Tabysh Ltd., with positive feedback from AB; proper mixture of ingredients to be proposed for the local market. Visit to Tabysh Ltd.

Mission report for 11-17 April 2016. Munich by Amit Rai [23]

Objective: Attending Building materials and construction machinery exhibition, Munich, and UNIDO HQ, Austria.

Accomplishments

Various products and technologies observed at the exhibition, discussions with companies offering innovative and housing technologies on adoption in the ongoing project, participated in the team meeting in UNIDO HQ to discuss and resolve various issues related to project implementation as well as procurement issues; visited art housing technology demonstration site in Vienna for exchange of experience. Three European companies were identified for immediate interaction and follow-up communication.

Mission report for 8-10 Nov 2016 by Farrukh Alimdjanov [24]

Objective: update donor representative on project progress; discuss project activities with key partners (Gosstroy and KRSU); network with Government offices and stakeholders to explore synergies and cooperation; participate in 4th AB meeting.

Results and accomplishments

Meetings with project partners and beneficiaries to present and discuss project progress and implementation modes.

The 4th AB meeting was conducted, where progress to date was presented; the list of technologies/equipment for procurement was approved.

Mission report for 2-5 Oct 2017 by Farrukh Alimdjanov [20]

Objective: i) opening ceremony of UNIDO TDC Smart Build Center, ii) updating partners and donor representatives on the progress, iii) visiting project beneficiaries (private enterprises), and iv) attending the 5th AB meeting.

Results and accomplishments

The project "TDC Smart Build Center" at KRSU officially launched on 3 Oct 2017. The 5th AB meeting was conducted, where interim progress report and UNIDO technology database were presented. The list of proposed equipment/technologies was approved at the meeting.

New agreements on manufacturing mud stabilized bricks were reached. Project will cooperate with KRSU to research and investigate optimal composition for these block/bricks.

3.1.6 The Mid-term review

The Mid-term review was conducted on 8 March-8 May 2017, approximately 5 months behind schedule due to overloaded project activities, applying a 'mixed approach': using an external consultant supervised by two co-implementation project managers.

Objectives of the review¹:

1. Review project design/assumptions in view of changed circumstances and adjust it accordingly;
2. Enhance transparency and dialogue among stakeholders;
3. Confirm achievement level of outputs and prospects for achieving outcomes by the end of the project;
4. Gain insights on the implementation process;
5. Assess the project according to evaluation criteria—relevance, effectiveness, efficiency, impact and sustainability; and
6. Draw up recommendation for improvement of the project in achieving the outcome and identify lessons learnt.

The project was assessed in line with five evaluation criteria according to 5 levels: highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory and unsatisfactory. The project has high relevance assessed from its consistency with Kyrgyzstan's development policies and construction industry development policies, country' needs of affordable building materials, UNIDO development assistance policies and donor policies.

Effectiveness of the project at the level of the Midterm review [10,25,26] was assessed as moderately satisfactory since four outputs were expected to be achieved or partially achieved, and objectively verifiable indicators for expected outcome would be partially achieved. The efficiency of the project was ranked as moderately satisfactory. While many inputs have been implemented as scheduled or with slight delays, there have been several factors that have decreased efficiency of project implementation. At the time of the review it was difficult to evaluate the impact of the project, since it was too early to assess the probability of achieving development goal. Sustainability is also ranked as moderately satisfactory by institutional/organizational, financial, technical and other points of

¹ Midterm review of the UNIDO project "Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan, UNIDO ERP ID: 140116, May 2017 (50pp)

view. To enhance the achievement of the expected outcome the following recommendations were made:

For UNIDO (Project team):

- Consider extension until March 2018
- Finalize feasibility study by 31 May 2017
- Assist Tabysh LTD in finding better composition of mud stabilized blocks/brick as walling material or filler
- Assist Tumar Art Group in producing heat and acoustic insulation material
- Complete the 3rd procurement and identify beneficiaries in parallel
- Prepare a plan of training, conduct series of training upon completion of 3rd procurement
- Develop technical manuals upon completion of the 3rd procurement
- Review schedule and complete construction of demo houses at earliest possible
- Plan preparation and development of the promotion material upon completion of the 3rd procurement
- Consider and revise the logframe and discuss it with stakeholders in a timely manner
- For monitoring: i) prepare action plan for follow up with indication of responsible staff member and follow up on progress; ii) collect data according to OVI in the logframe
- Hold Abs more frequently

UNIDO and Gosstroy:

- Develop technology information database of locally available building materials and housing technologies with further hand over to Gosstroy

UNIDO, Gosstroy and KRSU:

- Develop a plan for demonstration/dissemination of the project adopted technologies, as well as medium term dissemination strategy with the effective use of TDC
- Secure cooperation framework between Gosstroy and KRUS beyond project duration

Medium to long-term

Gosstroy and Min. of Economy:

- Introduce legislation towards standardization of emerging building materials and housing technologies and promotion of SME in relevant sector

UNIDO:

- Streamline approval processes (such as procurement) at UNIDO headquarters for timely implementation of the project

Lessons learnt:

- Conduct preliminary survey or allot certain time for baseline data analysis, in for data is available before launch of the project
- Take into account local geographical and climate conditions in designing projects on transfer of cost-effective, environmentally friendly and energy efficient housing technologies
- Throughout implementation of the project bearing in mind that market is constantly evolving, properly assess market needs and appropriately reflect those in project activities.

The following source of information and data were used in the review: documents agreed prior to or agreed during the project implementation, statistical data, record of project inputs and activities, responses gained through questionnaires from project managers, project team and other key stakeholders both Government and private [27], and interviews with project managers and team, and other key stakeholders. Interviews were conducted via Skype with no direct observations on the project site. Via the questionnaires [27], questions were asked relating to Project implementation process and Project design and to the five evaluation criteria, *i.e.* Relevance, Effectiveness, Efficiency, Impact and Sustainability. The fate of these questionnaires is not known, so it was assumed that the questions were just asked orally and based on the answers the expert (Ms. Kaori) wrote her Midterm report [10].

Inputs from UNIDO included: personnel for the project implementation – 2 project managers and 1 international consultant from HQ, international consultant/team leader and 2 national experts and 1 project assistant; establishment and strengthening on TDC furnished and equipped with video conference system, library and other equipment; equipment and machinery Hydraform (2 sets) and wool deburring machine (1 set). Total expenditure amounted at 1,283,804.52 USD as of 7 March 2017.

Kyrgyzstan contribution was done in kind – office space in Gosstroy.

Activities progress:

1. Technical and economic feasibility study:
 - field visits, assessment and selection of the raw materials – completed

- identify various instruments and machines – completed
 - complete housing needs assessment and identify local needs in rain water harvesting, water recycling, etc. – completed
 - identify machines for development moulds for water storage, recycling, distribution and drainage systems - completed
 - research on international and regional know-how, machinery and equipment – completed
 - check suitability of identified know-how and technology to be adopted by the project– completed
 - assess potential for modification and use of different machines (for building material production) for water storage, recycling, distribution and drainage system – completed
 - identify new and upcoming building materials and housing technologies– completed
 - review existing legal framework and barriers – completed
2. Field testing adaptation and demonstration:
- Procure equipment for further testing and adopting – in process
 - Test developed building materials in the lab and field – in process
 - identify local networking partners for dissemination – in process
 - adapt appropriate and affordable building materials – in process
 - adapt the same machinery for creating building components for irrigation and drainage – in process
3. transfer know-how and technologies for local manufactures:
- establish national capacity for technology demonstration and training – in process
 - identify, select and train local construction workers, engineers and other stakeholders – in process
 - create national technology database containing 15 to 20 new and emerging technologies – in process
 - develop appropriate methods and tools for rain water harvesting, water recycling, transportation and storage – in process
 - develop few pilot project studies – in process
4. construction of demo houses and rehabilitation of the pilot irrigation and drainage object:
- select equipment and material – in process (based on Output 2)
 - develop pre-fabricated building components – in process
 - conduct field level implementation through construction of the demo houses – in process
 - organize awareness and dissemination events – in process

- prepare brochure, catalogue and possible training module on streamlining project communication in the future – in process
- While activities under Output 1 were completed, activities within outputs 2 and 3 were implemented almost yearly, which led to delay of the subsequent activities.

Delays

- Feasibility study to be finalized by 31 May 2017
- Better composition of mud stabilized blocks is still not identified. Development of sheep wool insulation material also pending
- Third procurement and selection of beneficiaries are still pending
- TDC will be completed with delay (May 2017)
- Training on the procured machines and education material upon procurement under 3rd tender
- Technology information database will be developed
- Demo houses to be constructed using adopted building materials and technologies.

At the inception phase of the project, certain time was taken to identify partners, which led to the delay in starting of the planned activities. Procurement approval as per UNIDO procedures took significant time, which hindered subsequent activities related to testing and adopting and further.

Output 1: survey was conducted to assess availability of local raw material, identify appropriate technologies and collect data on local companies. By the time of the review no feasibility study was completed.

Responses of the experts suggested to ensure feasibility study to be conducted with full involvement of the private sector with the report available at the initial stage of the project, schedule of the study to be discussed and agreed with project team and key stakeholders. There were also opinions that such studies should be a continuous process as market is constantly evolving and needs are changing.

OVI 1.1 – n/a, but the report to be finalized

OVI 1.2 – to be achieved, 12 cost effective building materials to be identified, total procurements under all three tenders consider procurement of 17 technologies/equipment.

Output 2: anticipated to be partially achieved by the end of the project. The technologies were procured and tested, adaptability of the rest of the technologies is unknown. In view of time resources needed for testing and adopting, the project needs to accelerate activities under this output.

OVI 2.1 – n/a, field test results availability—not clear

OVI 2.2 – to be partially achieved. Two technologies were procured and are being tested against 4 to be procured and adapted and tested (as set by the project manager for the midterm review). Procurement of further four or five is under process. Some Gosstroy lab testing is done for the mud stabilized block, with the rest pending. Certification of these blocks as walling material is under question due to the fact that mud stabilized blocks are recommended as filler. The company still needs to find better composition to reduce costs (fly ash as an alternative to cement was rejected by AB). Mud stabilized blocks were found useless for repair of irrigation canals. Another set of equipment on production of mud stabilized blocks was provided to KRSU. Given the recent confirmation of the set of equipment provided and to be provided to KRSU, they haven't yet prepared space to house all set of equipment. Thus first set of equipment was not put into production line nor used for educational purposes. No collaboration was observed between Tabysh and KRSU. Tumar Art Group, which received wool deburring machine for production of heat and acoustic insulation material are testing it and aim to obtain Gosstroy certification.

Output 3: to be achieved. Additional OVI “developed education material” is suggested. Indicator on this output doesn't contain number of people to be trained, with no training plan observed by the evaluator. Trainings were conducted for the receivers of the first two technologies – Tabysh LTD, Tumar Art Group and KRSU.

OVI 3.1 – to be achieved. Training on to be procured technologies will be organized and delivered, but no plan detailing purpose, subject, etc. was developed. Two manuals – on installation and operation of the equipment and on mud stabilized technology were developed. More manuals will be developed for the technologies to be procured.

OVI 3.2 – to be achieved. The database development is under process. Project team plans to develop web portal containing approximately 50 locally available technologies. The project needs to discuss and agree with Gosstroy further maintenance and update of the database.

Output 4: is anticipated to be partially achieved. Additional OVI “developed promotion material” is suggested.

OVI 4.1 – not to be achieved. Design is ready, estimated duration of the construction is 6 months, mud stabilized blocks will only be produced in warm season, therefore according to some interviewees the construction will not be completed by the end of the project.

OVI 4.2 – to be achieved. The technology of shotcrete is considered as relatively reasonable option and is under procurement.

OVI 4.3 – to be achieved. TDC is set up and furnished with necessary equipment and materials. KRSU plans starting utilization of the TDC for educational purposes at earliest in 2017.

For dissemination and awareness raising purposes project attended/participated in number of public events, like sector exhibitions/fairs, business meetings and forums. There were also some media coverage of the project.

Expected outcome: if modified from “local population and SMEs in building materials sector benefit...” to “SMEs in building materials sector benefit” will be partially achieved. Modifications to the OVI are also suggested: OVI 2 doesn’t indicate how many alternative building materials were expected to be provided by the project, it is proposed to modify it as follows “promoted to the market”, OVI 3 is suggested to be modified as “increased access to and enhanced knowledge ...”.

OVI 1 n/a

OVI 2 to be partially achieved.

OVI 3 to be partially developed.

Development goal: too early to judge achievement of the development goal within three to five years after project completion. Achievement of development goal depends to cooperation between key partners beyond the project. Moreover as reflected in the logframe the Government should continue efforts for structural reforms and other arrangements for development of cost-effective building materials and promotion of SMEs.

“community level job creation” to be rephrased to “job creation”.

OVI: n/a. It is suggested to replace the current OVI with two OVIs 1) newly created income generating activities, and 2) the number of jobs created in building materials. The target for the 2nd indicator to be determined immediately and shared with the project partners to ensure takeover of data collection on this indicator according to agreed regularity.

Revised logframe [32]— it is not clear whether it has ever been officially approved—but the changes made to logframe were of minor impact anyway.

According to information coming from the project team, the four questionnaires [27] were used by Ms. Kaori during the Midterm evaluation mission conducted in March 2017. They were used during the interviews with project team, Government representatives, private sector, and other beneficiaries. Midterm evaluation report was developed based on these questionnaires.

3.1.7 Needs assessment

Various needs assessments were carried out under the project. These include Options for rain water harvesting for housing and agricultural fields [28,29], needs assessment and possibilities for utilizing

agricultural waste for development of value added materials [30], needs assessment and possibilities for adoption of cost effective and emerging housing technologies [31].

Needs assessment and possibilities for adoption of cost effective and emerging housing technologies (March 2015). Since 1991 Kyrgyz housing sector undergone major restructuring within the overall transition towards market economy [31]. Changes include withdrawal of the State from direct housing provision, decentralization to local government, mass privatization of houses and increased involvement of the private sector in housing construction. State of housing deteriorated, deterioration is linked to high poverty rate. Housing issues are further affected by mass rural-to-urban migration and natural population growth.

In 2007 the Country Development Strategy for 2007-2010 declared affordable housing to be a priority topic. Integrating housing into overall national strategy represented major progress, but due to underpinning housing objectives by a comprehensive institutional framework and appropriate financial infrastructure, the strategy failed to address the diverse housing needs of the population. The State Agency for Registration of Rights to Immovable Property (Gosregister), Agency for Architecture and Construction (Gosstroy) and Agency for Environmental Protection are state departments responsible for housing and land management. Effective cooperation between them is not in place (as per requirements of the National Program on Housing Construction for 2008-2010 [10,31,32]). A special government body to formulate and oversee the overall institutional framework for the development of the housing sector should be developed.

At the national level—the National program on housing construction for 2008-2010, as well as at the local level—housing and land management, are based on cooperation between local state administrations (as per 2002 Act on local self-governance and local state administration, to coordinate decisions on all matters of territorial development with local councils (local self-governance) and government bodies. At the community level, condominium associations are responsible for maintenance of the privatized multi-apartment residential buildings. Despite the fact that the 1996 Civil Code contains rules for organizing housing maintenance and management, the 1997 Act on Condominiums, the role of this institution remains limited, with only 25% of condominiums established homeowners' associations by 2005.

Decision making in housing and land management should be based on delegation of power to regional/local governments and

communities/residents. Capacity building is needed to enable lower levels of government play a more strategic role in their territories.

Housing conditions and new housing construction. A major challenge - decision-making in housing remains fragmented - with housing matters divided between different authorities at local and national levels. Despite decentralization housing matters beyond privatization and immediate local needs has not become part of the local authorities' responsibilities.

Legal and policy initiatives remain disconnected and address only specific problems. Systematization of the housing rules into a new Housing Code is under way. This Code would provide rules on shared ownership, decentralization of decision-making and integration of commercial spaces into residential buildings. Nevertheless, it is necessary to develop a comprehensive and coherent national housing strategy to address fragmented character of existing housing initiatives.

Major housing needs include housing maintenance, increase in housing through modernization and development of domestic building materials, provision of affordable mortgage financing and earthquake resistant housing. A systematic census on the existing housing stock and services is in progress, but no data is available yet. Housing stocks are not up to the housing needs due to faster population growth. Average available floor space per capita decreased to less than 5m². According to estimates of the Country Development Strategy of 2007, 166,000 families are in need of now housing.

Basic utilities are missing in a large percentage of homes. Thus, only 40% of households have access to running water (in urban areas 70%), 40% of dwellings are connected to public sewerage system (70% in urban areas), only 27% of households have flushing toilets (56% in urban areas) and 25% of HHs have bathroom/showers (52% in urban areas).

Neither new construction not rehabilitation of the housing stock in cities consider energy efficiency as a priority concern. Internal migration from south of the country to cities led to the development of informal and semi-formal settlements (nosotroiki) in Bishkek and Osh, where adequate infrastructure is not always provided.

The construction industry is underdeveloped with only 20,000 employees, compared to 150,000 employees in 1990.

General housing characteristics:

- Build without proper building materials, design, planning, insulation and sanitation facilities;
- Most of the houses constructed with Adobe (mud bricks/blocks with agro waste);
- Different size of such mud blocks/bricks depend of the size of building and requirement;
- Doors and windows made of wood and in few cases iron doors;
- Roofing mainly made using wood trusses and placing GI or asbestos sheets;
- Private houses are built with clay modular bricks, wood and plastic composite door shutters and GI sheets and asbestos roofing materials;
- Houses in city are well insulated;
- Companies use complete framed structure and pre-fabricated housing technologies in multi-storied buildings;
- Light weight foamed bricks/blocks as walling and partition materials

Key areas to be addressed under the project:

1. Production of building products with local material: research and development of building materials using local raw material with support of semi-mechanized employment generating machines; Application of basic raw material, such as sand, cement, clay, lime, gypsum and fly ash that are widely available in the country; Setting up smaller capacity plants with PPP or joint ventures to produce CLC, AAC, bricks, blocks and pavers using fly ash; Technology solution and training for production of mud stabilized blocks and other building components; Wood plastic composite and utilization of the agricultural waste; Mini cement plant as an option for joint venture; Raw material available in the country generates scope for blended cements; possible addressing of the sanitation problem by technology solution with construction of few toilet unit with bio-digester, pre-fabricated septic tank and solar panels in rural areas with no proper infrastructure.
2. Products and technologies for demo houses using local materials: stabilized earth block, micro concrete roofing tiles and precast RC planks and joists for floors and roofs.

Emerging housing technologies in Bishkek: permanent formwork of polystyrene foam, light gauge steel framing and 3D panels.

Possible **networking partners** under the project: J K Structures Housing Technology, Schnell Housing Technology, STYRO STONE

Housing Technology, IZODOM 2000 POLYSKA Housing Technology and Castwall Housing technology.

Options for rain water harvesting for housing and agricultural field (March 2015)¹

Kyrgyzstan is rich in water resources, which is used for generating electricity (90% of total electricity) and irrigation of agricultural land and greening of cities. There is an urgent need to re-look and recognize the status of water and value to preserve in for the future.

Resource value for water in Kyrgyzstan are currently in hydroelectricity, enjoyment of water (tourism and drinking water), water to support life (agricultural production) and cleaning.

Water in Kyrgyzstan is stored in large dams during summer to provide electric power in winter, the downstream countries suffer shortage of irrigation water. Kyrgyz rives are inland rivers and lake Issyk Kul is an enclosed water area at 1,600 m above sea level. Due to this effect of the pollution will extend over a long period and over a wide area. The glacial area is shrinking as a result of global climate change. For Kyrgyzstan to achieve sustainable development by 2040 the capacity of water management needs to be improved. The aspects of water use, which require consideration include: learn, incorporate and further development of examples of advanced water use, cultivation schemes and skilful methods of using water.

Some ideas for using water in a more planned manner by rain water harvesting and rain water for irrigation were described in the report.

The report also provided some insight into facts related to rain water storage for agriculture. These are: precipitation mainly through rains and in some districts through snowfall; 80% of rains are monsoon; there is scarcity of water for meeting domestic, agricultural and livestock needs; rain water harvesting and efficient use may be one of the steps to address water shortages (this has been adopted as a state policy and is being demonstrated, in some cases, through low cost technology).

Needs assessment and possibilities for utilizing agricultural waste for development of value added material (March 2015)¹. Agriculture in

¹ Options for rain water harvesting for housing and agricultural field [64], by Amit Rai/ UNIDO International Consultant/Project Team Leader (13pp)

Kyrgyzstan is a significant sector of economy, comprising 20.2% of total GDP and occupying 48% of total labor force. Only 6.8% of total land is used for crop production, and 44% used as pastures. Animal husbandry remains a significant part of the agriculture sector.

Crop production is mainly concentrated in Ferghana Valley, Talas and Chui provinces. Main crops are tobacco, cotton, potato (288,000 tons), vegetable (tomatoes 160,000 tons), fruit and berries. Largest crop is assorted types of animal fodder, second largest is winter wheat (611,000 tons), followed by barley (300,000 tons), corn and rice. Main animal products include sheep, goat, cattle and wool. Chicken, horses and pigs are also present, in some regions yaks are herded and bred. Most important livestock products are cow milk (750,000 tons), beef and veal (70,000 tons), mutton and lamb (50,000 tons), eggs (30,600 tons), wool (56,300 tons), pork products (30,000 tons) and poultry meat (25,000 tons).

Top export products are cotton and tobacco. Meat is also exported, but in less quantities. According to the privatization law, state agricultural assets are distributed according to a share system, in which all citizens have the right to a garden plot, but only rural population has the right to occupy land and other agricultural assets previously owned by state and collective farms. Recipients of shares can maintain the property as part of collective, transfer it to a cooperative or establish an individual farm.

Kyrgyzstan has continued to emphasize raw material production also after gaining independence. An estimated 62% of the population is rural.

Field visit to Osh

Survey of the rice production and processing as well as cotton production and processing was conducted. During the visit facilities for rice processing were looked at and possibilities for setting up unit for development and production of value added materials with rice processing waste were discussed. Possibilities for cotton cutting and processing waste were also explored. A rice processing unit, which was visited by the project team, processes rice grains from 250 ha every season.

About 20 cotton processing units operate in Osh region, most of them having 30 tons of accumulated waste each). The processing units

¹ Need assessment and possibilities for utilizing agriculture waste for development of value added materials [59]

visited expressed their willingness for sparing land and infrastructure for setting up unit for production of building material using cotton waste. This creates some possibilities for PPP for generating value added building materials using cotton stalk and cotton processing waste.

The report also contains short description of technologies using rice and cotton waste.

Needs assessment – housing needs. Housing supply in Kyrgyzstan (total living area per capita) as of Jan 2013 amounted to 12.7 m², while the statutory rate is 18.0m². In 2013 a total of 906.7 thousand m² were built from various funding sources. Out of this 757.9 thousand m² were built at the population's expense, the share of the individual housing construction was 83.6%. 133.9 thousand m² were built by private enterprises and organizations, the proportion of housing built by private investors was 100%.

Main challenges faced by the construction industry [31] are lack of cheap and reliable wall materials, durable and non-flammable insulation materials and lack or inadequate regulation for new construction technologies.

The paper [31] also offers quantitative data on the volume of housing construction and the cost per square meter of living space in KG.

Most popular wall material is burnt clay brick due to relative simplicity of construction and variability with room layouts. At the same time, burnt clay bricks is still expensive building material for majority of rural, small towns and suburbs population.

More widespread wall material is hand moulded adobe bricks, but constructions with adobe brick do not meet standards, short lasting and vulnerable to relatively weak earthquakes. As an alternative mud stabilized bricks can be applied, the production of which doesn't require construction of kilns and is less heat energy consuming. Research in the selection of optimal mixture for mud stabilized bricks was done by Professor M. Kasymova (KRSU).

Among other materials that are used for erecting walls are cement-sand blocks and expanded polystyrene concrete blocks with some limitations in their application.

Some companies attempt to introduce other construction technologies, like permanent foam from high dense expended polystyrene, but irresponsible attitude to the quality and use of cheap low dense polystyrene discredited this technology.

The market offers a number of insulation materials with various qualities and vulnerabilities (e.g. toxicity, flammability), some are fully imported, others produced locally (much energy consuming and lack of raw material). At the same time natural sheep wool is not used in production of insulation material despite its overproduction.

Another technology, which is spreading over Kyrgyzstan is cold-form steel technology. The main issue related to the cold-form steel technology in KG is absence of relevant construction code. This can be resolved by creating standards based on Eurocodes jointly with interested research, design and construction companies with further involvement of relevant government institutions.

Fast-growing poplar, which is widespread in Kyrgyzstan, has a good potential for introducing thermally compressed wood.

Another source of the raw material for production of construction products is garbage. Some companies in Bishkek already recycle used tires, but need more efficient equipment. Used tires can be utilized for the production of roofing materials.

Construction of passive solar houses has great prospects in Kyrgyzstan. Some enthusiasts have already constructed such houses.

Irrigation issues. Ministry of agriculture, food processing and melioration (Department of water resources and irrigation) is the government agency administering irrigation system in Kyrgyzstan. Functions of the department include timely provision of irrigation water for users, qualitative repair of water facilities and pumping stations, as well as development of new irrigated land plots. Thus, there are responsible for 5786.7 km of inter farm canals, 7,659 water structures, 3,236 water measuring stations, 107 pumping stations, 33 water reservoirs with total volume of 1,617.3 mln. m³. A total of 795 water structures, 760 water measuring stations, 91 pumping stations and 396.5 km of major canals were repaired in 2015.

Budget allocations only cover 23% of the funding required (for implementation of NSDS activities related to irrigation).

As per analysis of Ministry of Agriculture the challenges are as follows:

- debts (lack of funding)
- low quality or no commissioning at the pumping stations, leading to water supply disruption and additional costs
- work execution by contractors

- insufficient maintenance at the expense of the state budget (possibly, inefficient use of the state funding?).

Destruction the of isolation joints made of precast concrete trays is one of the technical problems of irrigation infrastructure. The problem can be solved by placing rubber seals that are produced locally, but due to the insufficient funding no state orders are placed for the production of these seals.

Recycled tires could also be utilized for production of rubber seal, but testing and introduction of this technology is risky due to: 1) existing tire recycling enterprises do not have necessary equipment, 2) properties of the rubber seal made of rubber powder are poorly understood, and 3) no guarantees on the state orders. Based on the above introduction of sealant technologies for precast concrete irrigation trays was found as inappropriate.

Contribution of UNIDO technical assistance to youth employment. UNIDO project is in line with the key strategic documents, namely National Sustainable Development Strategy for 2013-2017 and Midterm Development Program for 2012-2014, which set sustainable economic growth and social inclusion as priority targets. The project is aimed at promoting innovative low-cost sustainable manufacturing technologies and cost-effective and environmentally friendly building materials that can be easily adopted by construction industry for housing an irrigation purposes. UNIDO project also contributes to community-level job and income generation for national expertise, with special focus on youth.

3.2 Technologies and other benefits provided

The project is focused on exploring possibilities and potential for use of local raw material and building techniques for affordable, sustainable and durable housing.

One of the targeted groups are low-income youth and university students of the relevant studies. The project will provide entry point for learning and developing experience and skills in production of construction materials and building industry. Beneficiaries of the project will acquire new skills that can increase their employment opportunities.

UNIDO project collaborates with KRSU and local producers to increase youth access to employment and income generation through new job opportunities and skills development. Building material production

and construction are labor intensive and create considerable opportunities for employment generation, incl. unskilled labor.

The economic impact of the project on the youth is expected to be positive. Employment opportunities in building material manufacturing and construction will constitute a source of income for low-income population, thus contributing to poverty reduction.

The seven UNIDO-supplied technologies were as follows:

- (1) mud blocks press
- (2) roof/floor/wall tile extruder
- (3) stone splitter
- (4) straw mats knitting machine
- (5) shotcrete machine
- (6) wood modification chamber
- (7) wool deburring facility.

They are all of them important capacity building items. They will now be taken up and commented on one by one:

3.2.1 The seven technologies—Mud blocks press units

Two mud blocks presses were delivered [15,33], one to the KRSU and the other to a private enterprise selected by way of an open Call for Proposals.

(1a) One of three machine assemblies supplied to the KRSU. This is a Hydraform unit (Fig. 1), mobile, already installed albeit in a shed which hardly can serve as premises used for continuous production; with 9 staff trained; the training was held at KRSU on 24-28 October 2016. On the other hand, this is a location which is close to the building plot where the Demo houses have begun to be built (and the blocks will be used). The machine as such, being mobile, is intended eventually to be moved from one rural location to another in accordance to local needs, depending on local demand. The machine produced mud blocks of the type shown in Fig. 1 (right).

More accurately, "Hydraform Interlocking Hydraulic Block making machine with integrated pan mixer mounted on tow hitch trolley operating on 15 HP, 3 phase, 440 V electric, and fitted with HF 220 mm interlocking block mould to make mud and cement stabilized blocks", with compressive strength tester, block cutter, and accessories.



Fig. 1. Mud blocks press unit and typical building blocks produced

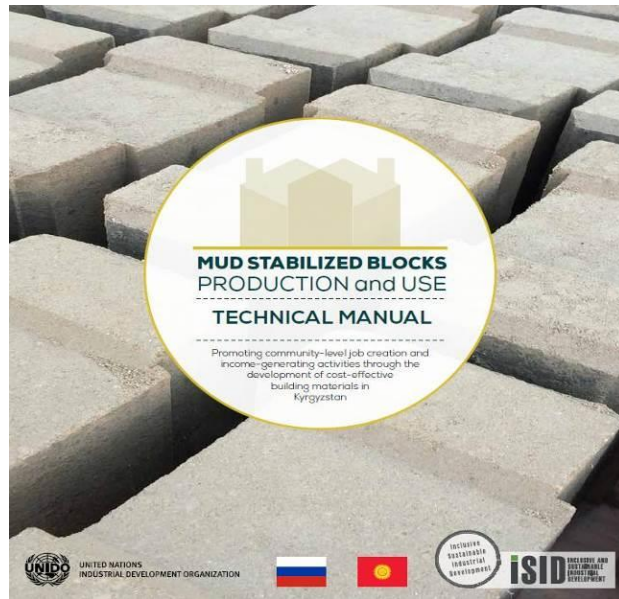


Fig. 2. Mud blocks technology manual—English and Russian language versions

The mud blocks manual [12] is a fine introductory manual (Fig. 2), with introduction by Amit Rai; it brings information on Brick making; Producing mud-stabilized blocks; Selection of materials; Stacking and curing; Sustainability and environmentally friendly aspects; Hydraform building systems.

(1a) The mud blocks press installed at a private enterprise (Fig. 3)



Fig. 3. The mud block press unit installed at a private entrepreneur

Connected with this partial objective of mud blocks manufacture is the technical manual on mud-stabilized block technology [12], *cf.* above, providing support for the first step in the partnership between UNIDO and private companies [34], under the third tender [35], to create the Technology Production Center. It will also serve to promote the center and its acceptance locally.

A training center for environmentally friendly and cost-effective housing technologies will help ensure the long-term sustainability of the skills and technologies promoted in the project and disseminate them among local manufacturers. The project was also expected to facilitate local job and income creation, which would improve people's livelihoods, especially in rural areas.

The subproject was also discussed in a 2016 meeting organized via Skype [36]. The mud blocks are intended primarily for rural houses—such as a traditional one in the photograph (Fig. 4).



Fig 4. A traditional mud brick house in the mountains on the way to Supara

3.2.2 The seven technologies—Roof/floor/wall tile extruder

The roof/floor/wall tile extruder [15] (Figs. 5 and 6) is another of the three machine assemblies supplied to the KRSU. It is currently stored (Fig. 6) in a shed which hardly can serve as premises used for continuous production.



Fig. 5. Roof/floor/wall tile extruder assembly



Fig. 6. The roof/floor/wall tile extruder in its current location

This subproject was also discussed in a 2016 meeting organized via Skype [36].

3.2.3 The seven technologies—Stone splitter

Stone splitter, to be used for splitting of any type of natural stone, including river rocks, [15], under the third project tender [35] for the production of medium to large size cobble stones, small wall stones, and tiles hydraulic splitter – cutting machine for processing natural stones (Fig. 7).



Fig. 7. Natural stone splitter

3.2.4 The seven technologies—Straw mats knitting machine

A machine of type Wantuo wt-2000, an inexpensive yet effective item of machinery [15,34]. Up and running at the Zarya Cooperative (Fig. 8).

Designed for the production of agro-waste based fibre boards. The project proposed to produce fibreboard of low, medium and high density based on agricultural wastes, which are available in the country in various forms and volumes: wheat and barley straws, stalks of cotton and other waste from the processing of cotton, corn waste, rice husks and straw – as fillers and as an alternative to the OSB (oriented strand boards, also known as flakeboard), gypsum boards (as per Minutes of the 2nd Advisory board meeting, June 2015 [34]).



Fig. 8. The straw mat knitting machine

These straw-based boards are one of the several types of insulation with which this project is concerned and for which a manual has been prepared (Fig. 9).



Fig. 9. Thermal insulation manual—English and Russian language versions [37]

3.2.5 The seven technologies—Shotcrete slinger machine

Type GAODE GSZ3000V shotcreting (guniting) machine [15], a mobile machine for shortcrete application (Fig. 10). Acquired under the third project tender [35].

Shotcreting is a kind of spraying can be described as the pneumatic application of a finely-graded cement mortar or concrete. The object is to force the mix onto a surface so that it will adhere firmly and harden to maximum density. This is achieved by literally shooting a jet of the mix through a nozzle at considerable force.

In spite of chronic underfunding, during 2015 the Department of Water Resources and Irrigation of the Ministry of Agriculture, Food Processing and Irrigation managed to repair 795 water structures, 760 water measuring stations, 91 pumping stations and 396.5 km of major canals.

Here the shotcrete technology comes into play as a means of advanced, mobile, and versatile rehabilitation of the damaged canals while other technologies such as those using recycled tyres rubber powder sealant appear risky and less suitable.

Besides, it is not only the irrigation canals but virtually a number of widely different building jobs where the shotcreting machine can find application.

The subproject was also discussed in the fourth AB meeting [34] held in November, 2015, and in a 2016 meeting organized via Skype [36].



Fig. 10. Shotcrete machine stored away in a garage

3.2.6 The seven technologies—Wood modification chamber

The wood modification furnace or oven is intended primarily for local poplar wood, to make it decay resistant and water resistant. The furnace is also used merely for drying the wood. So far, most timber is imported from Russia while the poplar trees in natural condition are not very suitable for construction. Thanks however to thermal modification at up to 200°C the sawn boards become water proof and even better looking and can be used especially for facades of residential homes and other buildings. The principle of upgrading the wood is caramelization of its components giving the wood physical strength and a pleasing colour. The beneficiary claimed this to be the only facility of this kind in Kyrgyzstan and around. This is a sawmill operator who has run the sawmill successfully without any thermal treatment so far. The treatment of course increases the price of the timber. The oven is type Sukhoviyy KTMD-4200 (Fig. 11).



Fig. 11. The wood modification oven at Mr. Moskalenko's sawmill

The sawmill caters to customers from nearby locations. There does not appear to be any promotion of the new technology, except on the sawmill fence (Fig. 12).

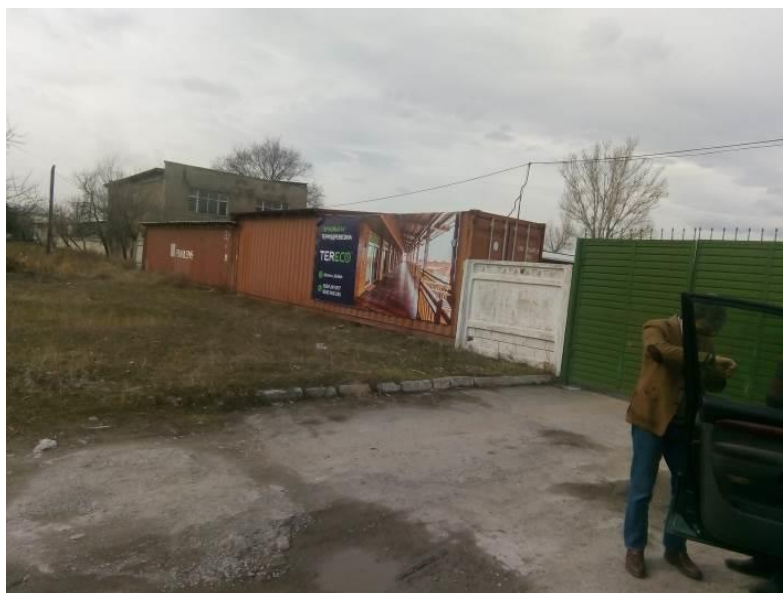


Fig. 12. Advertisement for 'Termodrevesina' – 'Термодревесина' on the fence of Mr. Moskalenko's sawmill

The subproject was also discussed in a 2016 meeting organized via Skype [36].

3.2.7 The seven technologies—Wool deburring facility

A wool deburring machine (Fig. 13). Provided to Tabysh Art Co. [15,33], under the first project tender [38]; was also a prominent subject of the Mid-term review [10].



Fig. 13. Wool deburring facility, a view of the upstream section of the processing line

The subsequent pictures (Figs. 14-16) illustrate the flow of the wool through the processing line.



Fig. 14. Black sheep wool prepared for treatment



Fig. 15. Sheep wool being fed into the Cormatex deburring machine to remove organic and mechanical dross- an operation generating plenty of dust



Fig. 16. Prefinished multi-layered wool felt after subsequent stages of treatment (combing, needle punching...)

3.2.8 Other benefits - Demo houses

The demo houses were discussed at length, *e.g.*, at the fourth AB meeting held in November, 2016 as well as at the fifth meeting held in October, 2017 [34], and were subject of a review within the Mid-term review [10]. They look nice (Fig. 17) but they are not real yet, and there was virtually nothing to show at the time of the terminal review.



Fig. 17 The demo houses as planned

3.2.9 Other benefits—Data base of technologies

The data base [39] is treated at greater length in the *Interviews & Visits* Section. It is sufficient here to state that the references accessible via the data base (such as Sheep wool insulation; wood modification; WPC which stands for "wood polymer composites" and the various companies listed) fail to provide any information of substance.

There appears however to be yet another data base developed under the project as reflected in a brief Word document [40], *viz.*, a data base on Emerging Housing Technologies—or it may be the same data base, with very basic information on Expanded Polystyrene based Housing Technologies; Light Gauge Steel Building System; Monolithic Building System; 3D Panels Building System; Precast Technologies for Mass Housing; Agro Waste for Insulated Housing; Bamboo based Housing Solutions; and Mud Stabilized Blocks based Houses.

3.2.10 Other benefits—Smart Build center

The Smart Build center is a fine facility of the KRSU, treated at length in the *Interviews & Visits* Section. Clean, airy, nicely designed, very well suited for educational, promotional, and conference events (Figs. 18-20). The subproject was also discussed in a 2016 meeting organized via Skype [36]. Some books and publications were already shipped to the center from Moscow and from Europe [41] but the library still looks rather empty (Fig. 20).



Fig. 18. Smart Build center, interior view



Fig. 19. Smart Build center, conference hall



Fig. 20. Smart Build center, an upper-story library area

A set of seven instruction panels devoted to the seven technologies furnished by UNIDO has been installed at the Smart Build center (Figs. 21-28). Each of these panels is deserving of praise because the respective technologies and materials are clearly defined and explained.



Fig. 21. Instruction panels referring to the seven technologies supplied by UNIDO

СТАБИЛИЗИРОВАННЫЕ ГРУНТОВЫЕ БЛОКИ

COMPRESSED STABILISED EARTH BLOCK OR MUD STABILISED BLOCK TECHNOLOGY

СЭБ (стабилизированные земляные блоки) — это строительный материал, который производится из глины и песка. СЭБ производится с использованием технологии стабилизации почвы. Эта технология позволяет производить блоки, которые имеют высокую прочность и долговечность. Эти блоки используются для строительства стен, перегородок, перегородок и перегородок. Эти блоки используются для строительства стен, перегородок, перегородок и перегородок.

ТЕХНОЛОГИЯ СТРОИТЕЛЬСТВА С ИСПОЛЬЗОВАНИЕМ ПРЕССОВАННЫХ СТАБИЛИЗИРОВАННЫХ ГРУНТОВЫХ БЛОКОВ

Эта технология строительства использует стабилизированные земляные блоки (СЭБ) для строительства стен, перегородок, перегородок и перегородок. Эта технология позволяет производить блоки, которые имеют высокую прочность и долговечность. Эти блоки используются для строительства стен, перегородок, перегородок и перегородок.

SUSTAINABILITY AND ENVIRONMENTAL FRIENDLINESS OF CSEB

Earth is a local material, and the soil should preferably be extracted from the site and not transported from too far away.
Earth construction is a labour-intensive, easily adaptable and transferable technology.
A soil and energy effective material.
Much less energy consuming than country-fired bricks (about four times less).
Much less polluting than country-fired bricks (about four times less).

ЭКОЛОГИЧНОСТЬ ПСЭБ И БЕЗОПАСНОСТЬ ДЛЯ ОКРУЖАЮЩЕЙ СРЕДЫ

Глина для блоков — местный материал, желательно извлекать его с участка, где ведется строительство, или вывозить его не более чем на 10 км.
Строительство с использованием прессованных земляных блоков — это экологически и энергоэффективная технология.
Создание менее энергозатратное при производстве экологически чистые (продукты и отходы).
Существуют различные варианты использования прессованных земляных блоков (перегородки и перегородки).

ENERGY EFFECTIVENESS

The MuddaMudda Mudda is powered with a diesel engine or electric motor, and has a hydraulic power pack including assembly, and a loading assembly, all mounted on a robust trailer with a tow hitch and road tyres for mobility. This trailer is connected to the block-making unit.

Машин для изготовления стабилизированных земляных блоков

Машин для изготовления стабилизированных земляных блоков (СЭБ) — это строительный материал, который производится из глины и песка. СЭБ производится с использованием технологии стабилизации почвы. Эта технология позволяет производить блоки, которые имеют высокую прочность и долговечность. Эти блоки используются для строительства стен, перегородок, перегородок и перегородок.

ТИПЫ КИРПИЧЕЙ С ЗАМКОВЫМ (ПАЗОГРЕБНЕВЫМ) СОЕДИНЕНИЕМ

Машин для изготовления стабилизированных земляных блоков (СЭБ) — это строительный материал, который производится из глины и песка. СЭБ производится с использованием технологии стабилизации почвы. Эта технология позволяет производить блоки, которые имеют высокую прочность и долговечность. Эти блоки используются для строительства стен, перегородок, перегородок и перегородок.

Fig. 22. (1) mud blocks press panel



Fig. 23. (2) roof/floor/wall tile extruder panel

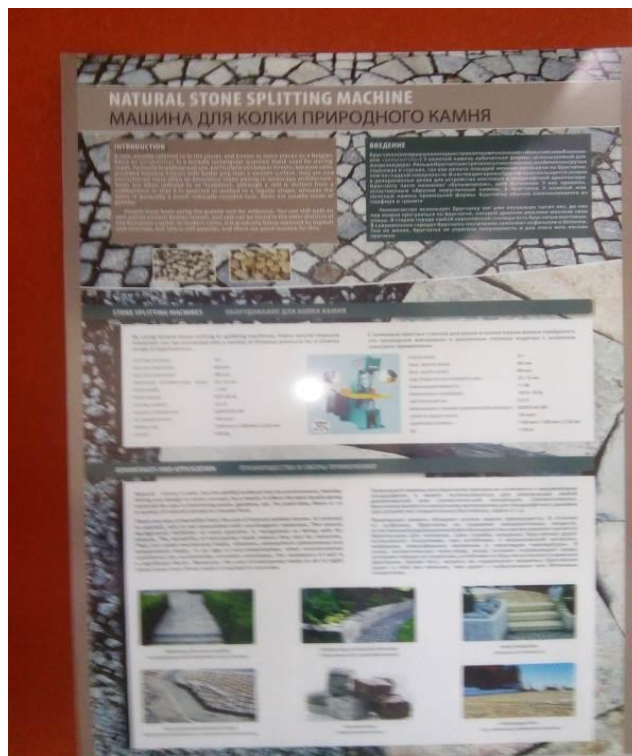


Fig. 24. (3) stone splitter panel



Fig. 25. (4) straw mat knitting machine panel

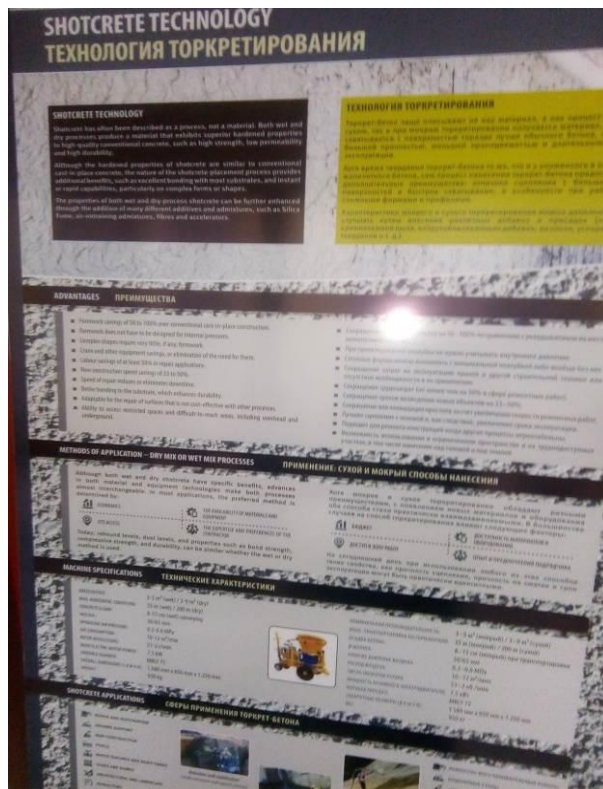


Fig. 26. (5) shotcrete machine panel



Fig. 27. (6) wood modification chamber panel

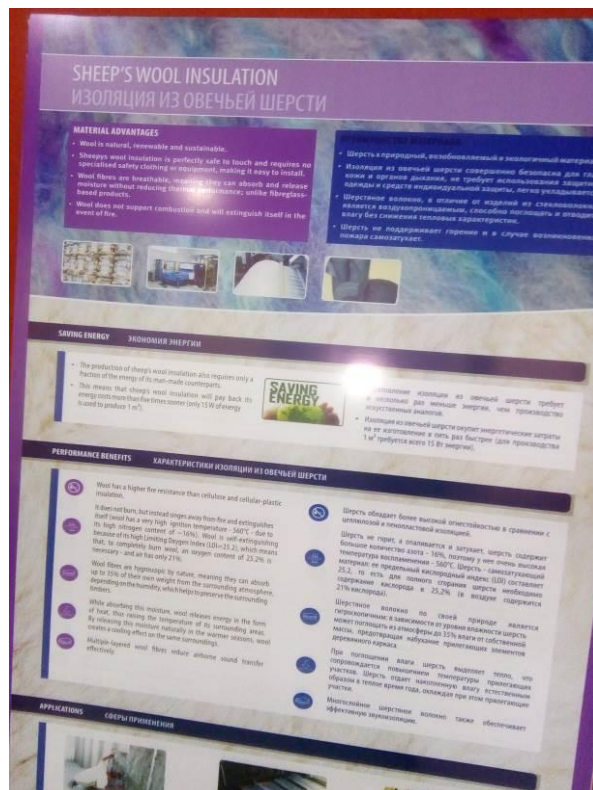


Fig. 28. (7) wool deburring panel

3.2.11 Training aspects

Training. The training component of the KG operations under the project appears to be promising at the KRSU. These trainings must not be confused with the introductory training received by the operators of the machinery provided. A major training course for students and courses for SMEs are yet to be organized.

For training, see also the *Other project outputs* Section, under *Smart Build center*.

3.2.12 Publicity and awareness raising

This has so far included several events and a training course held at the Smart Build center; two manuals (on Mud blocks [2] and on Insulation [8]); minor events organized at the private entrepreneurs; more events organized by University; and some advertisements of the new technologies. No systematic publicity and/or awareness raising activity has been ongoing, due mainly to the delays in delivery of the machines.

3.3 Interviews and visits

The meetings and visits are listed and described in a chronological order.

3.3.1 The project (management) team

This was the very first meeting of the Evaluators with the project management team. The meeting took place at the Gosstroy project office. After introductions by the International and National Terminal Evaluators and the project team members, a number of topics were covered so that the evaluators would obtain an insight and a better understanding regarding the scope and contents of the project, prior to embarking on their inspection/review activity.

A list of key results/findings as seen by the project team is given below.

Some general statements were made, and the seven UNIDO-supplied technologies were covered, to a different degree:

- (1) mud blocks press
- (2) roof/floor/wall tile extruder
- (3) stone splitter
- (4) straw mats knitting machine
- (5) shotcrete machine
- (6) wood modification chamber
- (7) wool deburring facility.

Other outputs and a number of miscellaneous issued were also covered (see below). After the initial meeting with the project team, the Evaluators were of course receiving further inputs from the team members throughout their stay in Bishkek, especially during visits to the various sites where the diverse pieces of machinery are installed or located.

General

The seven UNIDO-supplied technologies

Technologies 'owned' by University. The project is believed to have been rather ambitious, with not enough budget to support all the seven technologies. Only some of them are well suited to the country conditions (climate, etc.). The main counterpart was the KRSU, highly interested in cooperating with UNIDO; three of the technologies came eventually to be sited on University grounds: the mud-block press, the roofing/flooring/ wall tiles extrusion machine, and the stone splitter.

Two of the three technologies mentioned above have arrived recently (late in 2017), and have not even been unpacked yet because they are waiting for the suppliers' representatives to arrive and do the installation work; also, the roofing/flooring/ wall tiles machine still lacks the compressor, and the stone splitting machinery requires an adequate supply of oil (400 litres) which the University feel unable to provide themselves.

How will all this benefit the building materials industry of the country? However limited such benefits may be, they will be bolstered by transference of know-how to students and university staff; also the university intend to ask for a permit to engage in commercial activity; this would permit application of the materials produced by the machines *e.g.*, at the Demo houses being built.

(1) mud blocks press

The first piece of machinery to be brought to the KRSU site, *cf.* Fig. 1 in Section 3.2.1.

Mud brick pricing: The mud bricks as per the project presently come out to be no less expensive than ordinary bricks and thus are not particularly attractive. Mud simply turns out to be no cheaper than ordinary brick making material. The mud bricks have no significant thermal insulation capacity. After a period of some three years of high demand for construction materials, the construction sector has experienced a slowdown; as it recovers the prices will be expected to go up making the mud bricks more acceptable again. There is one advantage with the mud bricks: it allows experimenting with various blends (incl. straw, farm waste, cotton waste, ...).

The Adobe straw bricks on the other hand are supposed to be good for providing insulation, unlike the mud blocks.

(2) roof/floor/wall tile extruder

The extrusion machine—not yet put into operation—has not been discussed in this initial meeting with project staff. See Figs. 5 and 6.

(3) stone splitter

The stone splitting assembly is waiting to be commissioned and put into operation pending of course, an adequate supply of natural stone to be contracted and provided, on a commercial basis yet to be determined. It was not specifically discussed at the initial meeting with the project team.

Technologies 'owned' by private companies. Four technologies altogether: a mud-block press again (there were two machines supplied, cf. above and in the *Technologies and other benefits provided Section*; the shotcrete machine; the thermal processing of wood; and the wool deburring machine.

(4) straw mats knitting machine

Has been installed and tested at a beneficiary (in a remote location, near Issyk-Kul Lake). The machine has been put into operation, producing insulating boards. See Fig. 8 for a photograph.

(5) shotcrete machine

The Irrigation sub-project for which the shotcrete machine was acquired was of a nature somewhat different from that of the other parts of the project. The activity that remains to be done is testing the shotcreting machine. This equipment has only arrived in December, 2017 and has not been tested yet. It can be tested at the earliest when the weather becomes less inclement *i.e.* at end of March and in early April. From mid-April the irrigation period will start so it will no longer be possible to test the machine. Besides, the delivery was

incomplete lacking auxiliaries – oil for the machine; the beneficiary will make up for the deficiencies. For photo, see Fig. 10.

There have been extensive discussions about Irrigation among the project team and Advisory board members, but the shotcreting machine has eventually been suggested as the best-suited approach since it would lend itself not only to repairing the irrigation canals but also to any other construction work, as the technology is rather universal.

(6) wood modification chamber

The wood modification furnace or oven, intended primarily for local poplar wood to make it decay resistant and water resistant. It works through exposure to elevated temperatures (up to 200°C) making the sawn boards water proof and better looking. The treatment of course increases the price of the boards so the economic benefit is doubtful unless a sufficient market is found for the heat modified timber. Yet there may be a social impact because the poplar otherwise is regarded as an inferior variety. So regions may now be producing more poplar trees providing that this new thermal treatment technology will become more widespread in the country.

The beneficiary's sawmill seemed to do well enough even without wood modification (also using the over just for drying the boards, at lower temperature (up to 90°C) and, to the Evaluators' knowledge, has not made any special effort to promote the heat modified product, except on the fence of his sawmill, *cf.* Fig. 12 in Section 3.2.6.

(7) wool deburring facility

Definitely, the wool deburring machine has been the most successful piece of technology supplied. It brought to completion a processing line the Tumar Co. already had but could not use properly, producing wool felt. Their production capacity was limited owing to inability to properly clean large volumes of black sheep wool, of a kind which normally is regarded as inferior to white wool. So owing to lack of demand there was no market for this wool. The machine bridged the gap in existing available technology which included combing, needle punching and auxiliary operations. Before installing the new machine they were producing 5 kg of clean wool per day, with the new machine (supplied from Italy) they are capable of processing 200 kg per day. This can have impact in terms of income for the sheep raisers—they can now sell what previously they could not. It also gives plenty of employment, much of it to women—not only in the primary, wool cleaning operation but also in the company's other facility specialized in manufactured items made of felt.

Also, the management of Tumar—unlike the other private entrepreneurs—has demonstrated an acute business sense, and has made suitable preparations to welcome the Evaluators; they had a demonstration run of the facility ready to show to them, fully staffed.

The wool cleaning and felt making line as a whole is dangerous, with unprotected chain and other transmissions (except for the new Italian machine), and the operation is extremely dusty. Some five staff minimum have to serve the running facility, and more staff is required to collect and prepare the sheep wool.

Other project outputs

Data base

The idea of the data base [39] came from Amit Rai the team leader who mostly acted remotely as he is based in New Delhi, India. The data base concept was developed based on UNIDO ToR [42] by an international expert (Ashraf Abushady from Egypt) who also did the data base training for the project team. The substance of the job has been "In consultation with the UNIDO Project Manager(s), and in collaboration with UNIDO International and National experts, to facilitate creation of a web based national technology information base with the 15 to 20 new and emerging technologies for housing and building material production, 25 w/d".

The data base provides links to different Google sites; is only in English; does not incorporate any specifics on the seven technologies concerned; and is yet to undergo a comprehensive testing of the data base interface. The owner of this website is not identified; also, at Gosstroy they have their own website with some kind of data base. The data base mentions the mud blocks manual <http://www.smartbuild-kg.com/compdir/ENG TECH WEB.pdf>, a project brochure [12] describing the UNIDO project <http://www.smartbuild-kg.com/compdir/Projectbrochure.pdf>, and includes an entry to the data base itself <http://www.smartbuild-kg.com/compdir/main.php> and its products:

Data base | [S](#) | [T](#) | [W](#) | [Clear Filters](#) |

It says "You have 4 products in the results below".

The Sheep wool insulation reference ([Sheep Wool Insulation](#)) fails to mention the beneficiary company Tumar, and mentions instead some company in Ireland.

The reference which is cryptically called "testest" ([testest](#)) refers to a wood modifier company located in Bay of Plenty, New Zealand, is

incomplete, and obviously is irrelevant to the project and to Kyrgyzstan. The respective beneficiary in Kyrgyzstan which is PE Moskalenko is not even mentioned.

The data base reference "Thermally Modified Wood" ([Thermally Modified Wood](#)) in fact is a copy of the previous entry.

And finally, the reference called WPC, which stands for [WPC \("Wood Polymer Composite" or Wood Plastic Composite\)](#), gives a description of another thermal treatment technology which is irrelevant to the project (it concerns biomass/wood fibres rather than wood) and only mentions an Indian company, "Hardy Smith WPC Center".

Under the heading "Companies" the data base offers a listing of 50 companies of which 48 are rather remote from Kyrgyzstan; the two relatively relevant listings are Tumar Art Group and UNIDO (which however is not a 'company'). The heading 'Tumar Art Group' does not even say which products the company is specializing in, it only gives an e-mail address and a telephone number; on the whole it is pretty useless.

There also has been a document [40] called *Database on Emerging Housing Technologies*, with very basic information on eight housing or house improvement technologies.

Smart Build Center and Training

Smart Build Center. At the KRSU, UNIDO renovated and equipped what previously was a warehouse, to a smart exhibition and demo center. Installed furniture, a library, videoconferencing equipment. Displayed seven fine panels describing the seven project technologies, cf. Figs.21-28 in Section 3.2.10. The initial plan was to interconnect the Smart Build center with other educational facilities; now the task is to make sure it is properly used.

Training. Training in the said technologies cannot be conducted yet as they have not yet been installed. This of course does not include the initial operators' training which took place for at least one of the machine assemblies provided (the mud blocks press).

A program of introductory training focused on web data bases was conducted in July 2017 [43].

One initial training course was organized for 2nd and 3rd year students though; this took place in October, as a one-off event. Several meetings organized by the University were held there, too, as well as at least one meeting of the Advisory board of the project.

The Center is mentioned and promoted on the UNIDO Bishkek official website: [Открыт ЮНИДО SMART BUILD центр](#), or rather on the UN official website [Прошло очередное заседание Консультативного совета проекта ЮНИДО](#). And the project as such is also prominently mentioned, at [Прошло очередное заседание Консультативного совета проекта ЮНИДО](#).

The website, posted in Russian, also mentions the "participation in that Advisory board meeting, within the framework of UNIDO, of the representatives of state enterprises and institutions, the private sector, and the educational establishments".¹

Demo houses

The demo houses, being built at the KRSU site on the outskirts of Bishkek, were also specifically discussed, as was the timeliness of the tender for building these houses. The decision of the tender committee was sent to project management too late, in December 2017, so the contractor has been able to start construction with a delay (not in September as intended). Even today they do not have all the materials from the seven technologies which were to have been used in the Demo house construction. As at now, only the foundations for the houses are being laid. Understandably, the payment of the contractor was also delayed. The houses are being built on a plot of University land, near the Smart Build center. It is hoped that the nearness of the center, with its planned manifold activities, will also induce more visitors to come and see the houses.

Miscellaneous issues

Additionally, a number of other project aspects were covered:

The role and functioning of the project Advisory board. This is treated in entirety elsewhere in this report.

The role of the Ministry of Economy. There was almost no communication of the project with the Ministry of Economy. The Advisory board member from the Ministry, of long standing with the project, left the Ministry, and his successor was not acquainted with the problems of the project.

¹ В рамках проекта Организации Объединенных Наций по промышленному развитию (ЮНИДО) «Развитие производства экономически эффективных строительных материалов в Кыргызской Республике с целью создания рабочих мест и поддержки предпринимательской деятельности» сегодня состоялось очередное заседание Консультативного совета проекта с участием представителей государственных учреждений, частного сектора и научно-образовательных учреждений.

Revisions to logframe. The mid-term revision [26,44] suggested some changes to the logframe [32,45] but these were minor, more or less editorial changes – incl. changes to some quantitative indicators, not to the substance, and rephrasing some of the indicator statements.

Other outputs. Two manuals [12,37] were developed under the project, cf. Figs. 2 and 9 in Section 3.2.

Specific questions as per the Evaluator's TOR. The team members were able to answer a number (not all) of the 36 highly specific questions posed in the TOR [46] and recapitulated in the Inception report [1]. On ownership and relevance, the technologies in fact are no high technology. Yet they are useful. The private companies will use them after installation. They will benefit the sheep farmers – sell black sheep wool. Tumar is building a collection point where they intend to buy out the wool from the farmers.

University will train future construction engineers who will become experts in these technologies. The Faculty of Architecture also has been developing a strategy for a more effective utilization of the Smart Build Center, of the Demo houses, and of any production outputs the technologies assigned to them will produce.

All this machinery will need suitable premises which it has not got yet. The mud blocks press can relatively easily be moved from one construction site to another. However, the stone splitter will definitely need sufficient space of its own, for the supply of stone and ancillary facilities. The same applies to the roofing/flooring/wall tiles machine.

Participation of counterparts. The counterparts *i.e.* beneficiaries were not part of the decision making process on the technologies; they did not in fact participate in any manner.

Selection of beneficiaries for the project. There was as a rule always an announcement by the project team in the local papers once any particular piece of equipment arrived in the country, cf. Fig. 29 – a newspaper announcement inviting potential bidders to cooperate in the establishment of a production & training center for the manufacture of mud blocks and bricks. Interested parties were pre-evaluated by the project team and submitted for decision by UNIDO HQs. The University however became a beneficiary based on common consent once this was discussed by the Advisory board.

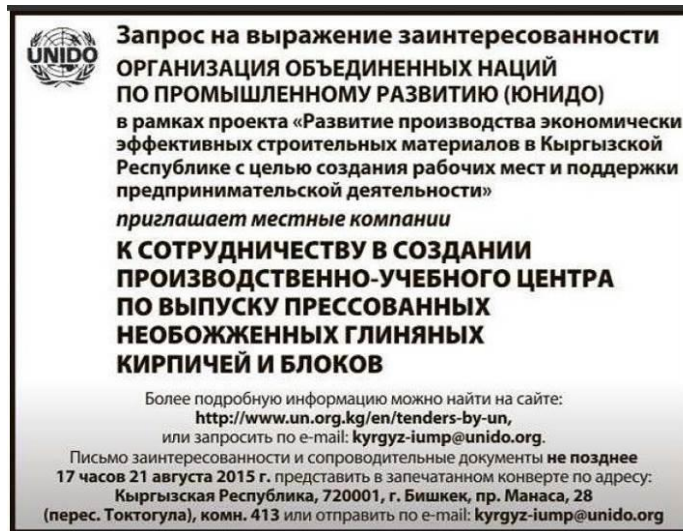


Fig. 29. Example of a newspaper announcement inviting potential bidders

The needs assessment [28,30,47], especially that prepared in 2017, was produced too late, by a time when the needs had already been identified. Thus, the technologies were identified in absence of any needs assessment and consequently, not all of the technologies are those in greatest demand.

Project staffing. At the moment there is no longer any project staff left so there is no one really responsible for any further implementation, except for the beneficiaries themselves. There is staff but they have no contract and are no longer paid. The project team would probably accept gratefully if the UNIDO representative, Marat Usupov, were entrusted with the further coordination and monitoring of the pending implementation activities.

Relevance to UNDP and ISID has been judged by the team to be more than adequate.

Efficiency and effectiveness. Procurement of some of the project technologies was experiencing delays; in fact during 2014-2016 there were almost no deliveries, or some of the deliveries were incomplete. Eventually, this had to be rectified by additional efforts.

Effectiveness is difficult to judge until all the technology is in place and until the market response can be observed and evaluated. The wool subproject is an exception: there has been a great rise in productivity; money derived from the sales of local company will stay in the country; the Tumar price levels tend to be rather high and yet they seem to sell successfully. Yet the ordinary customer is mainly

interested in price and imported materials tend to be cheaper than those by Tumar.

Inflexible UNIDO procurement rules. The rules, according to the project team, prevent full advance payment for machinery; this has resulted, in the opinion of the project team, in excessive costs being paid because those suppliers who accepted the condition of max 20% advance payment offered as a rule more costly wares – more expensive machinery.

Coordination and management. These have experienced some problems, mostly related to procurement delays that had to be expected in a project involving numerous different technologies as well as different locations, and in part remotely managed. In due time these problems were overcome.

Monitoring and self-evaluation. This was being done by the project team. But the logframe was regarded as too general to allow for close and effective monitoring.

Synergies. Synergies with other UNIDO projects are yet to be looked into because there was nothing to be offered by the project until the project machinery was in place. (Also cf. Meeting with Russian Embassy below.)

Extension of project. The project team agreed with the Evaluators that an extension is almost a must if the equipment is to be properly installed, commissioned and put into operation. An additional extension however is not likely there already having been one before. In this case, a post-project monitoring and supervision period is a reasonable option.

Impact and sustainability. The wool deburring subproject is believed to have social impact, at least near the Shopokov town territory, because this gives people an additional income and even will create some jobs.

Videoconference with Amit Rai. A videoconference with Amit Rai took place where he expressed his generally positive views of the project. He himself however is no longer associated with the project. Despite limitations (language, logistics, different payment terms, procurement delays...) his perception of the project is quite positive. One constraint he mentioned was the absence of standardization and testing facilities in the areas of the subject technologies. An extension of the project is regarded by him as essential. This is not needed just for adoption and mastering the technologies but also for bringing in new, emergent

technologies. Another aspect is linking students and academia with the business at hand. Dissemination also has to proceed in the future in order to ensure replication. Trainer training is to take place once the processes are operational.

India may well become a potential donor giving the good relations with Kyrgyzstan, and may bring additional technologies. Procurement could be made more effective by including nearby countries. He had a positive view of the data base.

Cross-cutting issues. Gender – equal opportunities but difficult to judge before progressing to the level of actual users of the technologies.

Job creation. No direct impact but in the second stage, after proper dissemination, there is job creation potential. So far only one machine was tested.

Seminar planned. Not conducted yet, was suggested by not yet adopted by HQs – intended to bring together the providers of technology and prospective users. Some customers can become interested in replicating the technology. Also good for students. The Smart Build center can be the vehicle for such events, even with international attendance.

3.3.2 UNIDO representative in Bishkek

Head of UNIDO operations in Kyrgyzstan M. Usupov proved to be fully conversant with the project issues. He talked about the history of the project and linked it with past UNIDO activities. He pointed to UNIDO's Country Partnership Program [58]. The project is to contribute to job creation. This housing construction project came up for the first time in 2010 as a potential component of the peace-building project for which however it had not been accepted, on the grounds that the peace-building activity was to be mainly reconciliatory and personal, to assist a rapprochement between the Kyrgyz and Uzbeks, rather than industrial like building of houses; also it was meant not to include any income generation component. Later, therefore, this construction project became viable thanks to Government approaching UNIDO with the request for assistance in support of the construction sector, and this is how the project eventually became approved.

The reason why the University was included among the partners was the potential of spreading the technology know-how through the students.

He mentioned specifically that the country produced ca. 11 thousand tons of untreated sheep wool making the wool deburring sub-project important for the national economy.

Indeed, making wool treatment industrialized has great potential. Also the stone splitting technology is important seeing that stone ranks among the country's raw materials in abundant supply.

He urged the project to rapidly enter the implementation stage for the benefit of all concerned.

A seminar would be beneficial as long as it could demonstrate the subject technologies, and also mentioned a construction industry exhibition to take place in April 2018 where Amit Rai the former project team leader intends to bring some Indian companies. UNIDO will support the Kyrgyz government in their efforts at developing industrial development strategies.

3.3.3 The University

Meetings with KRSU and visit to UNIDO demo hall, demo houses construction site, and project facilities at KRSU

The meeting with University officials, headed by the Rector, Mr. Vladimir I. Nifadev, confirmed the University's deep interest in the project. They are keen to use the project-supplied machinery and the project results for demonstrations to students as well as to local entrepreneurs. They also intend to set up a commercial unit for exploiting the technologies brought in. This includes the production of 'ash blocks' *i.e.*, cinder blocks for which they have an agreement with a local cement plant which will sell them cement at cost. Another agreement is being reached with the Bishkek heat plant, to purchase slag to be used in the production of the bricks.

Another area of interest by the University is establishing a testing facility for certification of construction materials and purchasing appropriate equipment. Here a reference was made by the International Evaluator to an established institute of this kind in the

Czech Republic (Klokner Institute in Prague¹) that has been in existence for a century and ranks among the best and most reputed of its kind worldwide; an excursion to this institute by interested KRSU officials would be useful and would provide a source of inspiration as well as of potential cooperation.

Discussions were held on the acquisition of the UNIDO technologies, also in conjunction with the University's desire to facilitate access for local products to the Euroasian (EEU) market.

Visit to SmartBuild center. A fine means to educate students and future entrepreneurs in civil engineering. Cooperation is envisaged with other ongoing university projects.

The Faculty of Architecture & Construction intend to set up a science and technology center focused on new construction technologies. The Dean of the Faculty, Mr. Ravil M. Muksinov, is also considering support to the emergence of small-sized spin-off companies on university grounds.

There is a rather large plot of land owned by the University on the outskirts of town where there is a shed which presently houses the equipment, plus a plot where the demo houses are to be built. The UNIDO equipment that has arrived lately is yet to be installed (the mud press, the tiles extruder, and the stone splitter). This is contingent on the suppliers' representatives to arrive and unpack the equipment for commissioning. At least some of the equipment e.g. the stone splitter will have to be relocated to larger premises so as to allow warehousing and logistics.

The demo houses are yet to be built; foundations are being laid at the moment. The reasons for delay include late start because of delayed approval of tender results; late payment to the contractor; and inability to incorporate any of the new products (to be turned out by the UNIDO-supplied machines) until these processes become operational, except for the mud bricks which are ready and will be used for walls of the houses. Eventually the houses are supposed to demonstrate the mud blocks, stonework made of split stones, the roofing tiles, and wool insulation materials.

The University intends to do some research on the composition of the mud blocks, firstly because of their size, they are rather heavy (15 kg), to make them more light-weight, also to make them stronger so as to

¹ <http://www.klok.cvut.cz/en/>, Klokner Institute—Research and Experimental Institute of Building Materials and Building Structures in Prague

be useful for load bearing structures (normally they cannot be used for load bearing structures, so the houses have to use reinforced concrete frames...), and also to make them heat insulating, so as to be able to make do without any additional external insulation. Nothing has been done yet along these lines.

The demo houses on the KRSU land plot are to be finished by May 2018 or at the latest, by summertime.

Three pieces of machinery were also inspected on the University land plot near the Smart Build center; these are described in Sections 3.2.1 – 3.2.3.

3.3.4 Melioration Department of Ministry of Agriculture

At Melioration (within the Ministry of Agriculture and Melioration), they are prepared to test the UNIDO technology—the shotcreting machine—when it is prepared for operation and the weather conditions allow. The future of this technology in irrigation will depend on the results of tests and on price of the service (to be set by the private company—beneficiary). The country of course cannot rely on rainfall but needs irrigation; there are 5876.7 km of irrigation canals, much of this in need of repair and upkeep.

Kyrgyzstan is rich in water resources, which is used for generating electricity (90% of total electricity) and irrigation of agricultural land and greening of cities [47]. There is an urgent need to reconsider and recognize the status of water and the value to preserve for the future.

Resource value for water in Kyrgyzstan currently relates to in hydroelectricity, tourism, drinking water, water to support life (agricultural production), and cleaning.

Water in Kyrgyzstan is stored in large dams during summer to provide electric power in winter, the downstream countries suffer shortage of irrigation water. Kyrgyz rivers are inland rivers and lake Issyk Kul is an enclosed water area at 1,600 m above sea level. Due to this effect of the pollution will extend over a long period and over a wide area. The glacial area is shrinking as a result of global climate change. For Kyrgyzstan to achieve sustainable development by 2040 the capacity of water management needs to be improved. The aspects of water use, which require consideration include: learn, incorporate and further development of examples of advanced water use, cultivate schemes and methods for skilful use of water.

Some ideas for using water in a more planned manner by rain water harvesting and rain water for irrigation were described in the report [47] which also provided some insight into facts related to rain water storage for agriculture. These are: precipitation mainly through rains and in some districts through snowfall; 80% of rains are monsoon; there is scarcity of water for meeting domestic, agricultural and livestock needs; rain water harvesting and efficient use may be one of the steps to address water shortages (has been taken as a state policy and is hopefully to be demonstrated through low cost technology).

Unfortunately, the report doesn't contain data on what practices in harvesting and using rain water are applied in the country, nor on the perception of both decision-makers and wider population towards promoting rain water harvesting and usage.

Another paper [29] outlines the present scenario for utilization of water in Kyrgyzstan; the resource value for water (once again, hydro power; tourism; support of life & drinking water); water use planning; and rain water harvesting (incl. Materials; Roofing; Gutters & down pipes; Storage tanks; Filtration; and related drawings). As pointed out by the project team however, unlike in India there is no need for rain harvesting in Kyrgyzstan, just the distribution of rainwater.

3.3.5 SME: Mud blocks press machine

A visit was also arranged to project beneficiary enterprise—mud blocks production where the second mud blocks press was installed at Tabysh Ltd., in Novopokrovka village just outside Bishkek. Brick making appears not to be the sole activity of that entrepreneurs; there was a small stockpile of mud blocks proving the machine has already been used.

The entrepreneur, Mr. Makulov, has already conducted experiments with various raw material blends to compress into bricks. Those with straw did not have adequate strength and they tended to clutter and become entangled irregularly, those with rice and cotton appeared to be more stable. These bricks cannot be pressed in cold weather. Also, they do not possess any inherent thermal insulation property. At the moment the mud bricks are not really competitive, because of the current slump in burnt bricks prices. One reason is the high content of cement required for the blends. Current market is to be determined after weather allows the manufacture of the blocks.

The entrepreneur's main business is not the mud blocks. The idea was

replacing Adobe blocks with his mud blocks. He may have rural customers around Bishkek—mostly private individuals building themselves single story houses, without having to import/buy any material, thanks to moving the mud bricks press to whichever village needs to engage in house construction.

3.3.6 SME: Sawmill

A visit to project beneficiary enterprise—wood modification has confirmed that Mr. Moskalenko the owner and operator of a sawmill in the Eastern Industrial Zone of Bishkek, had an industrial-type oven installed permitting the drying and/or thermal treatment of timber boards. To be used mainly on local poplar wood which otherwise, unless thermally stabilized, is less suited for construction. The furnace is installed and operational, used either just for drying the wood or for thermal modification consisting simply in exposure to up to 200°C temperature which stabilizes the wood and makes it more weatherproof. The business has not yet done anything to promote the new technology, except for a promotional poster on the gate, and work done (timber boards stabilized by thermal treatment) for some local shops, to potentially serve as reference. The heat modified poplar wood is supposed to be well-suited for the facades of residential houses and other buildings.

The Evaluators' observation has been that while the capacity of the oven is relatively limited, there is a fair chance of replication of the technology if a sufficient market is found.

3.3.7 SME: Wool deburring facility

In a visit to project beneficiary enterprise—wool deburring (Tumar Art Group Ltd.) it transpired that the company operates two sites, one in Shopokov Town and another one in the Western Industrial Zone of Bishkek. Even at the first glance the business acumen they displayed was much greater than that of all the other beneficiaries.

A total of 25 new jobs were created thanks to the new facility in Shopokov, plus 10 more at the other facility (in Bishkek) specializing in the manufacture of wool felt shoes and slippers.

At Shopokov, they already had a felt production line (wool comber, needle punching machine, ...) which they could not use properly until the technology gap was closed thanks to arrival of the UNIDO-supplied wool deburring machine. Productivity was raised by an order of magnitude. There had not been any market for black sheep wool but this year they already will buy 50 tons and produce more wool

insulation which they intend to market through their own shop. The wool buyout price will be 15 SOM per kg, whereas now the farmers can only sell their uncleaned wool at 5 SOM per kg.

The line at Shopokov although labor intensive already has a nature of an industrial operation. It is very dusty though, and the original machinery (not supplied by UNIDO) also is dangerous, with many chain and belt transmissions, where the operators have to spread and adjust the incoming wool material manually. Dirt is separated from the wool in the new, UNIDO-supplied installation positioned at the beginning of the processing line, wherefrom the cleaned wool is passed on to the comber and the needle-punching section to eventually produce multi-layered felt.

Imported basalt fibre felt is their chief competitor material.

Possible market for the deburred wool insulation, in addition to Kyrgyzstan, is Russia. What they feel they would need is certification and testing of the heat insulation parameters of their felt products, so as to have an official document to accompany their products. They did send a sample of their production to a laboratory in Russia. Another potential market they are contemplating is through contacting transport companies making deliveries by thermally insulated trucks.

Definitely, the wool deburring machine has been the most successful piece of technology supplied. It brought to completion a processing line the Tumar Co. already had but could not use properly, producing wool felt. Their production capacity was limited owing to inability to properly clean large volumes of black sheep wool, of a kind which normally is regarded as inferior to white wool. So owing to lack of demand there was no market for this wool. The machine bridged the gap in existing available technology which included combing, needle punching and auxiliary operations. Before installing the new machine they were producing 5 kg of clean wool per day, with the new machine (supplied from Italy) they are capable of processing 200 kg per day. This can have impact in terms of income for the sheep raisers—they can now sell what previously they could not. It also gives plenty of employment, much of it to women—not only in the primary, wool cleaning operation but also in the company's other facility specialized in manufactured items made of felt.

Also, the management of Tumar—unlike the other private entrepreneurs—has demonstrated an acute business sense, and has made suitable preparations to welcome the Evaluators; they had a demonstration run of the facility ready to show to them, fully staffed.

The wool cleaning and felt making line as a whole is dangerous, with unprotected chain and other transmissions (except for the new UNIDO-supplied machine which is adequately protected), and the operation as a whole is extremely dusty. Some five staff minimum have to serve the running facility, and more staff are required to collect and prepare the sheep wool.

3.3.8 SME: Shotcrete slinger machine

In the judgment of the project team, the Irrigation sub-project for which the shotcrete machine was earmarked had been ill-designed. It was rather incongruous with the other parts of the project. The activity that remains to be done is testing the shotcreting machine. This equipment has only arrived in December, 2017 and has not been tested yet. It can be tested at the earliest when the weather becomes less inclement *i.e.* at end of March and in early April. From mid-April the irrigation period will start so it will no longer be possible to test the machine. Besides, the delivery was incomplete lacking auxiliaries – oil for the machine; the beneficiary will make up for the deficiencies. For photo, see Fig. 10 in Section 3.2.5.

There have been extensive discussions about Irrigation among the project team and Advisory board members, but the shotcreting machine has eventually been suggested as the best-suited approach since it would lend itself not only to repairing the irrigation canals but also to any other construction work, as the technology is rather universal.

3.3.9 Russian Embassy

In a meeting with the representatives of Russian Embassy, the Evaluators flanked by some project team members were received at the Russian Embassy of the Russian Federation in the Kyrgyz Republic, in Bishkek. Mr. Vadim Chekmazov, Minister-Counsellor, proved to be well acquainted with the project and stressed the usefulness of generating some synergy between this basically industrial project with the other UNIDO project implemented in Issyk-Kul, called "*Linking the tourism industry to productive activities in the Issyk-Kul region of the Kyrgyz Republic*", which is focused on tourism and on linking agriculture with tourism. He voiced some (very mild) criticism of the slow project implementation; he was aware that late delivery of equipment did not leave time for all the scope of activities envisaged. He would be happy to see synergy with other projects supported by UNIDO, too.

3.3.10 Gosstroy

At the Republican Certification Center for Standardization of Construction Materials of the State Agency on Architecture, Construction and Communal Services (Gosstroy), Mr. Abdraev Zholdoshbek, Head of the institution, highlighted the importance of hiring technical staff for implementation of the projects. He argued that the main criteria under which candidates for the project staff are assessed are mainly related to their knowledge of and fluency in English, while technical expertise and experience are given second role.¹

As was stated in the project document, the objective of the project was to support the production of cost-effective and energy-efficient construction materials using local raw materials. In his judgment that objective was not fully met, still pending presentation of the final products to the advisory board members.

He also mentioned the 6th Advisory board meeting, which he said was conducted in January-February 2018, of which the project staff was not aware (the last AB meeting as per project staff was conducted in October 2017). No minutes of this meeting are available.

Recommendations: He believed that some of the technologies didn't take into account the climate and geographical location of Kyrgyzstan (*e.g.*, mud blocks which do not provide heat insulation features and are not earthquake resistant), making their application in the country not possible. The need of better informing the stakeholders was another remark of his. The project was implemented with significant delays. He also proposed to reconsider and maybe simplify the applicable procurement rules and procedures to ensure a faster implementation of the project, more consultations and inclusion of the stakeholders in decision making (he said their views and opinions were not taken into account), reconsidering criteria for hiring project personnel (people with more technical knowledge). In addition to this he also suggested that there should be some final meeting of the AB where stakeholders would be informed on all project activities, their implementation status, and the achievements attained. He also said this final AB meeting could be used to collect recommendations or any other comments related to the follow-up project, lessons learnt etc.

¹ In the terminal reviewers' view, the project team were not only fluent in English but primarily, technically competent and dedicated.

3.4 Project design

The design proper of the project was excellent even though eventually, its overall quality was judged only as Satisfactory by the reviewers, in view of the insufficient attention paid to the flow cycle of stocks being processed at the individual facilities. Refer to Annex 6 – Rating tables for details.

3.5 Relevance, effectiveness and efficiency, sustainability

Relevance and ownership relate to the national development priorities and Government strategies, as well as to target groups, the UNIDO mandate and counterpart involvement. This was judged as highly satisfactory by the Terminal evaluators. Refer to Annex 6 – Rating tables for details.

Both effectiveness and efficiency were judged only Moderately satisfactory, hampered as they were by multiple factors of which the failure to effectively use the machinery supplied to the beneficiaries, to resolve the procurement problems in good time, and to build the Demo houses to schedule were the most substantial. Refer to Annex 6 – Rating tables for details.

Sustainability hinges on attaining a smooth, streamlined workflow at the facilities rather than being bothered by delivery problems, and, of course, on finding suitable markets. The reviewers' over-all view of project sustainability was not very positive, owing to the risks preventing the facilities from attaining a sustainable mode of operation. In fact it has not been possible yet due to the short time elapsed to pass any judgment on Sustainability and Impact, except in the case of the successful subprojects, basically three out of seven relating to UNIDO-supplied machinery, and in the case of one subproject, the Smart Build center, out of the three which did not directly rely on the use of the UNIDO-supplied machinery.

3.6 Project coordination and management

This section of the evaluation report addresses the issues of project coordination and management, and various evaluation specifics and interim ratings.

3.6.1 Coordination

Coordination was an issue because a number of organizations took part, however minor in some cases, in managing the project and/or its various components: UNIDO HQs in Vienna; UNIDO office in Bishkek; Gosstroy as the chair of the Advisory Board; the entire Advisory board; the project (management) team; the University (KRSU) and its Faculty of Architecture and Construction; the Melioration Department of the Ministry of Agriculture; and last but not least, each of the private entrepreneurs/project beneficiaries who wanted to have a say in some aspects of the project. Consequently, communication became of paramount importance, and was not always optimal among the principal partners: UNIDO HQs, the project team, and the Advisory board.

3.6.2 Management

On the whole, project management was adequate but failed to prevent gross delays in the delivery of UNIDO-supplied machinery and other project benefits. This is also reflected in the Rating tables where some suggestions are also presented on how management could be streamlined.

3.6.3 Advisory board

Advisory board of the project had the principal function¹ of advising the project team on overall coordination and management, and the auxiliary if no less important functions of promotion activities, strategic policy guidance, monitoring and follow up [12,34,48].

Composition: 6 members – representatives of Min. of Economy, Min. of Agriculture by its Water and Melioration Department, State Agency on Architecture, Construction and Communal services, private sector/professional associations, and an academic institution.

Chaired by State Agency on Architecture

Frequency of meetings: Agreed to be held at least twice a year, max once a quarter. In reality however, the frequency of AB meetings was dropping sharply as project time progressed (Fig. 30), in spite of the

¹ Terms of Reference – Advisory Board

problems progressively mounting and accumulating—which would have required the opposite *i.e.*, stepping up the frequency of the meetings.

Rules and regulations: as usual for such Boards.

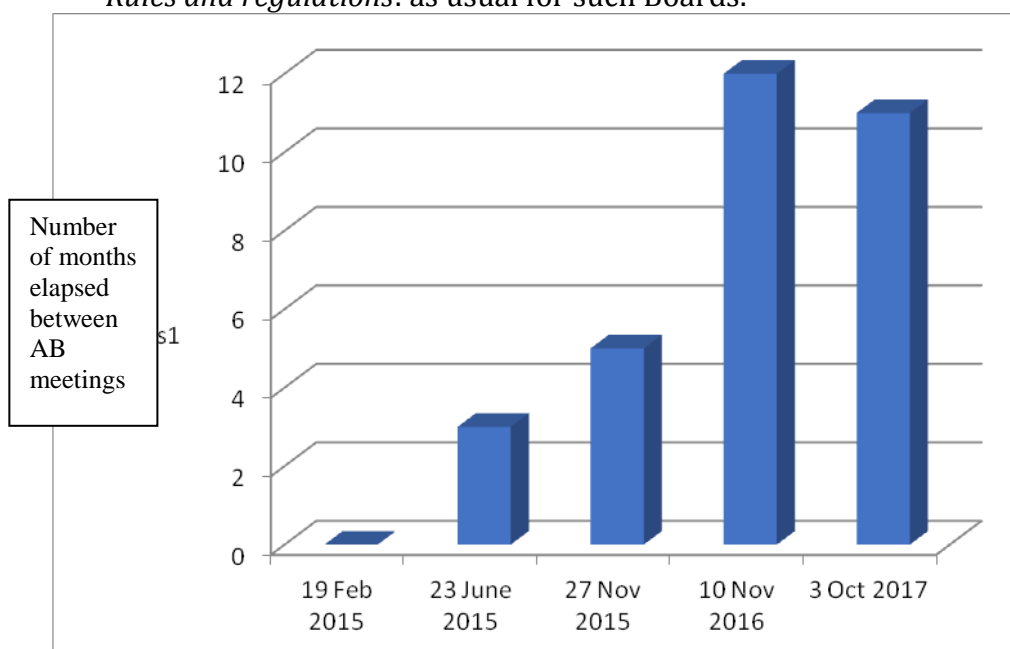


Fig. 30 Frequency of Advisory board meetings

First meeting^I was conducted on 10 Feb 2015, aimed at familiarizing with project and outlining expected results, implementation status and recommendations (with presentations by Marat Usupov, Head of UNIDO Operations in Kyrgyzstan and Farrukh Alimdjano, UNIDO Project Manager, as well as by a National expert and by project management team members). The meeting resulted in discussions of various technologies and raw materials also available locally, and brought to the attention of the project team the assessment of possible hazardous elements of some of the technologies and materials. An action plan for 2015 was endorsed during that meeting. At that meeting, the frequency of meetings was agreed—once every three months.

Second meeting^{II} was conducted on 23 June 2015; its agenda included a general update on implementation, information and technical specifications on UNIDO-proposed building materials, results of the 1st tender and information about upcoming 2nd tender, UNIDO production cum training center, and UNIDO technology

^I Minutes of the First Advisory Board Meeting, Feb 2015, (10pp)

^{II} Minutes of the Second Advisory Board Meeting, June 2015, (8pp)

demonstration center. Cooperation with KRSU where the UNIDO technology demonstration center was to be established was approved. The use of fly ash was discussed but not endorsed due to several reasons, including environmental issues. Production cum training centers to be established through the open media announcement and selection of enterprises/beneficiaries to be based on agreed criteria—experience, financial solvency, availability of physical space, and willingness to co-finance. As a follow up, a framework memorandum between State Agency and KRSU was proposed, and agreements with each of the selected private companies were to become an integral part of the framework memorandum.

Third meeting^I was conducted on 27 Nov 2015, also attended by observers. Tabysh Ltd., which submitted their application for partnering with the project (out of 5 who submitted their applications), was pre-selected based on the criteria presented at the 2nd meeting. The first piece of equipment was installed at Tabysh Ltd. (the mud stabilized block producing machine). One of the issues raised related to the selection of companies closer to Bishkek, as those located in rural or remote areas were not selected. Two project publications were also presented during the meeting. At the meeting, which was also the final meeting in tier 1 of the project, the AB members recommended to speed up the project activities and refused the idea of using fly ash due to its incompliance with Kyrgyz normative documents. In addition to this, the MoU between KRSU and Gosstroy was to be amended to reflect the role of the private sector.

Fourth meeting^{II} of the AB took place one year later, on 10 Nov 2016; the agenda included progress to date, information on technologies and upcoming tender for procurement of equipment and agreeing further plans. Tumar Ltd. was selected as project partner. They would be provided with equipment for the production of sheep wool insulation material. Technologies for rehabilitation of the irrigation canals were also presented and discussed. Mud blocks were found to be not very satisfactory due to the incompatibility of their physio-mechanical properties with the requirements of normative documents of the Kyrgyz Republic. Preliminary sketches of one-story and two-story demo houses were displayed. One of the follow up activities of the meeting was jointly with Ministry of Agriculture to select an irrigation area for testing the proposed technologies. Proposals of the project team and the AB were approved, specifically, (i) To launch the tender for procurement for the shotcreting technology and for equipment items for producing concrete tiles, straw-based panels, straw mats, thermally poplar modified wood and concrete canvas; (ii) To pay

^I Minutes of the Third Advisory Board Meeting, 27 Nov 2015 (5pp)

^{II} Minutes of the 4th Advisory Board Meeting, 10 November 2016 (6pp)

attention to the weight of concrete tiles; (iii) To explore the possibilities for rubber sealants from recycled tyres to be used for sealing concrete prefabricated irrigation channels; (iv) To finalize equipping the UNIDO Technology Demonstration Center (TDC) at KRSU premises; and (v) To design the sketches/drawings of the demo houses to be built construction at KRSU.

Fifth meeting¹ was conducted on 3 Oct 2017, one year later again, with an agenda including SMART BUILD Center official inauguration, overview of seven machines/technologies adopted by the project, out of which two have been commissioned. Equipping of the training center in KRSU was still ongoing. Zarya Cooperative was selected as project partner for the production of straw mats from agricultural wastes. The portal www.smartbuild-kg.com was launched, to become a data base of suitable building materials and emerging housing technologies with information on ca. 45 international *i.e.*, foreign companies. The web page was to contain manuals, standards, research papers and guidelines. Due to the delays and difficulties with equipment delivery the project has been granted a six-month extension. The construction of the demo houses now was to be completed by March 2018, the construction process was to be recorded on a film.

General remarks: Each meeting provoked discussions on various technologies and equipment proposed by the project team. Consequently, new ideas and a further search for potential technologies and raw materials utilization were initiated.

Sixth meeting may have taken place late in 2017 or early in 2018 but this was without the knowledge and participation of the project team. Minutes from the 6th AB meeting is not available.

A concluding meeting is envisaged to take place soon—at least, has been proposed by Gosstroy—to recapitulate the results achieved as well as the persisting delays and possible remedies (Завершающие мероприятия проекта). In the opinion of the Evaluators it should also address the issues of project extension, further project staffing, the management and monitoring of both the delayed activities and those progressing satisfactorily, and last but not least the exploitation of potential synergies within the project and with other projects, and future promotion of the project outcomes.

The project highlights/milestones, which ought to be closely supervised by the Advisory board, were (or were to have been):

- Opening of the SMART BUILD demo center at KRSU on 3 October 2017

¹ Minutes of t 5th Advisory Board Meeting, 3 October 2016 (6pp)

- Finalization of delivery and installation of remaining equipment at KRSU and selected enterprises. Production of respective construction materials—not done yet
- Start-up of actual operations at the beneficiaries using UNIDO-supplied machinery—so far, Wool deburring; Wood modification; Straw mats knitting; yet to be done: Mud press; Stone splitter; Tiles extruder
- Finalization of demo houses construction at KRSU—not done yet
- Film production about demo houses construction at KRSU—not done yet
- Information events for disseminating experience and achieved results—done in part, to be continued
- Conducting the Final evaluation of the project—being done right now.

In addition to formal AB meetings, there were of course numerous less formal, managerial meetings some of which were attended by AB members, such as the Skype meeting [36] held on 8 December 2016, related to a management event concerned with cooperation with KRSU; the Thermally Modified Wood facility; irrigation canal sealants; roofing tiles; straw mat boards; procurement of Demo Hall equipment; etc., or meetings resulting in various management/workplan monitoring documents [49,50].

3.7 Reviewers' rating of the project

The overall rating of the project as seen by the reviewers is shown at the end of this section and also in Annex 6 – Rating tables.

The project objectives were met in part, about one half of the results were achieved. Further success depends on overcoming the problems encountered. Sustainability of project outcomes hinges on having all the machines, not just some of them, up and running as soon as possible and putting them to use in a smooth, streamlined workflow which in turn depends on finding suitable outlets *i.e.*, market for all the items produced while complying with applicable the legislation. This appears to have been met in the case of the sheep wool deburring facility, the wood modification furnace, and the straw mats knitting machine. The outcome is less certain in the case of the mud brick presses, the shotcrete slinger, and the stone splitter which are yet to be tested in practical operation.

Monitoring and evaluation were on the whole, adequate. Project formulation was very good, project design as well as project management were adequate although the latter suffered from insufficient communication between the project team, the Advisory board, and UNIDO.

The reviewers' overall project rating is "**Moderately successful**".

3.7.1 Midterm versus Terminal assessment

View of the Mid-term review [10]	View of the Terminal Evaluators
Review results	
<p>The Project was assessed based on the five evaluation criteria according to the following five levels: highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory and unsatisfactory.</p> <p>The Project has high relevance, assessed from its consistency with Kyrgyzstan's development policies as well as construction industry development policies; the country's needs of affordable building materials; UNIDO's development assistance policies to Kyrgyzstan; and the donor's policies.</p> <p>The effectiveness of the project is assessed as moderately satisfactory since four outputs are expected to be achieved or partially achieved, while it is anticipated that the Objectively Verifiable Indicators (OVIs) (including the suggested ones) for Expected Outcome will be partially achieved.</p> <p>The efficiency of the project is judged as moderately satisfactory. While many of the Project inputs have been implemented as scheduled, or slightly behind schedule in order to produce intended Outputs, there have been several factors that have decreased the efficiency of the project implementation.</p>	<p>Except that Midterm assessment was biased toward more positive results— as has been proven by the delays that occurred later on. This may have been caused by the 'mixed approach' adopted for the Midterm review.</p> <p>Complete agreement; the relevance of the project cannot be overestimated as it is very high indeed, from whatever of the angles mentioned in the Midterm review it is regarded.</p> <p>The Evaluators are tempted to assess the effectiveness of the project as moderately unsatisfactory, if it were not for those project components that have proven rather successful— depending of course on how they will fare in the future. These are, notably, the sheep wool deburring subproject and the Smart Build center.</p> <p>Efficiency was in fact moderately unsatisfactory. At the end of the project, four out of the seven technologies provided have never yet been put into operation. The same applies to the Demo houses yet to be built. And indeed there were several delaying factors which probably involved all of the following, to different degrees: the project team, the Advisory board, the UNIDO HQs, the counterparts/beneficiaries and unavoidable problems that have not been managed with sufficient</p>

View of the Mid-term review [10]	View of the Terminal Evaluators
Review results	
<p>It is difficult to assess the impact of the project at the moment, since it would be too early to judge the probability of achieving Development Goal.</p> <p>The Sustainability of the Project is assessed as moderately satisfactory from institutional and organizational, financial, technical, and other points of view.</p>	<p>forethought. In the Evaluators view, the project team were the least culpable.</p> <p>Agreed, it is much too early to responsibly judge and assess impact and sustainability. So while the Evaluators agree that potentially, both impact and sustainability can be high, this cannot be predicted today with any certainty. At least one year will have to elapse before any meaningful data can be obtained, on the condition that the project even if not extended will continue to be managed.</p>
Recommendations	
<p>UNIDO (the Project Managers and the Project Team)</p> <ol style="list-style-type: none"> 1. Consider the extension of the Project until 31 March 2018. 2. Finalize the feasibility study report by May 2017 (Output 1); 3. Assist Tabysh Ltd. in finding a better composition of mud-stabilized blocks, whether as walling material or filler (Output 2); 4. Assist Tumar Art Group LLC in developing heat and acoustic insulation material, making use of the wool deburring machine (Output 2); 5. Complete the third procurement of four or five lots by June or July 2017, and in parallel, select the beneficiaries (Output 2); 6. Prepare a plan of training on the procured as well as to-be-procured technologies/lots, detailing the purpose, target, schedule, etc.; and following it, conduct a series of training once the third procurement is completed (Output 3); 7. Develop technical manuals for the to-be-procured technologies/lots, once the third procurement is completed (Output 3); 8. Review the schedule of and complete the construction of demonstration houses at the earliest possible date (Output 4); 9. Plan the preparation of promotion materials for the procured as well as to-be- 	<ol style="list-style-type: none"> 1. That is clearly not enough; estd. one year additional extension or monitoring is required. 2. No true feasibility report was found although a wealth of data was accumulated. 3. Wait until the pricing situation and proven market demand makes mud blocks competitive. In the meantime, KRSU may continue research. 4. Tumar are capable now to proceed on their own, just need help with certification 5. Done. 6. These tasks still stand. But there must be some staff and management to do all these things. Some training of course will be done by the KRSU, but training conducted by the private companies is questionable. 7. Fine manuals are available on Mud blocks and Insulation. 8. Continues to apply. But the earliest possible date is estimated to be in summer 2018 if all the materials to be produced by the supplied technologies are forthcoming. 9. All technologies have been procured already. Additional

View of the Mid-term review [10]	View of the Terminal Evaluators
Review results	
<p>procured technologies/lots to be used for the demonstration/dissemination of these technologies; and develop them, once the third procurement is completed (Output 4);</p> <p>Kyrgyzstan – Cost-effective Building Materials Project Mid-term Review Report 3</p> <p>10. Consider and revise the logframe referring to the suggested version; and share it with the project stakeholders in a timely manner;</p> <p>11. For the monitoring of project activities: 1) prepare an action (follow-up) plan, for the Project Team, by detailing the current individual work plans, including the responsibilities as well as the deadlines, and periodically follow up on the progress; and 2) collect the data based on the OVIs in the logframe;</p> <p>12. Hold AB meetings more frequently, if necessary, in order to make better use of technical local knowledge as well as further involving the private sector (i.e. the business association that represents the private sector’s interest) to precisely reflect their needs in the project implementation;</p> <p>UNIDO and Gosstroy</p> <p>13. Develop a technology information base (database) of locally available building materials and housing technologies so that it will be effectively used as well as regularly updated even after its handover to Gosstroy (Output 3);</p> <p>UNIDO, KRSU and Gosstroy</p> <p>14. Prepare a plan of demonstration/dissemination of the adopted technologies, detailing the purpose, target, schedule, etc., as well as a dissemination strategy on the medium-term basis including the effective use of TDC (Output 4);</p> <p>15. Secure the cooperation framework between Gosstroy and KRSU even after the completion of the project period in order to secure</p>	<p>promotional materials and events however are advisable and, in fact, necessary if the project momentum is not to be lost.</p> <p>10. Sadly behind schedule, needs extension and/or further monitoring. But the logframe need not be changed.</p> <p>11. Continues to apply but should be the task of the beneficiaries, no longer of the project unless speedily extended.</p> <p>12. At least hold a concluding AB to recapitulate everything and to chart the way forward.</p> <p>13. Drop the data base and focus on more promising tasks; or hand over the existing nucleus of the data base to Gosstroy right away, for them to merge it with their own data base.</p> <p>14. Agreed in full.</p> <p>15. Yes, this cooperation should receive all possible support, and a body where both parties will be represented should be instituted.</p> <p>16. To be discussed and the way forward charted jointly by KRSU, Gosstroy, and Ministry of Economy.</p>

View of the Mid-term review [10]	View of the Terminal Evaluators
Review results	
<p>Development Goal achievement; In the medium- to long-term: Gosstroy and the Ministry of Economics 16. Introduce legislation toward the standardization of emerging building materials and housing technologies (e.g. referring to foreign systems) as well as the promotion of SMEs in the relevant sectors; and UNIDO Headquarters 17. Streamline approval processes (such as procurement issues) at UNIDO Headquarters for timely project implementation.</p>	<p>17. This should be given some thought at UNIDO Hqs., or at least the comments by the project team should be heard.</p>
Lessons Learnt	
<p>1. Before launching a new project, should there be no basic information available on the relevant sectors as well as potential project partners, it could be an option to conduct a preliminary survey or to allot a certain period of time to conduct such a survey on the inception stage of the project; 2. When designing a project to transfer cost-effective, environmentally-friendly as well as energy-efficient housing technologies, it is essential to define the time frame taking due account of local geographic and climatic conditions; and 3. Throughout the implementation process of a project to transfer cost-effective, environmentally friendly as well as energy-efficient housing technologies, based on the fact that the market for building materials is constantly evolving, the market needs should be properly assessed and accordingly reflected in project activities.</p>	<p>1. This statement by the Midterm review is confusing. Availability of at least basic and, preferably advanced information is of course a must at the launching of any project, and this reasonably includes a preliminary survey and appropriate scheduling. 2. This again is obvious. 3. In this case, the market needs in housing were known and/or properly recognized, and were in fact correctly reflected in the choice of the technologies that eventually came to be provided by UNIDO.</p>

3.7.2 Questions and Answers as per TOR

The key evaluations questions as per TOR [51] for Independent terminal evaluation are answered below.

Ownership and relevance	
<p>1. Relevance of the project objectives, outcomes and outputs to the different target groups of the intervention</p>	<p>On ownership and relevance, the technologies supplied under the project in fact are no high technology. Yet they are all of them useful. The private companies will use them after installation; ultimately of course it depends on the companies' or entrepreneurs' decision. They will benefit the sheep farmers—sell black sheep wool. Tumar Art Group Co., one of the beneficiaries, is building a collection point where they intend to buy out the wool from the farmers.</p> <p>University will train future construction engineers who will become experts in these technologies. The faculty also are developing a strategy for a more effective utilization of the Smart Build Center, of the Demonstration houses, and of any production outputs the technologies assigned to them will produce.</p> <p>It has been noted that all this machinery will need to be installed at suitable premises which it does not have yet, <i>cf.</i> Question 18. On the whole, clearly defined ownership, and high relevance.</p>
<p>2. The counterparts' appropriate involvement and participation in the identification of their critical problem areas and in the development of technical cooperation strategies and their active support of the implementation of the project approach</p>	<p>The counterparts i.e. beneficiaries were not part of the decision making process on the technologies; they did not in fact participate in any manner except on the Advisory board. But they were not part of the decision making process on the selection of technologies. The machinery allocation process was fully supervised by UNIDO. The selection of beneficiaries for the project was done in such a way that as a rule, there was always an announcement by the project team in the local press once any particular piece of equipment arrived in the country (see example, Fig. 29). Interested parties were pre-evaluated by the team and submitted for decision by UNIDO HQs. The University however</p>

	became a beneficiary based on common consent once this was discussed by the Advisory board.
3. Relevance and sufficiency of the outputs as formulated in the project document to achieve the expected outcomes and objectives	Relevant, sufficient but overly ambitious and diffuse as to purpose—with too many disparate objectives.
4. Relevance of the project to the UNDAP objectives and ISID agenda	Yes, relevant enough.
Efficiency of implementation	
5. Provision of UNIDO and counterpart inputs as planned and adequacy of these inputs to meet requirements	Too many delays. Most equipment delivered in 2017, the final year of the project. Procurement has generally come under criticism, as being very slow. There were three tenders on plant and machinery [52]. In fact during 2014-2016 there were almost no deliveries so this has largely immobilized the project team. Some of the deliveries were incomplete—either through faulty/incomplete specification, or because of administrative incompetence.
6. The quality of as-planned UNIDO inputs and services (expertise, training, methodologies, etc.) and their contribution to the production of outputs	Except for the delays, there was quality planning; high-quality expertise (even if Gosstroy insisted the project team composition could have been more 'technical'); well proven UNIDO methodology; a minor contribution of training (only at the level of bringing the various machines supplied to an operational condition, <i>i.e.</i> , operators' training, not yet completed). However, even at the inception phase of the project there was hardly any proper preparation in terms of finalization of analysis and research of the housing and irrigation needs.
7. Provision and adequacy of as-planned UNIDO procurement services in terms of timing, value, process issues,	The presently applicable UNIDO procurement rules prevent full advance payment for machinery; this has resulted, in the opinion of the project team, in excessive costs being paid because those suppliers who accepted the condition of max 20% advance payment

responsibilities, etc.	offered as a rule more costly wares—more expensive machinery. Examples: Ordering a relatively commonplace machine from a supplier located half a globe away from destination; delivery by air freight of the first mud block press, definitely a piece of equipment where no great urgency was required; according to the project management team, this was rushed in by air which—even if justified—caused resentment, moreover arriving in wintertime when no mud blocks could be produced anyway.
Project coordination and management	
8. Efficiency and effectiveness of the national management and overall field coordination mechanisms of the project	There appear to have been numerous delays in decision making, blamed (by various parties) on HQs, the project team, and the fact that the project was managed remotely from different locations far removed from Kyrgyzstan, i.e., Vienna and India. All this made things unwieldy and cumbersome.
9. Efficiency and effectiveness of the UNIDO management, coordination, quality control and technical inputs	UNIDO management would probably be rendered more efficient and effective, and might even save money, if greater responsibility and independence (and also, a higher job security) were afforded to the local project team, and if the UNIDO procurement rules could be relaxed somewhat to allow purchasing cheaper equipment albeit at more flexible terms of payment.
10. Monitoring and self-evaluation carried out based on indicators for outputs, outcomes and objectives and using that information for project steering and adaptive management	The project team, the Advisory board as well as UNIDO HQs all off them engaged in monitoring and self-evaluation, and the indicators for outputs, outcomes and objectives were followed, cf. for instance, the Mid-term review [26]. However, the logframe even after modification is regarded as too general to allow close and effective monitoring.
11. Approvals and documentation of changes in planning documents during implementation	The project logframe [45] was amended [32] in the course of the project, but these were minor changes only and occurred rather late, in 2017. One example of problematic management concerned the approval of tender results by which the construction company assigned to building the demo houses. was selected: The decision of the tender was sent to

	<p>project management too late, in December 1917, so they were only able to start construction with a delay (not in September as intended). Even today they do not have all the materials from the seven technologies which were to have been used in the Demo house construction. As at now, only the foundations for the houses are being laid. Payment of the contractor was also delayed. They are being built on a remote plot of University land even though near the Smart Build center, so the question is what will induce visitors to come and see the houses.</p>
12. Synergy benefits that can be found in relation to other UNIDO activities in the country or elsewhere	<p>Synergies with other UNIDO projects are yet to be looked into because there is nothing of substance to be offered by any of the subprojects until the relevant machinery is in place and running.</p>
Effectiveness	
13. The extent to which outputs have been produced and how the target beneficiaries use the outputs	<p>See data elsewhere in this questionnaire on the respective seven technologies. Difficult to judge until all the technology is in place and until the market response can be observed and evaluated. The wool subproject in an exception: there has been a great rise in productivity; money derived from the sales of local company will stay in the country; the Tumar price levels tend to be rather high and yet they seem to sell successfully. Yet the ordinary customer is mainly interested in price and imported materials tend to be cheaper than those by Tumar.</p>
14. The extent to which outcomes have been or are likely to be achieved through utilization of outputs	<p>Different for the various technologies and other benefits provided. There is detailed information also in the Midterm review.</p>
15. Contribution of the project to inclusive and sustainable industrial development	<p>Implementing inclusive and sustainable industrial development (ISID) is one of the modern visions pursued by UNIDO based on the 2013 Lima Declaration. "Inclusive" in this context means that industrial development must include all countries and all peoples, as well as the private sector, civil society organizations, multinational development</p>

	institutions, and all parts of the UN system, and offer equal opportunities and an equitable distribution of the benefits of industrialization to all stakeholders. The term “sustainable” addresses the need to decouple the prosperity generated from industrial activities from excessive natural resource use and negative environmental impacts [53]. Within these definitions, the KG national economy is certain to welcome all the new technologies supplied by UNIDO, and the project design as per the project document can be regarded as excellent even if too ambitious, and focused primarily on Kyrgyz SMEs and rural communities.
Impact and sustainability	
16. To what extent developmental changes (economic, environmental, social, inclusiveness have occurred or are likely to occur as a result of the intervention and are these sustainable	Rather high impact for the wool deburring subproject in the area of job creation and continued gender equality at the beneficiary (Tumar Art Group), and as a means of generating an additional income opportunity for the sheep growers. The wool deburring subproject is believed to have social impact even today, at least near the Shopokov territory. Good impact and sustainability for straw mat knitting. Moderate for wood thermal processing, stone splitting, and tile extrusion. Probably not high for the mud blocks presses and the shotcreting machine, owing to pricing and funding constraints.
17. Was the project replicated/ did it have a multiplying effect	No replication yet due mainly to procurement, installation, and start-up delays involving the UNIDO-supplied equipment; potential replications and a considerable multiplication effect are expected after all the equipment will have become operational, tbd after at least one year of actual operations.
18. Was sustainability correctly factored in the project strategy (risks analyzed and assumptions identified at design stage and appropriately monitored during implementation);	Probably not; e.g. the mud brick prices became non-competitive as of 2015 but no action was taken to modify the project. Sustainability tbd after the processes will have become operational; risks of delayed delivery of equipment underestimated. Also regarding the siting of the equipment, <i>e.g.</i> that entrusted to the KRSU, it has been noted that all this machinery will need suitable premises which it does not have yet. The mud blocks press

	can relatively easily be moved from one construction site to another—this is one of its primary advantages as it is primarily destined for rural house construction. However, the stone splitter will definitely need sufficient space of its own, for the supply of stone and ancillary facilities. The same applies to the roofing and wall tiles machine, they cannot be operated from the shed in which they are presently stored; however, the University has abundant land available nearby, also in the vicinity of the Demo houses being built.
19. The prospects for technical, organizational and financial sustainability	The prospects are different for each of the seven UNIDO-supplied technologies: For (1) mud blocks, financial sustainability is limited by the current price situation where ordinary burnt bricks are cheaper than, or at the same niveau as, the mud blocks; for (2) roof & tile extruded products, the prospects (technical, organizational and financial) tbd after starting the production operations; for (3) natural stone splitting, potentially very good thanks to abundant supply of raw material but again, tbd after starting the production operations and developing a market; for (4) straw mat knitting, probably very good thanks to simplicity of operation and easy use of the product; for (5) the shotcrete machine, constrained by the narrow window of opportunity between the cessation of frosty weather and filling the irrigation canals with water, and also limited by the underfunding of the Melioration department; yet expanded by potential applicability of shotcreting outside the irrigation area, in virtually all different areas of civil construction; for (6) wood thermal processing, rather good although on a relatively limited scale; and for (7) wool deburring, excellent technically and organizationally thanks to the greatly enhanced productivity of the wool treatment process, but limited financially by the high price of the product (felt) which is yet to find adequate markets.
Private sector development related questions	
20. Promotion of private sector development (PSD) through industrial upgrading and modernization of the manufacturing	This fits the project purpose and objectives all right, but cannot be exercised—eve, it would be counterproductive—unless all the supplied technologies are up and running, and in shipshape condition.

sector enterprises. Did this modality fit the project purpose and objectives?	
21. Feasibility of the project at the macro, meso and/or micro level? Appropriateness of the choices made	None of the technologies supplied can be discarded as being of no use to the Kyrgyz economy. The choices made were appropriate and it is only up to making all the technologies operational whether they will show a potential for advancing from the micro to the higher levels thanks to replication. Only time will show.
22. Involvement of private sector institutions/associations in the project design and implementation. If yes, in what way? If not, should they have been?	No involvement at the design stage; more than 50% involvement in project implementation. Four of the seven technologies were assigned to private subjects.
23. Potential of the approach adopted to address the problems identified/achieve the project objective	More time—a year a least—is needed to answer this based on actual operating results and market success.
24. Did the project address production and market issues in a satisfactory manner?	Yes, as to addressing production issues. In part only as to addressing market issues.
25. Has the issue of possible market distortions been considered:	Yes, but found unlikely to occur.
25.1 Have beneficiary companies been selected based on transparent, fair and appropriate criteria?	Selection took place at UNIDO HQs based on project team recommendations which in turn were based on screening the applicants.
25.2 Is the project affecting the competitiveness of existing enterprises? Have any measures been introduced to prevent market distortion?	Not yet, and unlikely in the future, owing to the modest size of the new operations. Also, the wool deburring facility is the only one in the country, and so is the wood thermal processing operation. No measures to prevent market distortion needed as yet.
25.3 To what extent have private companies	Through UNIDO-supplied equipment (free of charge)

been subsidized by the project	
25.4 Are companies paying for services rendered or equipment obtained?	No, the equipment has been supplied free of charge—except for some missing items which either UNIDO or the beneficiary in question will eventually have to set to rights.
26. If the project has worked with a limited number of selected companies, can the results be expected to be replicated to achieve higher impact?	Yes with some of the technologies which already are operational (mud blocks—to a limited extent pending improvements in the positioning of mud bricks in the marketplace. Wood thermal processing—depending on market success). Straw mat knitting—good prospects. Limited potential for replication in case of the wool deburring technology—requires know-how and a considerable amount of additional machinery. The as yet untested technologies (tile extrusion; stone splitting)—tbd. Shotcreting technology—well proven but will depend on future funding of operations.
27. Established linkages to financial institutions	Not yet as far as known; not needed at present.
28. Expected enterprise effects leading to socio-economic impact such as employment or income generation, gender, equality and poverty reduction?	Potentially present, although to unequal degree yet to be determined, with all the technologies supplied, but yet to be proven by actual success of the operations. Proven already in the case of the wool deburring technology: it has increased employment, created potential for income generation, and contributed to gender equality).
29. Existence of an M&E system, including baseline information, to allow for measurement of results and impact	to be developed
30. Have synergies with other UNIDO branches/services been exploited, in particular TCB, environment, agri-business development and energy? Would there have been a case to establish such linkages.	The KRSU claims to perceive (and exploit in the future) synergies with other University projects. As for any other synergies and linkages, any responsible evaluation thereof has to wait until all the project technologies will have taken off from the ground.

Cross-cutting questions	
<i>Environment</i>	
31. Has the project promoted environmental sustainability?	Yes, particularly the (1) mud blocks technology requiring no external inputs; the (3) natural stone splitting relying on local material in abundant supply; the (4) straw mat knitting technology, for obvious reasons; the (5) shotcreting technology contributing to the regional water balance; the (6) wood thermal processing relying on local material made more resistant; and the (7) wool deburring opening the market for black sheep wool.
32. Are any positive environmental benefits likely, even if they may be indirect?	Yes, no doubt, <i>cf.</i> above; their scope and extent will depend on the future success of replication.
<i>Gender</i>	
33. To what extent was gender dimension mainstreamed and operationalized during the project design and implementation?	Fully adequate gender representation on the project team; in some of the technological operations such as primarily, wool deburring; and on the terminal evaluation team. At the level of the entire project, equal opportunities but difficult to judge before progressing to the level of actual users of the technologies.
<i>The objective of "Job creation"</i>	
34. KG unemployment figures & breakdown	Kyrgyzstan, with a population of 5.8 million recently increased to about 6.03 million (according to a 2016 National Statistical Office estimation [2]) is predominately young: over half of population is under the age of 25. Kyrgyzstan is included in the "lower middle-income" group of countries in World Bank rankings. Rural areas suffer from high unemployment and working-age people continue to move from rural areas to urban areas to earn a living or to Russia and Kazakhstan for seasonal labor. Unemployment rate in Kyrgyzstan decreased to 2.30 per cent in December from 2.40 per cent in November of 2017. It averaged 2.64 per cent from 2000 until 2017, reaching an all-time high of 3.50 per cent in December of 2006 and a record low of 2.20 per cent in August of 2015 [7].

	<p>According to a different source [8], unemployment is lower in rural than in urban areas, and labor force participation is slightly higher in rural areas, mainly because the agriculture sector has flexibly absorbed labor as necessary. Unemployment rate actually is quite low, as rural population who have got land plots are considered to be farmers, even if actually do not cultivate the soil. However, underemployment is widespread there, with 31% of rural working-age men and 54% of rural working-age women employed for fewer than 25 hours per week.</p>
<p>35. Total estimate of jobs created; breakdown by facilities; by sectors; by location/regions; by type of job</p>	<p>Insignificant so far on the national scale but potentially, quite important. Main potential, in the (1) mud blocks technology providing jobs for rural population; in (4) straw mat knitting which is easily replicated; in (6) wood thermal processing and poplar growing (local variety largely unused in construction but apparently, excellent for facades); and in (7) wool deburring (25+10 jobs created at Tumar Art Group producing felt and wool products). As regards the other technologies (so far only one machine was tested) there was no direct impact yet but in the second stage, after proper dissemination, there is job creation potential. Some customers can become interested in replicating the technologies once successfully demonstrated, and today's University students can become customers for the technologies tomorrow. The Smart Build center of the KRSU can be the vehicle for such events, even with international attendance.</p>
<p><i>The objective of "attracting advanced technologies and investment in the construction materials sector"</i></p>	
<p>36. Sound out the opinions and notions of individual stakeholders, especially KG Government & University</p>	<p>Only some of the technologies brought in by the project can be regarded as 'advanced': to an extent, the (5) the shotcrete machine; to a moderate extent, the (6) thermal processing of poplar wood; and to an extent of considerable importance with substantial potential impact on Kyrgyzstan, the (7) wool deburring technology. However, even the remaining technologies can attract new investment in the construction materials sector: the (1) mud blocks technology in rural areas; the (2) roof & tile extruded products for general civil construction purposes, the (3) natural stone splitting machines providing quality material</p>

for construction; the (4) straw mat knitting machine relying on local inputs. The Advisory board by its decisions has never halted or downsized any of the seven technologies evidently regarded as sound investment (even though the Chair of the AB, Gosstroy, expressed reservations regarding the mud blocks technology and the project-related communication between the AB and the project management team; Gosstroy sees the mud blocks as ill-suited for a country with winter and summer cycles, and as poorly resistant to earthquakes). The project team were dedicated to making the project succeed; the former team leader (from India, already dissociated from the project) expressed generally positive views of the project outputs reached so far. The KRSU people were enthusiastic and expectant (also having in mind the possibility of setting up commercial spin-offs, in addition to educational/training purposes and research activity); the private entrepreneurs—beneficiaries (as far as determined) were all of them happy with the machines they received; the Melioration department were hopeful but unsure yet of future success.

3.7.3 Evaluation specifics

Consideration of downstream markets is an important factor of future success or failure of the UNIDO-supplied technologies.

Promotion is going to be the prime factor of success of the Demo houses and, to a degree, also of the Smart Build center; the Demo houses ought to demonstrate the advantages of the products based on the supplied technologies, and the Smart Build center ought to be intensely utilized for students and other interested parties, for them to become acquainted with the technologies and to contribute to their future multiplication.

Another, related consideration is the pricing situation concerning these technologies and their products.

Presently the pricing situation is not very favourable for the mud bricks, *cf.* Table below.

Table: The prices for bricks and blocks in Bishkek, 2018 [54]:

UNIDO mud stabilized block, size 220x115x220 mm, non-load-bearing, insulation required - 15 som/pc. (prime cost)
Sand-cement block, size 400x200x200 mm, non-load-bearing, insulation required - 25 som/pc.
Aerated concrete block, size 600x250x100 mm, non-load-bearing, insulation not required - 60 som/pc.
Burnt clay brick, size 250x120x88 mm, load-bearing, insulation required (not required if wall thickness is 640 mm) - 6 som/pc.

In the wood modification business, the treatment of course increases the price of the timber: boards dried at say 90°C sell at 15.000 som per meter square while thermally treated may be costed as high as 40.000 som (by the beneficiary's statement).

Even in the largely successful wool deburring business, the company executives expressed a concern that the treatment of the wool increases price—and thus constrains the field of application.

In all these cases, vagaries of the market have to be coped with, and the respective technologies can only be expected to find adequate markets if the prices are right.

Overall rating of UNIDO project

Criterion	Evaluator's summary comments	Reviewers' rating*
Attainment of project objectives and results		
Design	Good logframe, adequate design even though not focused (too many disparate technologies even though virtually all of them falling under the umbrella term INSULATION. This feature however has not been exploited Little action was sometimes taken in response to the external experts' inputs.	S
Relevance	Highly important to all stakeholders, highly relevant toe KG economy, rural development, etc.	HS
Effectiveness	No more than moderately effective; plagued by problems.	MS
Efficiency	Methodologies were good but outputs were not always forthcoming.	MS
Sustainability of project outcomes		
Economic dimension	Going in the right direction but will eventually depend primarily on actual market demand and om replication capability.	MS
Social dimension	Adequate reflection of the current needs, especially of the rural population.	S
Environmental dimension	The best intentions but not sustainable in view of the problems encountered in seeking suitable outlets for the products of all the technologies supplied. Generally harmless processes in building construction. Possible expansion of the use of local materials in case of virtually all the technologies (mud blocks; tiles; cut stone; sheep wool; irrigation canals, ...).	MS
Project management		
National management	Very good, competent; not always in accord with UNIDO HQs and/or Advisory board. Supervision & support: not always tight enough, resulting in numerous delays.	S
UNIDO management	Supervision and backstopping: adequate	S
Monitoring and self-evaluation	On the whole, adequate.	S
Synergies	The regional office of UNIDO was helpful in facilitating with Govt counterparts. All stakeholders were keen on having the project succeed but often they have not worked in harmony. Selection of beneficiaries was a difficult task Procurement and delivery hampered by a number of unforeseen even if rather commonplace hitches and hindrances which they had to be overcome:	MS
UNIDO specific ratings		
Quality at entry and termination	Moderately successful, with potential to upgrade to Very successful.	MS
Implementation approach	Adequate.	
Overall rating		S

***NOTE:**

- Highly Satisfactory (HS): The project had no shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency;
- Satisfactory (S): The project had minor shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency;
- Moderately Satisfactory (MS): The project had moderate shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency;
- Moderately Unsatisfactory (MU): The project had significant shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency;
- Unsatisfactory (U) The project had major shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency;
- Highly Unsatisfactory (HU): The project had severe shortcomings in the achievement of its objectives, in terms of relevance, effectiveness or efficiency.

4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED

4.1 Conclusions

The overall objective of the project, “to contribute to promotion of community level job creation and income generating activities through the development and use of cost-effective building materials for housing purposes and for the environmentally sound rehabilitation of water irrigation and drainage system in the rural areas of Kyrgyz Republic” has been met in its general outlines and as regards the general thrust of the project. It is so ambitious though that it could not have been met in its specific manifestations, i.e., through the delivery of machinery and other benefits used to help industrialize the housing construction sector, particularly in rural areas, unless it can be presented as an outstanding model example and replicated throughout the country.

For that the project would have to be fully successful but was in fact hampered by a number of delays, particularly in the procurement of the seven UNIDO-supplied technologies, so that by the end of the project period the processes involved have not had a chance yet to arrive at full operational capability.

The design of the project was very intelligent and so adapted as to maximally benefit local populations and SMEs by providing locally available building materials. The technologies were responsibly and cleverly selected so as to maximally benefit local populations and SMEs by providing locally available building materials. Thus the project was fully in line with Kyrgyzstan's National Sustainable Development Strategy and the State Program on Affordable Housing as well as with the UNIDO principles.

The immediate objectives included the distribution to both the KRSU University and SME beneficiaries of self-contained machinery assemblies to support seven different technologies well adapted for use in rural areas, plus of other benefits including mainly a so-called Smart Build center and Demonstration houses intended to serve for education, training, demonstration of construction materials, and promotion of the technologies so that they can be replicated thus bolstering the local construction industry.

The implementation of the project has recorded several success stories and several tasks yet to be completed. The former included the provision, commissioning, and start-up of machinery for sheep wool deburring (most successful), for thermal modification of locally grown poplar wood and for the knitting of straw mat insulation (judged moderately successful), and for the manufacture of mud bricks and/or blocks for rural house construction (judged successful pending favourable price developments in the construction sector). The latter included the three remaining technologies based on machinery already delivered but yet to be put into operation (tile extruder and stone splitter for the building trade, and shotcrete slinger for irrigation canal repair work).

The common denominator of all these technologies is Insulation—against inclement weather, rainwater, rough usage, or heat insulation. This is a good slogan, a catchword more likely to register with the builders and the entire construction community than the too abstract declared project objectives.

Specific conclusions:

(i) The number of project stakeholders listed was rather high and only some of them made substantial contributions to the project. A local project team leader would be preferable to one coming from afar. The project team, competent enough, would work better if given more independence in taking operational decisions. The Advisory board of the project should convene more frequently when problems arise.

(ii) The communication channels linking the principal project actors, *i.e.*, Gosstroy, KRSU, the Advisory Board, the UNIDO office as well as UNIDO HQs should be strengthened.

(iii) For the future, the number of different technologies collected under the umbrella of one single project should be reduced. Particularly, the irrigation canal improvement technology is rather distant from the general orientation of the project.

(iv) The training programs/courses based on the UNIDO-supplied technologies have to be developed and implemented, mainly at the University and less at the SMEs. Course curricula should be discussed with, and tailored according to the needs of, the trainees. Tight training schedules should be developed and adhered to in order to fully exploit the training center potential.

(v) The KRSU should pay a visit to a reputable institute active in the area of testing and certification of construction materials before embarking on launching an institute of their own. The outstanding Klokner Institute in Prague, of 100 years fame, would be a suitable candidate for the visit. The plan should be consulted with Gosstroy.

(vi) Certification in the area of textile materials, such as that desired by one of the SME beneficiaries, can be negotiated with any suitable textiles testing institute such as exist in many countries.

(vii) The attractive Smart Build center on the KRSU grounds should be widely used not just for training but possibly also *e.g.*, for conferences or seminars devoted to the experience acquired with the seven technologies and with the general approach to tackling the country's needs by this UNIDO project, under the guidance of the Head of UNIDO operations in Kyrgyzstan.

4.2 Recommendations

The reviewers recommend:

- (i) Endeavor to extend the project, albeit with a modified focus and scope, by as much as one year to fully exploit its demonstration and promotion potential. If the modality of a formal project extension proves impossible (which is likely, there already having been one extension), arrange for a post-project monitoring period to supervise the completion of the unfinished tasks and also to guard against the possibility of some of the technologies brought in never being actually put into operation. For this purpose, re-hire the project team, reactivate the Advisory board, and involve the UNIDO Country Representative. Thus the remaining, as yet unfinished project components will have an opportunity also to succeed and eventually contribute to job creation and technology upgrading at the country level.
- (ii) Consider a follow-up project primarily focused no longer on production of the building materials but on two related objectives: on wider dissemination, demonstration, capacity building and curricula development based on the tested and to-be tested technologies, thereby aiming to contribute to upscaling of employability by the construction sector especially in rural areas.
- (iii) Invite UNIDO to participate in, and/or to act as the implementing agency for, any future project expansion, extension or follow-up,

owing to its wealth of experience in the field, also based on the specific experience acquired with the present project.

- (iv) Impact and sustainability of the project and its various components can only be responsibly assessed after a period of undisturbed operation. That constitutes yet another compelling reason for project extension or, alternatively, for a suitably designed follow-up project. Thanks to the thrust of the extension period or rather, of the follow-up project adjusted so as to focus less on technology proper and more on testing and certification of the products manufactured, or even potentially, on local production of the machinery, it will become easier for the technologies involved to succeed in the local marketplace and elsewhere.
- (v) UNIDO through its regional office in Bishkek and through contacts with KRSU should maintain lively contacts with the construction industry scene, in order to foster the basis for a true nationwide and international cooperation. In this context, paying close attention to market developments in the volatile construction sector is essential.
- (vi) Depending on the success of the project technologies which have not yet had a chance to display their advantages/benefits, manuals for those which will prove successful should be published along the same lines and to a similar format as those two already produced (on Mud bricks and on Insulation). These could also be used outside Kyrgyzstan.

4.3 Lessons learned

Never let schedules and delivery deadlines out of sight to avoid gross delays causing the project to grind to a halt.

Pay attention to the country's legislative scene in order not to miss any developments. It has been stated before, in relation to another project that displayed many similarities with the present project, that „No one will do anything until and unless there is pertinent legislation in place“. This should be remembered because it also applies to KG.

Complete success in the area of managing relatively complex projects on meagre means cannot realistically be expected; problems have to be expected and tackled as soon as they arise.

The valuable experience acquired by UNIDO staff and project experts during the course of the project is worth exploiting further, in (i) an experts' conference where papers principally by those experts who produced their specialized reports for the present project are delivered to an international audience recruited from KG as well as other Asian countries, and in (ii) any follow-ups to the project which, whether or not supported by UNIDO and/or any other organization, ought to be regarded as advisable by the Government and be included in Government planning—because the housing problem of Kyrgyzstan will not go away but is bound to expand and become no less acute as time progresses.

ANNEXES

Annex 1 – TOR for Final evaluation



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

TERMS OF REFERENCE

INDEPENDENT TERMINAL EVALUATION

UNIDO project “Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan”

Project ID: 140116

Time period: 2014-2018

August 2017

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BACKGROUND AND CONTEXT

PROJECT FACTSHEET

Project Title	Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan
UNIDO SAP ID	SAP ID: 140116
Region	East Europe
Country(ies)	Kyrgyzstan
Implementing agency(ies)	UNIDO
Executing partner(s)	
Project implementation start date	9 October 2014
Donor(s):	Russian Federation
Actual implementation end date	Original implementation end dated: 31 August 2017 Extended till 31 March 2018
Project Budget	
Total co-financing at design (cash and in-kind)	Cash: USD 2,000,000 (including support costs of 13%) In-kind:
Materialized co-financing at project completion (cash and in-kind)	
Planned terminal evaluation date	January-February 2018

(Source: Project document)

BACKGROUND

The Kyrgyz Republic (hereinafter referred to as “Kyrgyzstan”) is a landlocked country in Central Asia with a population of 5.7 million¹. Kyrgyzstan is geographically prone to

¹ Government of the Kyrgyz Republic and United Nations Development Assistance Framework 2018-2022.

multiple low-to-medium-level disasters: earthquakes, landslides and heavy snowfall, as well as floods.

Since its independence in 1991, the economy and public services have deteriorated drastically. After a political and social upheaval, a number of reforms have aimed to restore economic and social stability as well as address shortcomings in public governance. Kyrgyzstan faces additional challenges associated with sweeping changes in the global economy owing to its reliance on one gold mine, Kumtor, which accounts for over 10% of Gross Domestic Product (GDP), and on worker remittances, equivalent to about 30% of GDP spanning 2011-15.^I

Kyrgyzstan is among the few lower-middle-income countries in the region of Europe and Central Asia, with its per capita Gross National Income (GNI) of US\$1,170 in 2015. The poverty rate (measured at US\$2.5/day) increased by 1.4% to 30.6% of the population in 2015 due to weak economic growth and lower remittance inflows.^{II} Wide regional development disparities and income inequalities undermine the country's progress.

Industry is the second largest sector of the Kyrgyz economy providing some 10% of employment, following retail and wholesale trade; it consists of manufacturing, energy and water supply, as well as mining. However, the share of manufacturing in GDP is declining due to a slowdown in gold production at Kumtor, while the fall in industrial employment is primarily explained by a significant reduction in the number of workers in the garment and food industries, respectively.^{III} Agriculture remains an important sector and source of 32% of total employment in 2014.

Housing sector

The Kyrgyz Republic has undergone major changes in the housing sector since its independence in 1991, including state withdrawal from direct housing provision, decentralization of housing functions to local government, mass housing privatization and increased involvement of the private sector in housing construction^{IV}. A UNECE report on the housing sector (2010) identified the high poverty rate as one of the major reasons for inadequate housing. Moreover, mass rural-to-urban migration and natural population growth in the late 2000's increased pressures on urban housing.

Restructuring in the housing sector was followed by a sharp reduction in housing construction and a deterioration of living standards, as well as an increase of construction costs due to a declining building-material industry. Low income households, especially in rural areas, undertake housing renovation works themselves due to limited financial resources and are unable to purchase costly

^I Available at: <http://www.worldbank.org/en/country/kyrgyzrepublic/overview#1> (28/02/2017)

^{II} Available at: <http://www.worldbank.org/en/country/kyrgyzrepublic/overview#3> (28/02/2017)

^{III} Piga, G., Novovic, T. and Mogileskii, R. (2016) Common Country Assessment for the Kyrgyz Republic.

^{IV} UNECE, The Country Profile for Housing Sector of Kyrgyzstan, 2010.

construction materials^I. Most of the existing housing stock was built during the Soviet era and needs repair. Only 40 per cent of rural households have access to running water and 40 per cent are linked to public sewerage systems. Urban areas are in a better situation; 70 per cent have access to running water and sewerage systems, but most buildings are also in need of renovation^{II}.

The 2007 Country Development Strategy for 2007-2010, proposed a reorientation of housing policy and identified affordable housing as a priority. However, due to the lack of a comprehensive institutional framework and insufficient financial infrastructure, the Government failed to address the country's housing problems^{III}.

Further aggravation of the housing issue took place in April and June 2010 mainly due to unrest in South Kyrgyzstan that destroyed 1,900 houses. The conflict tore apart cities and their surrounding areas in the provinces of Osh and Jalalabad^{IV}. In the semi-formal settlements that arose as a result of the conflict and migration movements, houses are built using discarded building material. Since no infrastructure for residential use is available in these settlements, people live without electricity or water supply. While some settlements resemble simple residential areas with brick houses, others are an agglomeration of one-room huts accommodating entire families. During harsh winters, the huts are heated with coal ovens and insulated with plastic bags that close the windows and the partly open roof.

In response to the housing crisis facing the country, in 2001, the Government introduced a State Programme of housing construction until 2010. Similarly, in 2007 a National Programme of housing construction for 2008-2010 was approved by the Government. However, the goals of both programmes have not been achieved and, in 2008, housing construction decreased significantly^V.

Irrigation and drainage system development issues

In 2005, irrigation, which is vital for agriculture, covered an estimated area of 1,021,400 ha (full control irrigation). The irrigation system in rural areas of Kyrgyzstan, particularly in the mountainous regions, is mainly based on gravity-flow systems constructed in the late 19th century, although some were subsequently upgraded. During the Soviet period, responsibility for water distribution and maintenance of canals was the responsibility of collectivized landholdings and organized workers – “Kolkhozes” (collective farms) and “Sovkhozes” (state farms).

^I Swiss Agency for Development and Cooperation, Housing Microfinance Advisory Services Project. Accessed on 4 February 2014.

^{II} UNECE, The Country Profile for Housing Sector of Kyrgyzstan, 2010.

^{III} Ibid.

^{IV} Agency for Technical Cooperation and Development (ACTED), “Kyrgyzstan: one year after the violence”, 9 June 2011.

^V State Programme on Affordable housing in Kyrgyz Republic for 2012-2014

The irrigation system has undergone several upheavals in recent decades. After the collapse of the Soviet Union, land was redistributed^I and in the early 1990s, the irrigation system was affected by the difficult transition and the lack of government and farmers' capacity to cover the operation and maintenance (O&M) costs of irrigation schemes. This resulted in a rapid deterioration of the water supply infrastructure, including hydraulic structures, dams, head-works and canals. As a result, the area covered by irrigation was drastically reduced and became rain-fed because of high prices of electricity and spare parts for irrigation equipment. All equipment for the irrigation system was produced in the Russian Federation^{II}. The deterioration of higher-order irrigation systems, coupled with a shortage of finance and professional capabilities to adequately address the challenges and develop a new irrigation system, increasingly harmed the agricultural sector.

Currently, the main systems, particularly those downstream of large storage dams are well maintained. The distribution system, though, is generally poorly designed, built and maintained. Distribution efficiency is estimated at 55 per cent, mainly due to the considerable seepage and leakage losses. Irrigation and drainage network in Kyrgyz Republic comprises 12,835 km of canals, of which 82 per cent are earthen, 17 per cent concrete and 1 per cent pipes. The irrigation schemes are subdivided according to technical features as follows:

- Engineered irrigation scheme (40.2 per cent of the area): water-inlet structures on rivers that provide silt protection; the canals are lined.
- Semi-engineered schemes (34.4 per cent): water-inlet structures, but canals are only partly lined and partly equipped with water distribution structures.
- Non-engineered schemes (25.4 per cent): no water-inlets, and canals are not equipped with water distribution structures and are not lined.

According to the FAO, salinity and drainage problems in Kyrgyzstan are likely to increase in the upcoming years, while the Government is very restricted financially to address the issue. The main institutions involved in water resources, irrigation and drainage planning and development, the Ministry of Water Resources/Economy and the Ministry of Agriculture are unlikely to be able to maintain and operate the existing drainage system effectively, nor improve or extend it. Most drainage and salinity problems are in the northern part of the country, in the Chui province^{III}.

The current legal framework for water management in Kyrgyzstan is elaborate, and the management of most secondary canals was transferred to the newly formed Water Users' Associations (WUAs). Formalization of the WUAs was promoted by international donors, including the World Bank and the Asian Development Bank. WUAs were established at the local level to distribute water, maintain field channels and to collect the newly introduced irrigation service fees. The main functions of

^I Joe Hill, "Farmer managed irrigation systems in the Alai (Kyrgyzstan) and Pamir (Tajikistan) mountains", Discussion Paper 1343, Global Water Forum, November 2013.

^{II} FAO Water Reports, Irrigation in Central Asia in figures: AQUASTAT Survey-2012.

^{III} Food and Agriculture Organization of the United Nations, <http://www.fao.org/docrep/w4356e/w4356e0h.htm>

WUAs are O&M of the on-farm irrigation system, water distribution, and dispute resolution. However, the capacities of WUAs lag behind. Under the influence of donors, the Government wants to expand the role of WUAs to also cover O&M that remains under the responsibility of the Government^I.

Building materials sector

The building materials sector constitutes around 6 per cent of GDP. Activities of enterprises in the sector are mainly based on local raw material resources. Export-oriented products in this sector include cement, sheet glass, walling and facing tiles made of natural stone. Inflows of FDI and local investment facilitated the development of enterprises focusing on the production of import-substituting building materials such as cement, fire bricks, polystyrene concrete, dry concrete mix, and others.

Kyrgyzstan has natural deposits of raw materials that partially meet the needs of the building materials sector. According to the National Sustainable Development Strategy, locally available raw materials are used in three cement plants – the Kant Cement Plant with a capacity of cement production of about 1 million tons per year, LLC “Tehnolin” with a capacity of about 300 thousand tons, and the Kurment Plant with a production capacity of 70 thousand tons. The building materials industry also includes a number of brick factories and quarries for the extraction of sand and gravel, loam, clay, limestone, basalt and gypsum^{II}.

Since 2006, the building materials sector has experienced a certain degree of stabilization. Currently, about 200 enterprises are engaged in the production of building materials, employing 10,000 people. From 2010, an upward trend in building materials output was observed, mainly attributed to the development of new capacities of cement production, and the launch of sheet glass production in 2012. The modernization of existing, and the establishment of new, building materials enterprises are supported by domestic and foreign investments^{III}.

Currently, the building materials sector of Kyrgyzstan faces several challenges in terms of inefficient management. Due to a lack of financing, the Government is unable to conduct periodic inspections and provide licensing services, leading to unsustainable use of resources and unavailability of reliable sources of construction materials.

Disaster risk management

The Kyrgyz Republic is prone to multiple low to medium-level disasters due to its mountainous landscape and location in a highly active seismic zone. The country is

^I IFAD, Water users Associations in the NEN Region: IFAD interventions and overall dynamics, October 2012.

^{II} Ibid.

^{III} WTO, Trade Policy Review, Kyrgyz Republic, October 2013.

affected by earthquakes, landslides, mudflows, avalanches and floods, as well as heavy winter snowfall. There are around 14,000 hazard-prone sites. On average, natural disasters cause approximately USD 30–35 million of damage annually, but the Government’s annual allocation for disaster response and risk reduction does not exceed USD 6 million^I.

Frequent earthquakes, landslides, heavy snowfall, as well as floods partially caused by deteriorated irrigation water supply system, hamper Government efforts to reconstruct the housing and irrigation systems in the country, due to lack of financing and unavailability of affordable construction materials.

Main challenges

Despite the efforts of the Kyrgyz Government, limited progress has been achieved in addressing the challenges of both *affordable housing* and the *rehabilitation of irrigation systems*, especially in rural areas.

The lack of **cost-effective housing** remains a severe problem for the local population, negatively impacting quality of life and access to basic facilities. Since centralized construction of housing decreased significantly, there is little infrastructure for residential use, with most existing housing requiring repair. Low income households, especially in rural areas, undertake housing renovation work themselves due to limited financial resources and are unable to purchase costly construction materials. The shortage of low-cost building materials negatively affects the availability of affordable housing, particularly for the low-income population in semi-formal settlements. While some semi-formal settlements resemble simple residential areas with brick houses, others constitute an agglomeration of settlements built using discarded building materials.

Deficient low-cost construction materials also hamper timely reconstruction and repair work of **irrigation canals and drainage systems**, especially in rural areas. The irrigation system in Kyrgyzstan faces several challenges related to secondary salinization, a lack of drainage, waterlogging and erosion that are mainly caused by the low efficiency of irrigation networks due to poor maintenance, deterioration of drainage network and a lack of financial and technical resources to run rehabilitation works^{II}.

As a result of the technical consultations held with the project donor (the Russian Federation), it was requested to integrate a component addressing the country’s needs in the rehabilitation of the water irrigation systems to the current project proposal on “Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan”.

^I World Bank, 2013.

^{II} UNCCD, Impacts from sustainable land management, case study – Kyrgyzstan.

Hence, the potential of the country's building material sector to address the challenges of affordable housing and rehabilitation of irrigation and drainage systems is not fully employed. The local construction, manufacturing and, indirectly, agricultural sectors face the following constraints:

- Severe shortages of low-cost construction materials;
- Lack of access to energy-efficient and environment-friendly material manufacturing technologies;
- Shortage of adaptable technologies based on local resources of materials and manpower;
- Insufficient institutional support for promoting cost-effective technologies and investment in the material manufacturing sector;
- Unexploited potential for management of wastes/residues from agriculture and industry;
- Lack of employment opportunities leading to poverty.

One of the **key strategic development priorities of the National Sustainable Development Strategy for 2013-2017 and the Medium Term Development Programme for 2012-2014 of the Kyrgyz Republic is the promotion of sustainable economic growth and social inclusion**. This is to be achieved through industrial infrastructure development, sustainable private sector development, advanced and resource efficient technology promotion, affordable housing provision, rehabilitation and expansion of irrigation systems for agriculture, and sustainable job creation. The Government of the Kyrgyz Republic requested UNIDO to provide technical assistance in the development of a technical assistance project aiming at creating new jobs, attracting advanced technologies and investment in the construction materials sector.

PROJECT CONTEXT

To address the above-mentioned challenges, the Kyrgyz government requested UNIDO for the Project. The objective of UNIDO technical assistance is to facilitate the promotion of innovative and low-cost sustainable manufacturing technologies and disseminate knowledge in the area of cost effective and environmentally friendly building materials that can be easily absorbed by the local construction industry for housing and irrigation purposes. At the outset, the project will conduct a feasibility study to identify the best international and locally available technology solutions for the manufacturing of energy efficient, environmentally friendly and cost-effective building materials based on local raw materials. The technologies and know-how identified will be tested on site and used in the construction of low-cost demonstration houses and in the provision of technology solutions for rehabilitating irrigation systems. Modernization of the country's building material sector through adoption of innovative technologies and capacity building activities will facilitate community level job creation and income generating activities in the beneficiary and other related sectors, and improve livelihoods, especially in rural areas.

UNIDO has over four decades of experience in delivering technical assistance to developing countries and economies in transition. This experience has shown that effective technology management is crucial for industrial development. The

proposed approach draws upon UNIDO technical cooperation projects aimed at promotion and effective implementation of know-how and technologies for production of environmentally friendly and energy efficient materials on the basis of sustainable use of locally available resources. These UNIDO projects have helped various countries in Africa, Asia and Latin America to meet low-cost construction and housing needs for low-income population. UNIDO, as a part of its ongoing programmes in the area of materials science and engineering, particularly in the construction sector, have taken steps to support the industrialization process in developing countries by building up capacity for investment promotion and technology transfer, creating awareness among policy makers, industrialists and researchers on new materials and processing technologies.

Based on this technical knowledge and experience, UNIDO identified a number of cost-effective environmentally friendly, and energy efficient technologies that can be sustainably promoted and absorbed in the low-cost construction sector in different countries, based on the following criteria:

- Materials are based on locally available renewable raw material resources, including residues and wastes from industry, forestry, agriculture, natural plant materials and fibres;
- Pre-processing and processing activities generate livelihoods in rural areas;
- Manufacturing technologies are energy efficient and lead to skills upgrading, employment generation and quality products;
- Manufacturing performed by locally trained technicians based on short term training and use of easy to operate equipment;
- Materials and manufactured components reduce/substitute imports of materials.

Due to an array of constraints, the construction industry in the country faces the challenges of material shortages aggravated by rising prices. The “traditional material” based manufacturing technologies tend to consume a lot of energy and deplete natural resources of forests and agricultural top soil. Furthermore, technological development and modernization is increasingly seen by the manufacturing sector as a tool to streamline productivity, protect the environment, enhance energy efficiency, generate employment, upgrade skills and alleviate poverty.

To address the above challenges and contribute to the Government’s efforts to achieve the objective of affordable housing, the proposed project seeks **to facilitate the transfer of technologies and know-how on the production of cost-effective construction materials leading to the modernization of domestic enterprises in the construction materials sector, and quality improvement of construction materials produced by local enterprises.** One of the proposed technology solutions is to use innovative composite materials based on sustainable use of local resources from forestry, agriculture, natural fibres, plant materials, other locally available sources, such as agricultural and industrial wastes, and good clay and basalt deposits. Alternative materials can also be manufactured using natural fibres as reinforcement in a binder such as cement or polymer.

The project demonstrates how technology diffusion and absorption by local enterprises can be strengthened by integrating public policy with private investment through close cooperation with local authorities and SMEs.

The project main outputs include:

1. **Detailed technical and economic feasibility study** outlining the country's resources and needs and identifying appropriate know-how and technologies for cost-effective building materials demanded by the domestic construction industry and in rural areas and communities. The feasibility study will result in recommendations for specific project activities tailored to the country's needs and technical requirements in housing and rehabilitation of irrigation and drainage systems based on locally available, affordable and eco-friendly raw materials. Special focus will be put on promoting cost-effective, locally competitive and environmentally friendly¹ manufacturing technologies and also those aimed at generating employment in various regions of Kyrgyzstan (depending on availability and price range of locally available materials). The feasibility study will pay a special attention to environmental protection and energy efficiency issues of the proposed solutions. This output will also make extensive use of the UNIDO database for available building material technologies. The results of the feasibility study will be shared with the Government in order to raise awareness of the problem and thus contribute to the development of national long-term plans.
 - **Activity 1.1:** Visit the field, assess and select local materials such as clay, gypsum, lime stone, basalt, river sand, aggregates, natural fibres and other by-products to convert into value added cost-efficient and environmentally friendly building materials for housing and irrigation purposes. The selection of the raw materials will be also based on Environmental Impact Assessment (EIA) to be conducted in accordance with the national regulations and evaluation of its the sustainability
 - **Activity 1.2:** Identify various instruments and machines available locally for manufacturing building materials and assess the possibility using them in the project.
 - **Activity 1.3:** Complete a housing need assessment and identify local needs in terms of rain water harvesting, recycling of water, different methodologies for the storage and transportation of water inter alia based on samples and available information.
 - **Activity 1.4:** Identify machines for the development of moulds for defining water storage, recycling, and distribution and drainage systems.
 - **Activity 1.5:** Conduct research for the regionally and internationally available advanced know-how, machinery and equipment for manufacturing building materials based on identified needs, environmental impact assessment (EIA), energy and resource efficiency, and collected samples of applicable raw materials.

¹In view of the various measures taken by the international development community towards the clean technologies, the project will, *inter alia*, seek to develop environmentally friendly building materials with a balance towards the reduction of the production and technology costs at the end of project.

- **Activity 1.6:** Identify suitability of identified know-how and technology for the development of building products for construction of affordable housing under this project.
- **Activity 1.7:** Assess potential for modification and use of various kinds of machines (identified for building components and housing technologies) for the provision of better water storage, recycling, distribution and drainage system.
- **Activity 1.8:** Identify new and upcoming building materials and housing technologies, which may be adopted in Kyrgyzstan also for adoption by the local entrepreneur in future.
- **Activity 1.9:** Review existing relevant legal and regulatory frameworks in country and regional context to address possible gaps and barriers for sustainable development of building materials and related sectors.

2. Field testing, adaptation and demonstration of technological processes for cost-effective manufacturing of building materials and components. Field testing and adaptation of equipment will ensure that any technologies transferred as part of the project will be appropriate for the end users. These technologies will provide cheaper alternatives to imported building materials and will be used by the local construction industry in Kyrgyzstan.

- **Activity 2.1:** Procure equipment for further testing and adapt acquired technological processes to use as per local conditions (including specific properties of identified raw materials, local building materials and building systems).
- **Activity 2.2:** Test developed building materials and building systems in the laboratory and field to verify (i) their various properties as per the requirement of the building codes and building design; and (ii) the implementation of demonstration housing building for seismic and other parameter required for the cost-effective housing.
- **Activity 2.3:** Identify local networking partners for the dissemination of technology at the field level and its documentation.
- **Activity 2.4:** Adapt appropriate and affordable building materials with the support of employment generating housing machines and technologies.
- **Activity 2.5:** Adapt the same machineries for creating building components for irrigation and drainage purposes with special application requirements. The machinery will be adapted to develop moulds for generating building components for channel lining, rain water harvesting, water recycling, distribution and drainage systems.

3. Transfer of know-how and technology to local manufacturers for production through the training of local engineers, skilled and semi-skilled workers, entrepreneurs in building materials sector, and construction supervisors from Kyrgyzstan. Training will provide both male and female skilled manpower able to operate and maintain the machinery that will be demonstrated and disseminated among participating communities as part of the project. As the machinery is relatively simple to operate – with production remaining labour intensive – technology transfer of these machines will decrease the cost of

housing while creating joint employment opportunities. All training for experts from support institutions and companies will be developed and rolled out in a way that they will be accessible to men and women alike (taking into account possible constraints of female workers in the context of machine maintenance/operations and handling of heavy loads, etc.).

- **Activity 3.1:** Establish a national capacity for technology demonstration and training of the local construction workforce for learning and adoption of identified and developed housing technologies. The training and demonstration capacity will be established within the premises of an existing vocational training institution, sectoral association or local municipality administration to be identified during the feasibility study phase of the project in close consultations with local authorities of the Kyrgyz Republic.
- **Activity 3.2:** Identify, select and train local construction workers, engineers, and staff of local agencies and other stakeholders on the production of building materials to ensure their further participation in the construction of demonstration buildings and rehabilitation of pilot irrigation and drainage objects as per applicable codes and standards in the country.
- **Activity 3.3:** Create a national technology information base with the 15 to 20 new and emerging technologies for housing and building material production with required technical know-how, technology providers, researchers and companies, so that further building industry growth may be maintained with the support of local agencies, technology database and local entrepreneurs^I.
- **Activity 3.4:** Develop appropriate methods and techniques for various systems of rainwater harvesting, recycling of water, different methodology for storage, transportation and drainage of water.
- **Activity 3.5:** With the support of trained experts, develop few pilot project studies for their further implementation at ground level.

4. Construction of demonstration houses and delivery of technology solutions for rehabilitation of pilot irrigation and drainage objects using the new building technologies, aforementioned machines and production methods; and **communication of developed manufacturing practices** through the development of promotional materials and organization of advocacy events^{II}. The demonstration objects will be used in trainings to demonstrate various technologies and techniques.

- **Activity 4.1:** Based on results of Output 2, select the equipment and materials for production from the identified technologies and local raw

^I The national technology information base will be established as a reference database complementary to existing web-platforms of a selected project counterpart/stakeholder institution. The national database will also form a basis for upscaling the developed technology solutions of country's housing problems through provision of affordable methods, technologies and building materials for construction of housing, particularly in rural areas.

^{II} The project communication campaign will actively involve country level experts, technologists and entrepreneurs in order to take the project forward with industrial partnership.

resources considering their sustainable consumption for the required types of building components for housing, irrigation and drainage purposes.

- **Activity 4.2:** Develop pre-fabricated building components for housing, irrigation and drainage purposes and standardize as per local conditions.
- **Activity 4.3:** Conduct field level implementation through the construction of demonstration buildings at the national capacity for technology demonstration and training; and deliver technology solutions and capacity building activities on irrigation, drainage, water distribution and recycling for pilot irrigation objects as per the codes and standards applicable in the country and using identified and developed building materials.
- **Activity 4.4:** Organization of awareness and dissemination events through information briefings, seminars, and a final press-conference to communicate project results and manufacturing practices generated. The activity will also facilitate public-private dialogue as a means to strengthen policy making at the national level¹.
- **Activity 4.5:** Preparation a brochure, catalogue and, if possible, training module for streamlining project communication for future.

Project logframe is presented in Annex 4.

CURRENT STATUS OF IMPLEMENTATION

In the period of October 2014-May 2017, the project has accomplished the following activities:

- Within the framework of the UNIDO project, a technical study and survey were conducted to assess the availability of local materials and possibilities for their use in the development and production of building materials and housing construction. The following materials were identified:
 - natural resources: clay, sand, stone, limestone and gypsum are available as natural resource materials;
 - agro industrial waste: rice husks, cotton and wheat straw and corn waste
 - recyclable waste: used car tyres, waste black sheep wool and plastic and polymer wastes can be recycled and used as input material for the production of building materials.
 - Several technologies using organic and inorganic wastes have been identified. One technology already adopted with private company. Procurement of two other technologies is under process.
- Based on the research, a list of machinery and technologies were identified, including the following:
 - Plant and machinery for production of fly ash, cement, lime, gypsum, sand and aggregates-based bricks;
 - Plant and machinery for production of raw and laminated medium density fibre board using various kinds of agricultural wastes;
 - Sheep wool processing w/o washing – wool deburring machine;

¹ The project will also demonstrate how technology diffusion and absorption by local enterprises can be strengthened by integrating public policy with private investment through close cooperation with local authorities and SMEs.

- Used tyres recycling and roof tile production line (an indicative list of the equipment: ring cutter; strip cutter; lump cutter; steel wire separator; rubber crusher; conveyor; vibrating sieve; magnetic separation; rubber mixer; vulcanizing machine; mould sets);
- Machines for making light weight roofing, walling and flooring tiles;
- The mud stabilized block/brick has been identified as the first building material, to be produced and adopted under the project. The transfer of this equipment to the project beneficiary enterprise has been completed. Respective training delivered by the experts of the equipment supplier. The production of mud stabilized blocks at the project beneficiary enterprise is being continued and respective activities to improve the quality of the produced blocks to local conditions is being undertaken. Testing was carried out for the mud-stabilized bricks/blocks on the spot according to the existing standards for optimization of process and improvement of the properties of final products, once the equipment has been installed. The respective block samples were also successfully tested at the laboratory by the local authorities. This said equipment was installed, training conducted, technological adaptation to local conditions is in the process for selecting the optimal composition of the mud blocks. The samples of mud-stabilized blocks had been displayed as the alternative to the conventional walling material at the three-day BishkekBuild-2016 Exhibition in March 2016, the local largest and most popular flagship exhibition with a focus on the building materials and construction.
- As part of the 2nd tender, the following two technologies/equipment are to be procured: (1) sheep wool-based insulation material, (2) roofing material based on recycled tyres. As per joint decision taken by the Project Donor an additional set of equipment producing the mud-stabilized blocks/bricks were procured to the UNIDO Technology Demonstration Centre at the Kyrgyz-Russian Slavic University (KRSU).
- Based on the partnership established with the project beneficiary enterprise (Tumar Ltd) – recipient of the equipment for production of natural sheep wool insulation rolls, the UNIDO project will also be able to facilitate production the eco-friendly, affordable and innovative building materials that will be also used for construction of demonstration houses.
- As a part of the project, technologies for production of building materials were identified and adopted to the local requirements and needs, including the following:
 - Semi-mechanized transportable machinery to carry out dissemination and training for mud stabilized block technology at any location.
 - Technologies using agro waste, sheep wool and used tire for recycling and development of value added building materials.
 - A spectrum of other innovative technologies is subject of the 3rd tender currently underway.
- Capacity building activities included training and coaching of local engineers, skilled and semi-skilled workers, entrepreneurs and construction supervisors about installation, operation, production and use of interlocking mud stabilized blocks.
- As part of the 3rd tender, the project procuring the following equipment and

machinery, which will be further installed, adapted and tested locally:

- straw mats knitting machine;
 - plant and machinery for production of roofing, flooring and siding tiles;
 - natural stone splitting machinery for splitting of any type of natural stone, including river rocks, for the production of medium to large size cobble stones, small wall stones and tiles;
 - thermal modification chamber for wood;
 - mobile, universal machine for dry- and wet shotcrete application.
- The project facilitated establishment of cooperation between the State Construction Agency of Architecture, Construction and Communal Services (GosStroy), Kyrgyzstan and the Kyrgyz-Russian Slavic University (KRSU) (Memorandum of understanding was signed on 24 August 2015). The parties agreed to work together in research, demonstration and promotion of technologies, inter alia, through a UNIDO Technology Demonstration Centre being established at the premises of KRSU.
 - UNIDO Technology Demonstration Centre has been established jointly with the Kyrgyz-Russian Slavic University (KRSU). Renovation of demonstration hall is completed and currently the equipment and furniture is being procured. The Centre will be used to showcase various building materials and housing technologies. It will contribute to strengthening the skills and knowledge of KRSU students and staff and to improving public awareness about emerging and alternative technologies in the area of building materials and housing. The TDC will also disseminate hands-on knowledge among the targeted beneficiaries about the UNIDO-adopted building materials and showcasing the project achievements.
 - Design and architectural plan for the construction of two demonstration houses is ongoing. 2 demonstration houses are to be built based on locally produced materials that are to be partially produced by the UNIDO-supported equipment, which also constitutes part of UNIDO Technology Demonstration Centre. Project partner, KRSU, has already identified the site for construction of demonstration houses.
 - The essential concurrent component of the project is also rehabilitation of damaged irrigation channels from the construction materials and technologies as adopted by the project. As for the options for the technologies for rehabilitating the existing irrigation canals in the piloted areas, the project is exploring the possibilities for appropriate solutions such as the concrete canvas, and shotcreting.
 - Publication of two technical manuals in English and Russian, including (a) Hydraform mud stabilized blocks production and installation manual; and (2) Technical manual for production and use of mud stabilized blocks. The UNIDO article informing on technical substance, project progress and achievements as well as on the Donor country supporting the project implementation was published in Republican information and analytical magazine “Industrial Kyrgyzstan” (issue 2016#11 June-July 2016). The e-version of article can be found at: www.magazine.kg
 - Participation at the exhibitions, meetings with potential project partners facilitated establishment of institutional and business partnerships. Thus:

- On 1 November 2014, the Project participated in the First Corporate exhibition “JIA Kurulush 2014” which was held in Bishkek and organized by the Young Entrepreneurs’ Association (JIA). Information and public awareness about the launch of new project and its activities were disseminated by an individual UNIDO project booth, which was facilitated by organizers.
- In March 2015, the Project attended the Building materials exhibition in Bishkek, which helped to disseminate project information and to gather information about the building materials as being already available in the country and to be introduced in the market.
- The UNIDO Project (with participation of the project partner Tabysh Ltd) is presented at the annual international construction exhibition Bishkek Build 2016 held 30 March-1 April 2016 in Bishkek, Kyrgyz Republic. The project booth is equipped with pop up, information booklets, technical manuals, short videos about training on operation and maintenance of the first set of equipment.
- The UNIDO project and its preliminary results were also disseminated at the 3rd “Issyk-Kul 2016” Economic Forum, which brought up together the representatives of governmental offices, business communities, business associations. The forum was organized by the Investment promotion Agency under the Ministry of Economy of the Kyrgyz Republic, jointly with “Huahe International”.

BUDGET INFORMATION

Budget status as of June 2017:

Grant	Total allotment	Total expenditure	% Implementation	Donor
2000002838	US\$ 1,769,911.50	US\$ 1,566,880.04	88.52	Russian Federation

PURPOSE OF THE EVALUATION

The purpose of the independent terminal evaluation is to assess:

1. Project relevance with regard to priorities and policies of the Government of the Kyrgyz Republic, the Donor, and UNIDO;
2. Project effectiveness in terms of the outputs produced and outcomes achieved as compared to those planned;
3. Efficiency of implementation: quantity, quality, cost and timeliness of UNIDO and counterpart inputs and activities;
4. Prospects for development impact; and

5. Likelihood for long-term sustainability of the support mechanisms results and benefits. The evaluation should provide the necessary analytical basis and make recommendations to the Government of the Kyrgyz Republic, the Donor and UNIDO.

The evaluation should also draw lessons of wider applicability for replication of the experience gained in the project in other interventions.

The terminal evaluation will be undertaken as per UNIDO Evaluation Policy, the Guidelines for Technical Cooperation Programmes and Projects and the project document. The Project Manager, in collaboration with the Independent Evaluation Division (ODG/EVQ/IEV) will commission the terminal evaluation.

SCOPE OF THE EVALUATION

The independent terminal project evaluation will cover the project implementation period from 2014 till the end of August 2017 covering all the activities that are part of the project, with particular focus on the evaluability of the outputs, outcomes, as a result of the UNIDO technical assistance, including inputs and activities, impact and sustainability of the project implementation.

- Consider all the activities that are part of the project;
- Cover the entire results chain from inputs and activities to impact and sustainability and review processes as well as results;
- Produce recommendations (e.g. what has worked and what has not and what are the lessons from implementation to date, which issues needs to be addressed in a possible next phase and what conditions should be in place).

EVALUATION ISSUES AND KEY EVALUATION QUESTIONS

The evaluation consultant(s) will be expected to prepare a more targeted and specific set of questions and to design related survey questionnaires as part of the Inception Report, and in line with the above evaluation purpose and focus descriptions.

However, the following issues and questions are expected to be included in the assessment:

Ownership and relevance

The extent to which:

- The project objectives, outcomes and outputs are relevant to the different target groups of the intervention;
- The counterpart(s) has (have) been appropriately involved and were participating in the identification of their critical problem areas and in the development of technical cooperation strategies and are actively supporting the implementation of the project approach;
- The outputs as formulated in the project document are relevant and sufficient to achieve the expected outcomes and objectives;
- The project is relevant to the UNDP objectives and ISID agenda.

Efficiency of implementation

The extent to which:

- UNIDO and counterpart inputs have been provided as planned and were adequate to meet requirements.
- The quality of UNIDO inputs and services (expertise, training, methodologies, etc.) was as planned and led to the production of outputs.
- UNIDO procurement services are provided as planned and were adequate in terms of timing, value, process issues, responsibilities, etc.

Project coordination and management

The extent to which:

- The national management and overall field coordination mechanisms of the project have been efficient and effective;
- The UNIDO management, coordination, quality control and technical inputs have been efficient and effective;
- Monitoring and self-evaluation was carried, were based on indicators for outputs, outcomes and objectives and using that information for project steering and adaptive management;
- Changes in planning documents during implementation have been approved and documented;
- Synergy benefits can be found in relation to other UNIDO activities in the country or elsewhere.

Effectiveness

The extent to which:

- Outputs have been produced and how the target beneficiaries use the outputs;
- Outcomes have been or are likely to be achieved through utilization of outputs;
- The project/programme contributes to inclusive and sustainable industrial development.

Impact and sustainability

- To what extent developmental changes (economic, environmental, social, inclusiveness have occurred or are likely to occur as a result of the intervention and are these sustainable;
- Was the project replicated/ did it have a multiplying effect;
- Was sustainability correctly factored in the project strategy (risks analyzed and assumptions identified at design stage and appropriately monitored during implementation);
- What is the prospect for technical, organizational and financial sustainability.

Furthermore, the evaluation will address the following questions specific to the **private sector development** related questions:

- How has private sector development (PSD) been promoted through industrial upgrading and modernization of the manufacturing sector enterprises? Did this modality fit the project purpose and objectives?
- Did the project work at the macro, meso and/or micro level? Were the choices made appropriate?
- Have private sector institutions/associations been involved in the project design and implementation? If yes, in what way? If not, should they have been?
- Did the approach adopted have the potential to address the problems identified/achieve the project objective?
- Did the project address production and market issues in a satisfactory manner?
- Has the issue of possible market distortions been considered:
- Have beneficiary companies been selected based on transparent, fair and appropriate criteria?
- Is the project affecting the competitiveness of existing enterprises? Have any measures been introduced to prevent market distortion?
- To what extent have private companies been subsidized by the project
- Are companies paying for services rendered or equipment obtained?
- If the project has worked with a limited number of selected companies, can the results be expected to be replicated to achieve higher impact?
- Have linkages to financial institutions been established? If yes, what were the results? If not, was there a need for this?
- Can enterprise effects be expected to lead to socio-economic impact such as employment or income generation, gender, equality and poverty reduction?
- Did an M&E system exist, including baseline information, to allow for measurement of results and impact?
- Have synergies with other UNIDO branches/services been exploited, in particular TCB, environment, agri-business development and energy? Would there have been a case to establish such linkages.

The following cross-cutting related questions shall be also covered by the evaluation.

Environment

- Has the project promoted environmental sustainability?
- Are any positive environmental benefits likely, even if they may be indirect?

Gender

- To what extent was gender dimension mainstreamed and operationalized during the project design and implementation?

In addition to the qualitative assessment based on the evidence gathered in the evaluation, the evaluation team will rate the project on the basis of the **rating criteria for the parameters described** in 5.

EVALUATION APPROACH AND METHODOLOGY

This terminal evaluation will be carried out in accordance with UNIDO Evaluation Policy and the Guidelines for the Technical Cooperation Programme and Project Cycle. While maintaining independence, the terminal evaluation will adopt a participatory approach and will seek the views and feedback of all parties. The lead evaluation consultant will liaise with the Project Manager on the conduct of the evaluation and methodological issues.

The lead evaluation consultant will be required to use different methods to ensure that data gathering and analysis deliver evidence-based qualitative and quantitative information, based on diverse sources (including literature reviews, field visits, surveys and interviews with counterparts, beneficiaries, donor representatives and program managers). The lead evaluation consultant will develop interview guidelines.

The terminal evaluation will apply the standard for assessing the relevance of criteria of effectiveness, efficiency, impact and sustainability of programs to assess achievements against objectives and indicators outlined in the Logical Framework.

The methodology will be based on the following:

- Desk review of project document including, but not limited to:
 - (a) project / programme policy documents;
 - (b) The original project document, monitoring reports (such as progress and financial reports, output reports (case studies, action plans, sub-regional strategies, etc.) and relevant correspondence;
 - (c) Notes from the meetings of committees involved in the project (e.g. approval and steering committees);
 - (d) Other project-related material produced by the project.
- Interviews with project management and technical support including staff and management at UNIDO HQ and in the field and – if necessary - staff associated with the project’s financial administration and procurement.
- Interviews with project partners including Government counterparts, companies, and partners that have been selected for co-financing as shown in the corresponding sections of the project documents.
- Interviews with intended users for the project outputs and other stakeholders involved with this project. The evaluator shall determine whether to seek additional information and opinions from representatives of any donor agencies or other organizations.
- Interviews with the UNIDO’s project management and project team members and the various national and sub-regional authorities dealing with project activities as necessary.
- Other interviews, surveys or document reviews as deemed necessary by the lead evaluator and/or UNIDO EVA.

TIME SCHEDULE AND DELIVERABLES

The independent terminal evaluation is scheduled to take place from January-February 2018.

This section contains a timetable for the evaluation process with tentative deadlines for key events, tasks, deliverables and milestones. The schedule is based on foreseen project timeline and will be adjusted according to encountered delays.

Task	Description/ Deliverables	Timeframe
Contract signed with evaluators		January 2018
Desk review and development of interview guidelines	Background materials provided by Project Manager	January 2018
Delivery of draft inception report. The report to contain work plan, key findings of desk review, methodology, sampling technique, and evaluation tools such as questionnaires and interview guidelines.	Inception report	January 2018
Briefing of evaluators at HQ and deskwork and interviews at HQ		January 2018
Evaluation mission (briefing of evaluators in the field, possible testing of evaluation tools, field visits, field research, interviews, observation, questionnaires, etc.)	Mission report and information collected Debriefing to field stakeholders	January 2018
Presentation of preliminary findings	Presentation in English to Project Manager and project team	January/February 2018
Additional data collection and analyses of information collected, preparation of the draft evaluation report and circulation, within UNIDO for comments	Draft report	February 2018
Incorporation of comments and preparation of final draft report	Final draft report	February 2018
Sharing of draft report with main stakeholders. Collection of comments and finalization of report	Final report ¹	February 2018
Presentation and submission to UNIDO, Government of Kyrgyz Republic and donors	Final Report and Management Response Sheet	February/March 2018

EVALUATION TEAM

The independent terminal evaluation will be conducted by one international lead evaluation consultant with one national consultant or junior international consultant who will be working under the guidance of the UNIDO Evaluation

¹ As per ToC in Annex 2 and including the ratings as per table in Annex 5.

Manager in IEV in coordination with the Project Manager and with the project team in Bishkek and in Vienna.

The Job Descriptions for the evaluation team members are presented in Annex 1.

QUALITY ASSURANCE

The Project Manager (PM) will be responsible for the administration and logistical support for the evaluation, The draft and final reports will be reviewed and cleared by IEV The PM will distribute draft and final reports to stakeholders (upon review by IEV) for factual validation and feedback, and organize presentations of preliminary evaluation findings which serve to generate feedback on and discussion of evaluation findings and recommendations at UNIDO HQ and in the field.

The quality checklist for to be used by IEV for the evaluation report is presented in annex 3.

ANNEXES

- Annex 1: Job description for team member(s)
- Annex 2: TOC for the Evaluation Report
- Annex 3: Checklist on evaluation report quality
- Annex 4: Logical Framework of the UNIDO Project

Annex 2 – Program of the Evaluation mission

Bishkek, Kyrgyz Republic

Mission Members:	Rudolf Stefec, Nazira Matkadyrova
Places visited:	Bishkek & vicinity, Kyrgyz Republic
Project:	“Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan” (UNIDO Project ID140116)
Mission Period:	5 March – 12 March, 2018 [56,57]

Time	Activities	Address/ Comments
3 March 2018, 06:10	Arrival Manas Airport	Bishkek, Smart Hotel, 204 Abdrahmanov street
3 March 2018, 14:00	Meeting with Ms. Nazira Matkadyrova, National Evaluation Expert	Bishkek, Smart Hotel, 204 Abdrahmanov street
4 March, 10:30	Briefing with Ms. Nazira Matkadyrova, National Evaluation Expert	Bishkek town
5 March, 09:00 – 13:00	Meeting with project team: Mr. Iskender Sydykov, National Expert (Engineer) Ms. Tursunai Usubalieva, National Expert (Economist) Ms. Asel Duisheeva, Project Assistant Mr. Amit Rai, International Expert/Team Leader (via Skype)	Project office, Gosstroy, 28 Manas Avenue 4th Floor, Room 413 720001 Bishkek Tel.: + 996 (312) 613469
5 March, 14:00 -16:00	Meeting with Mr. Marat Usupov, Head of UNIDO Operations in Kyrgyzstan	UNIDO office, 9 Erkindik Boulevard Bishkek, 720040
6 March, 10:00 - 14:30	Meetings with KRSU and visit to UNIDO demo hall, demo houses construction site, and project facilities at KRSU Mr. Vladimir Nifadev, Rector of Kyrgyz-Russian Slavic University (KRSU) Mr. Ravil Mouksinov, Dean, Faculty of Architecture, Design and Construction, KRSU	2 A, Ankara street, Bishkek 720048 Tel.: 662567 krsu@krsu.edu.kg +996 312 631877, +996 555720555 Kievskaya str. 44, Bishkek 720000, www.krsu.edu.kg , mouksinov and Eastern Industrial Zone KRSU facility
6 March, 14:30 – 15:30	Meeting and visit to project beneficiary enterprise: Victor Moskalenko – Individual entrepreneur	Bishkek, Eastern Industrial Zone, +996 559 241077

Time	Activities	Address/ Comments
6 March, 16:00 – 17:00	Meeting and visit to project beneficiary enterprise, Tabysh: Mr. Syrgak Makulov, Director	36 Pushkin str., Novopokrovka village, Issyk-Ata rayon, Chui region +996 709609231, +996 555611410
7 March, 9:30-10:30	Mr. Vadim V. Chekmazov, Counsellor, Embassy of the Russian Federation in the Kyrgyz Republic Ms. Kamilia A. Dzhabbarova, Attaché	Address:, Manas street Tel.: 300641 http://kyrgyzstan.ved.gov.ru/ru/
7 March, 11:00 – 15:00	Meeting and visit to project beneficiary enterprise, Tumar Art Group: Ms. Chinara Makashova, Director General, Ms. Valentina Scherbakova, Executive Director	9 Shopokov str., Shopokov town, Sokuluk rayon, Chui region, and Bishkek Western Industrial Zone operations +996 555222650
7 March, 16:00 – 17:00	Meeting and visit to project beneficiary enterprise, LIS [Stroyproekt] Maksim Litvinov – Director General (not met)	1 A, Murmanskaya str., Bishkek, Chui region, Western Industrial Zone +996 777924180
8 March 11:00-14:00	Meeting with Ms. Nazira Matkadyrova National Evaluation Expert	Garden Hotel, Bishkek
9 March, 10:30 – 15:00	Meeting with Ms. Nazira Matkadyrova, National Evaluation Expert	Garden Hotel, Bishkek
10 March, 10:30 – 15:00	Meeting with Mr. Marat Usupov, Head of UNIDO Operations in Kyrgyzstan	Bishkek and Supara-2 Chunkurchak, Tash-Tyube
11 March, 10:30 – 13:00	Meeting with Ms. Nazira Matkadyrova, National Evaluation Expert	Garden Hotel, Bishkek
11 March, 13:30 – 17:00	Meeting with Mr. Iskender Sydykov, National Expert (Engineer)	Bishkek and Ala-Archa, Tian-Shan
12 March, 10:00 – 11:00	Abdraev Zholdoshbek, Head, Republican Certification Center for Standardization of Construction Materials of the State Agency on Architecture, Construction and Communal Services	28 Manas Av., Bishkek Tel.: 312793
12 March	Departure from Bishkek	
Followed by:	mission program, debriefing in Vienna	28-29 March [55]

Annex 3 – List of persons met

1. Mr. Vadim V. Chekmazov, Counsellor, Embassy of the Russian Federation in the Kyrgyz Republic
2. Ms. Asel Duisheeva, Project Assistant on the Project team
3. Ms. Kamilia A. Dzhabbarova, Attaché, Embassy of the Russian Federation in the Kyrgyz Republic
4. Ms. Chinara Makashova, Director General, Tumar Art Group Ltd., project beneficiary
5. Mr. Syrgak Makulov, Director, Tabysh, project beneficiary
6. Ms. Nazira Matkadyrova, National Evaluation Expert
7. Mr. Victor Moskalenko, individual entrepreneur, project beneficiary
8. Mr. Ravil Mouksinov, Dean, Faculty of Architecture, Design and Construction, Kyrgyz-Russian Slavic University (KRSU)
9. Mr. Vladimir Nifadev, Rector of Kyrgyz-Russian Slavic University (KRSU) & his entourage
10. Mr. Amit Rai, International Expert/Team Leader of the Project team (via Skype)
11. Ms. Valentina Scherbakova, Executive Director, Tumar Art Group Ltd., project beneficiary
12. Mr. Iskender Sydykov, National Expert (Engineer) on the Project team
13. Ms. Tursunai Usubalieva, National Expert (Economist) on the Project team
14. Mr. Marat Usupov, Head of UNIDO Operations in Kyrgyzstan
15. Mr. Abdraev Zholdoshbek, Head, Republican Certification Center for Standardization of Construction Materials of the State Agency on Architecture, Construction and Communal Services (Gosstroy)

Annex 4 – List of documents reviewed

- [1] **Inception report** relating to Independent terminal evaluation of UNIDO project "Promoting community level job creation and income-generating activities through the development of cost-effective building materials production in Kyrgyzstan", by R. Stefec, version Kyrgyz20180210, February 2018, 9 pp.
- [2] **Common Country Assessment for the Kyrgyz Republic**, by G. Piga, T. Novovic and R. Mogileskii for UNIDO, Bishkek, July 2016, 161 pp.
- [3] **Kyrgyzstan country profile**, 26 November 2017, BBC News, 1 p., <http://www.bbc.com/news/world-asia-16186907>
- [4] **Bertelsmann Stiftung's Transformation Index (BTI) 2016**, https://www.bti-project.org/fileadmin/files/BTI/Downloads/Reports/2016/pdf/BTI_2016_Kyrgyzstan.pdf
- [5] **UNIDO project document** *Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan*, starting date August 2014, document 140116_ProDoc_Kyrgyzstan_LCH.PDF, 52 pp., plus **Short info on the project (ProDoc)** UNIDO PROJECT ID 140116, by Nazira Saipjanova, document 01 - ProDoc summary.docx, January 2018, 3 pp.
- [6] **Country information KG**, by R. Stefec, document *CountryInfoKG*, accruing compilation of country information on Kyrgyzstan; based on *Economic Intelligence* reports etc.
- [7] Kyrgyzstan Unemployment Rate 2000-2018, <https://tradingeconomics.com/kyrgyzstan/unemployment-rate>
- [8] **The Kyrgyz Republic strategic assessment of the economy**, Promoting inclusive growth, Asian Development Bank 2014, 156 pp., www.ibc.kg/en/download/365
- [9] **Economic Intelligence Unit country report Kyrgyzstan**, <http://country.eiu.com/kyrgyz-republic>
- [10] **Report of the Mid-term review** of the UNIDO project *Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan*, May 2017, 50 pp.
- [11] **National sustainable development strategy** for 2018-2023, finalized in 2017: "Zhany doorgo 40 kadam" (40 steps to new era), a Government document
- [12] **Mud stabilized blocks production and use**, Technical manual, UNIDO/ISID relating to the project "Promoting community level job creation and income-generating activities through the development of cost-effective building materials production in Kyrgyzstan", project-related with Project overview, undated, 44 pp.; an introductory manual, with introduction by Amit Rai
- [13] **Government of the Kyrgyz Republic and United Nations Development Assistance Framework 2018-2022**, draft text, 42 pp.
- [14] **Review of the legal and regulatory framework**, under project UNIDO PROJECT ID 140116, by T. Usubalieva (National expert] and F. Alimdjanov (Project Manager), March 2015, 8 pp.
- [15] **List of beneficiaries** – UNIDO PROJECT ID 140116 – Transfer of equipment, 2 pp., listing the equipment supplied under the project, plus **List of beneficiaries**, document *List of beneficiaries_UNIDO PROJECT ID 140116_Transfer of equipment.xlsx*, February 2018, 1 p.; lists 8 beneficiaries from companies and university, incl. **List of beneficiaries** and their contact details under UNIDO project "Promoting community level job creation and income-generating activities through the development of cost-effective building materials production in Kyrgyzstan" (October 2017 - March 2018), 5 pp., listing 8 project beneficiaries

- [16] **Memorandum of understanding** between the State Agency of Architecture, Construction and Communal Services under the Government of the Kyrgyz Republic and the B.N. Yeltsin Kyrgyz-Russian Slavic University, on institutional cooperation within the UNIDO Project "Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan", of 24 August 2015, 5 pp., plus recapitulation by N. Saipjanova, document *03 - MoU between Gosstroy and KRSU, January 2018*, 2 pp.
- [17] **Mission reports**, an overview by N. Saipjanova, document *08 - Mission reports.docx*, February 2018, 3 pp., referring to back-to-office mission reports: five reports by Farrukh Alimdjanov (October 2014, February 2015, June 2015, November 2016, October 2017), one report by Farrukh Alimdjanov and Anders Isaksson (November 2016), and one report by Amit Rai (April 2016)
- [18] **Back-to-office mission report** by F. Alimdjanov, Mission to Bishkek, 23-24 June 2015, 28 pp. and the same report revised, 12 pp.
- [19] **Back-to-office mission report** by F. Alimdjanov, Mission to Bishkek, 9-12 February 2015, 33 pp.
- [20] **Back-to-office mission report** by F. Alimdjanov, Mission to Bishkek, 1-4 October 2017, 35 pp.
- [21] **Back-to-office mission report** by A. Isaksson and F. Alimdjanov, Mission to Bishkek, 25-28 November 2015, 10 pp.
- [22] **Draft Back-to-office mission report** by F. Alimdjanov, Mission to Bishkek, 19-25 October 2014, 19 pp.
- [23] **Back-to-office mission report** by A. Rai, 11-17 April 2016, 3 pp., mission to Munich and Vienna, to visit Building Materials and Construction Machinery exhibition 'Bauma' in Munich, Germany, and UNIDO HQs Vienna
- [24] **Back-to-office mission report** by F. Alimdjanov, Mission to Bishkek, 8-10 November 2016, 4 pp.
- [25] **Progress reports**, an overview by N. Saipjanova, document *04 - Progress reports*, January 2018, 9 pp., contg. information on Mid-term report and Annual report, also **Progress report** Oct 2014/Jan 2015, 4 Feb 2015, 13 pp. **Progress report** Jan/June 2015, 7 Sep 2015, 16 pp.; **Annual report** 2015, 15 March 2016, 20 pp.; **Progress report** Jan 2015/Dec 2017, undated, 26 pp.; **Progress report** Jan/Dec 2016, 5 Jan 2017, 25 pp.; **Progress report** Jan/June 2017, 5 Jul 2017, 21 pp. recommending project extension until March 2018
- [26] **Midterm review**, an overview by N. Saipjanova, document *07 - Midterm review*, January 2018, 6 pp., contg. information on Midterm review conducted in March-May 2017 applying mixed approach: external consultant under supervision of two co-implementation project managers
- [27] **Questionnaires under Mid-term review** for (i) UNIDO experts, (ii) KG Government (Ministries of Economy and Agriculture, and Gosstroy) and KRSU, (iii) Private sector (companies and business associations); and (iv) Donor
- [28] **Needs assessment**, an overview by N. Saipjanova, document *06 - Needs assessment.docx*, January 2018, 8 pp., contg. information on adoption of cost effective and emerging housing technologies (2015), on Housing conditions and new housing construction, and on Options for rain water harvesting for housing and agriculture
- [29] **Options for rain water harvesting** for housing and agricultural field, undated, by A. Rai, 13 pp.
- [30] **Needs assessment** report and possibilities for utilizing agriculture waste for development of value added materials, March 2015, by A. Rai, 16 pp.
- [31] **Needs assessment** of housing supply and requirements in Kyrgyzstan, undated, 11 pp.

- [32] **Project results framework/logframe**, Target beneficiaries KRSY and SMEs/entrepreneurs in the building materials, construction and other related sectors, Project duration October 2014-October 2017, 6 pp., May 2017, Version 1
- [33] **List of Lot 3 equipment**, 1 p., 29 Sep 2017, comprising Wool deburring machine, Hydraform mud block making machine (2 pcs), and minor items
- [34] Minutes of six Advisory board meetings, 2015-2017
- [35] **Third tender documentation folder**, ca. 15 pp. (various items of machinery e.g., stone splitter and straw mats knitting machine; contracts; TOR; beneficiaries; invoices; Transfer of ownership; related documents)
- [36] **Minutes of the Skype meeting held on 8th December 2016**, 1 p.
- [37] **Thermal insulation** - Properties and applications in housing, UNIDO Technical manual on Promoting community level job creation and income-generating activities through the development of cost-effective building materials production in Kyrgyzstan, by Amit Rai; also in Russian: Teploizolyatsiya – Svoistva i sposoby primeneniya v zhilishchnom stroitelstve
- [38] **First tender documentation** folder, ca. 10 pp. (Tabysh wool deburring – newspaper announcement; contract; TOR; Transfer of ownership; related documents)
- [39] **The SmartBuild Kyrgyzstan database**, <http://www.smartbuild-kg.com/compsdir/main.php> with headings/links for access to List of companies, List of products of companies, and List of smart building technologies, incl. **Database**, document *05 - Database.docx*, 1 p., contg. sketchy information on the structure of a data base of construction materials
- [40] **Database on Emerging Housing Technologies**, developed under UNIDO Housing Project in Kyrgyzstan 2014-2017, Word document, 9 pp.
- [41] **Transfer of equipment to beneficiaries**, an Excel table, undated, ca. 3 pp., giving a detailed breakdown of the allocations for the machinery, office equipment, office furniture, and books furnished for the project by UNIDO
- [42] **UNIDO TOR, July-August 2017, for an International Expert in database.**
- [43] **SmartBuild – Preliminary programme**, Web Database Introductory Training, 2 pp., program of training conducted on 26-27 July 2017 by Ahraf Abushady (UNIDO)
- [44] **Midterm report** Jan/June 2016, 6 Sep 2016, 19 pp.
- [45] **Logframe** (original and suggested revised versions), Original version, 6 pp., Version 0
- [46] **TOR for personnel under individual Service Agreement (ISA) for International Evaluation Consultant/Team Leader**, document *JD International evaluator, UNIDO PROJECT ID 140116_19.12.201.PDF*, 19.12.2017, 3 pp.
- [47] **Needs assessment**, March 2015, by UNIDO Vienna, 20 pp., providing a background for and justification of the various project technologies
- [48] **Advisory board of the project**, an overview by N. Saipjanova, document *02 - Advisory board, January 2018*, 2 pp.
- [49] **Action plan/work plan for execution of UNIDO project** (June-October 2016), table of activities and allocation of responsibility, 1 p.
- [50] **Workplan with timetable for June/Oct 2016**, 10 pp. a management/workplan monitoring document
The target audience received an initial training on data bases incl. inserting, deleting, and updating/modifying data into the data base, including HTML content, and structured programming, related to the data base at <http://www.smartbuild-kg.com>
- [51] **Final draft TOR for Independent terminal evaluation** of UNIDO project "*Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan*", August 2017, 39 pp.
- [52] **Procurements**, document *09 - Procurements.docx*, 1 p., referring to three tenders on plant and machinery

- [53] **UNIDO website** <https://www.unido.org/inclusive-and-sustainable-industrial-development>
- [54] I. Sydykov: private communication, March 2018.
- [55] **Draft mission programme**, document *Draft Mission Programme Inception Evaluation mission Kyrgyzstan*, 3 pp.; sets out the agenda for briefing in Vienna
- [56] **Draft mission to Bishkek programme updated**, by N. Saipjanova, document *2018-02-06 - DRAFT Mission Programme Evaluation mission Kyrgyzstan Updated*, February 2018, 4 pp.; an update of [57], plus **Updated draft of activity**, document *Updated draft JD International evaluator UNIDO PROJECT ID 140116_19.12.2017*, 3 pp.; sets out Outputs 1 through 4
- [57] **Draft mission to Bishkek programme**, 4 pp.
- [58] **UNIDO Country Partnership Programme** (in Russian: *Programma stranovogo partnerstva UNIDO*), November 2017, 46 pp.
- [59] **In-kind contribution Kyrgyzstan** – Goods/Services in kind, table 1 p., 8 Feb. 2017

Annex 5 – Rating tables as per TOR

(as per Draft TOR UNIDO database project ID 140116)

Ratings are presented in the form of tables **with each of the criteria / aspects rated separately and with** brief justifications for the rating **based on the findings and the main analyses (see Table 1 to Table 3) below. Table 4 presents a summarization of the overall ratings.**

Table 1. Rating criteria for Quality of project identification and formulation process (LFA Process)

Evaluation issue	Evaluators' comments	Ratings
1. Extent to which the situation, problem, need / gap is clearly identified, analyzed and documented (evidence, references).	Clearly identified, adequately analyzed, sufficiently documented.	S
2. Adequacy and clarity of the stakeholder analysis (clear identification of end-users, beneficiaries, sponsors, partners, and clearly defined roles and responsibilities in the project).	Multiple expert reports covering various aspects; clear enough in most aspects. Memorandum of Understanding between the two chief stakeholders.	S
3. Adequacy of project monitoring and evaluation (M&E) design.	Adequate, with numerous reports, several needs assessments, a Midterm review—although some of the recommendations made were not acted upon.	S
4. Overall LFA design process.	Addressed in the various reports.	MS

Table 2. Quality of project design (LFM)

Evaluation issue	Evaluators' comments	Ratings
1. Clarity and adequacy of outcome (clear, realistic, relevant, addressing the problem identified). Does it provide a clear description of the benefit or improvement that will be achieved after project completion?	Addressed, clearly described, but owing to various hitches, reflected mainly in procurement delays, the improvements or benefits expected could not be realized in full.	MS
2. Clarity and adequacy of outputs (realistic, measurable, adequate for leading to the achievement of the outcome).	Adequate.	S

Evaluation issue	Evaluators' comments	Ratings
3. Clarity, consistency and logic of the objective tree, and its reflexion in the LFM results hierarchy from activities to outputs, to outcome and to overall objective.	Clear and consistent, logical. Insufficient market analysis with proper attention to eve longer-term market fluctuations.	S
4. Indicators are SMART for Outcome and Output levels.	Yes.	S
5. Adequacy of Means of Verification and Assumptions (including important external factors and risks).	External factors and risks while fully understood were not fully reflected in action: examples include (i) the new facility building not completed by the end of project; (ii) markets originally promising for certain specific products eventually proving not to be feasible; the problem was compounded by delayed legislation.	MS
6. Overall LFM design quality.	Satisfactory.	S

Table 3. Quality of project implementation performance

Evaluation criteria	Evaluators' comments	Ratings
7. Ownership and relevance: to national development priorities and Government strategies; to target groups; to UNIDO's mandate and thematic priorities; to Donor's priorities; counterpart(s) were appropriately involved in the identification of critical problem areas and in the development of implementation strategies; supported actively project implementation including through in-kind and cash contributions; and the project(s) / program are relevant to the ISID agenda).	Quite important to national development priorities, the National development strategy and other Govt strategies; also important to target groups; fully consistent with UNIDO's mandate and thematic priorities, also relevant to Donors' priorities. The counterparts' involvement was differentiated, each of them focusing on areas closest to their remit; there has been keen support by the University (KRSU).	HS
8. Effectiveness: objectives and final results at the end of the project (outputs were produced; outcome(s) were achieved or are likely to be achieved through the operation of outputs; and the project/program contributed to inclusive and sustainable industrial development).	No more than moderately effective, and even less so in some cases: again, hampered by (i) delays in procurement and delivery of the UNIDO-supplied machinery; (ii) some of the deliveries incomplete owing either to contractor failure or wrong/incomplete specification; (iii); further post-delivery delays so that ca. one half of the machine assemblies was not yet operational at the time of Terminal evaluation; failure to build the Demo houses to schedule. No pressure exerted by the Advisory board to speed up the works.	MS
9. Efficiency (UNIDO, Donors, implementing agencies and	On the whole, efficiency should be improved. Too much time lost prior to bringing	MS

Evaluation criteria	Evaluators' comments	Ratings
<p>counterpart inputs have been provided as planned and were adequate to meet requirements; the quality of UNIDO, Donors, implementing agencies and counterpart inputs and services (expertise, training, methodologies, etc.) was as planned and led to the production of outputs; UNIDO procurement services were provided as planned and were adequate in terms of timing, value, process issues, responsibilities; the project used the most cost-efficient option and was cost-effective etc.).</p>	<p>in the respective technologies. Many operations and/or steps toward accomplishing the project objectives were delayed (such as, the international tenders for equipment; the construction of the Demo houses; the commissioning of machinery). Training was limited so far to operator training by the contractors, except for a training course organized by the University. Methodologies were good but they have not yet led to almost any production of outputs (exceptions: the sheep wool business, some activity at the Smart Build center, and moderate activity at the wood modification facility The downstream markets assessment was insufficient, or better said, no conclusions were drawn <i>e.g.</i>, from the slump of burnt brick prices which made the mud bricks promoted by the project less competitive.</p>	
<p>10. Impact (which long term developmental changes, e.g. economic, environmental, social and inclusiveness, have occurred or are likely to occur as a result of the intervention).</p>	<p>Potentially, high enough but too early to judge as many of the technologies were never started yet. Impact will be augmented if and when the facilities are all of them up and running, complete and operational. Then the work flow problems will have to cope with (input materials and markets for the products), and only then the time will come to assess the impact. Allow one year extension before being able to assess impact in a responsible fashion. Completion of the Demo houses would help as these could demonstrate the usefulness of the machinery and technology; these houses should be completed as soon as possible, to be admired by all who come and see them and to act as inducement for replicating the technologies.</p>	ML
<p>11. Likelihood of/risks to sustainability (results achieved so far are sustainable; the project was replicated/had a multiplying effect; a sustainability strategy was formulated; and what are the prospects/risks for technical, organizational, financial, socio-political, institutional framework and governance, and environmental sustainability).</p>	<p>Sustainability assessment requires a fairly long period of undisturbed operation to elapse, and not even one year project extension might be enough. This however does not apply to the successful subprojects: the wool deburring, probably the straw mats knitting, and to a moderate extent, the wood modification technology. Risks will be reduced and chances at attaining sustainability will improve if and when the problems mentioned above are resolved. The KRSU is expected to take an active part in bringing the situation on a firm footing. The concerned Government (Melioration; Gosstroy) will do what they can to employ the technologies, within the limits of their funding of the future operations. Also, the UNIDO country office is ready to help. Of course, completeness and full operational capability of the technologies having resolved their problems would however be a prerequisite to demonstrating them as a model to follow.</p>	L

Evaluation criteria	Evaluators' comments	Ratings
<p>12. Project management (the national management and overall field coordination mechanisms of the project have been efficient and effective; the UNIDO management, coordination, quality control and technical inputs have been efficient and effective; changes in planning documents during implementation have been approved and documented; and synergy benefits can be found in relation to other UNIDO activities in the country or elsewhere).</p>	<p>Problems of multiple management bodies, with associated communication problems, were described. With professional competencies being equal, a local project team leader who is constantly on site would be preferable to one having to repeatedly travel from a distant country, not speaking of being better versed in the local problems. The UNIDO country office can be counted on, not only for facilitating encounters with Govt counterparts. The activities of the project (management) team ought to be better harmonized with those of the Advisory board (which should be more active anyway and meet more frequently when problems accumulate). UNIDO HQs should consider keeping the project team—who are competent enough—on a looser rein and letting them have more independence, to speed up matters. The stakeholders on the whole are keen on having the project succeed, and this should be put to better use allowing them more initiative. Management tended to be hampered by a number of unforeseen even if rather commonplace hitches and hindrances which they had to overcome, for instance, late or incomplete deliveries, or taking too long before deciding relatively simple matters. It should be borne in mind though that this was a bold, rather ambitious, and in a way experimental project where some new problems had to be expected, due last but not least by the fact that the project did not have a single focus but rather, consisted of a number of relatively disparate activities (even though there was a common denominator to all of them which could be summarized under the term "INSULATION". In a way, all the seven technologies brought in were insulation technologies: mud blocks providing insulation against outdoor weather; the tiles extruder producing insulation also against rainwater; the stone splitter technology providing insulation against harsh external conditions; the shotcrete slinger providing insulation so that water could not escape; and straw mats as well as wool felt providing primarily thermal insulation.</p>	<p>L</p>
<p>13. M&E (monitoring and self-evaluation was carried out based on indicators for outputs, outcomes and objectives; M&E activities were documented; and M&E information was used for project steering and adaptive management).</p>	<p>Monitoring and self-evaluation were all right but management found themselves unable to adapt to changing market conditions and to speedily cope with unforeseen hitches.</p>	<p>ML</p>

Table 4. Overall ratings

Criterion	Evaluators' summary comments	Ratings
Attainment of project objectives and results (overall rating), sub criteria (below)	Only some of the objectives were met and some of the results achieved. The remaining ones are not far from the point of completion but need more time until they overcome the problems encountered.	MS
Project implementation	Lagging behind.	MS
Effectiveness	No more than moderately effective; plagued by problems.	MS
Relevance	Highly important to all stakeholders; very relevant, especially to rural population but also to the country at large.	HS
Efficiency	Methodologies were good but outputs were not always forthcoming.	MS
Sustainability of project outcomes (overall rating), sub criteria (below)	Sustainability cannot yet be estimated with any certainty. The facility when operational (some of them have never yet been started ad used) will have to cope with routine problems and find suitable outlets for all their products.	L
Financial risks	Some of the facilities can become profitable soon, so financial risks are not a prime consideration..	L
Socio-political risks	None.	L
Institutional framework and governance risks	Depend on the survival of the facilities and their enhanced productivity and efficiency.	MU
Environmental risks	Most of the technologies brought in are environment friendly, the risks of other technologies (<i>e.g.</i> , dust generation at the wool deburring facility) can be addressed.	L
Monitoring and evaluation (overall rating), sub criteria (below)	On the whole, adequate.	
M&E Design	Project rather ambitious but well designed.	HS
M&E Plan implementation (use for adaptive management)	Involved serious delays. There were several expert reviews during the course of the project but they failed to address the delays—which in any case became clearly transparent only as late as during the last project year.	MS
Budgeting and funding for M&E activities	Adequate.	HS
Project Formulation	Very good.	HS
LFA (Situation, stakeholder, problem and objective analyses / Preparation and readiness)	Clearly identified, adequately analyzed, sufficiently documented.	HS
Project Design	Adequate.	S
Project design (LFM, main elements of the project, i.e. overall	Adequate logframe matrix, revised. Fully adequate design. Little action was sometimes	S

Criterion	Evaluators' summary comments	Ratings
objective, outcomes, outputs, their causal relationship, indicators, means of verification and assumptions)	taken in response to external experts' inputs.	
Project management - UNIDO specific ratings	Adequate.	S
Quality at entry / Preparation and readiness	Excellent, fully in line with KG Govt strategies and UNIDO line of action.	HS
Implementation approach	The approach was good; the project had full support of all counterparts. However, the private companies became fully involved only after receiving the equipment. The KRSU was active throughout but could not avoid some of the delays. The Ministry of Economy proved less active but this was made up by the active role of Gosstroy.	HS
UNIDO Supervision and backstopping	Adequate.	S
Gender mainstreaming	Adequate.	S
Overall Project rating	Moderately successful; full success can only be expected on the condition that a project extension is granted.	S

RATING OF PROJECT OBJECTIVES AND RESULTS

Highly satisfactory (HS):	The project had no shortcomings in the achievement of its objectives in terms of relevance effectiveness or efficiency.
Satisfactory (S):	The project had minor shortcomings in the achievement of its objectives in terms of relevance effectiveness or efficiency.
Moderately satisfactory (MS):	The project had moderate shortcomings in the achievement of its objectives in terms of relevance effectiveness or efficiency.
Moderately unsatisfactory (MU):	The project had significant shortcomings in the achievement of its objectives in terms of relevance effectiveness or efficiency.
Unsatisfactory (U)	The project had major shortcomings in the achievement of its objectives in terms of relevance effectiveness or efficiency.
Highly unsatisfactory (HU):	The project had severe shortcomings in the achievement of its objectives in terms of relevance effectiveness or efficiency.

Please note: Relevance and effectiveness will be considered as critical criteria. The overall rating of the project for achievement of objectives and results may not be higher than the lowest rating on either of these two criteria. Thus, to have an overall satisfactory rating for outcomes a project must have at least satisfactory ratings on both relevance and effectiveness.

RATINGS ON SUSTAINABILITY

Sustainability will be understood as the probability of continued long-term outcomes and impacts after the project funding ends. The evaluation will identify and assess the key conditions or factors that are likely to contribute or undermine the persistence of benefits beyond project completion. Some of these factors might be outcomes of the project, i.e. stronger institutional capacities, legal frameworks, socio-economic

incentives /or public awareness. Other factors will include contextual circumstances or developments that are not outcomes of the project but that are relevant to the sustainability of outcomes.

Rating system for sustainability sub-criteria

On each of the dimensions of sustainability of the project outcomes will be rated as follows.

Likely (L): There are no risks affecting this dimension of sustainability.

Moderately likely (ML). There are moderate risks that affect this dimension of sustainability.

Moderately unlikely (MU): There are significant risks that affect this dimension of sustainability.

Unlikely (U): There are severe risks that affect this dimension of sustainability.

All the risk dimensions of sustainability are critical. Therefore, overall rating for sustainability will not be higher than the rating of the dimension with lowest ratings. For example, if a project has an Unlikely rating in either of the dimensions then its overall rating cannot be higher than Unlikely, regardless of whether higher ratings in other dimensions of sustainability produce a higher average.

RATINGS OF PROJECT M&E

Monitoring is a continuing function that uses systematic collection of data on specified indicators to provide management and the main stakeholders of an ongoing project with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds. Evaluation is the systematic and objective assessment of an on-going or completed project, its design, implementation and results. Project evaluation may involve the definition of appropriate standards, the examination of performance against those standards, and an assessment of actual and expected results.

The Project M&E system will be rated on M&E design, M&E plan implementation and budgeting and funding for M&E activities as follows:

Highly satisfactory (HS): There were no shortcomings in the project M&E system.

Satisfactory(S): There were minor shortcomings in the project M&E system.

Moderately satisfactory (MS): There were moderate shortcomings in the project M&E system.

Moderately unsatisfactory (MU): There were significant shortcomings in the project M&E system.

Unsatisfactory (U): There were major shortcomings in the project M&E system.

Highly unsatisfactory (HU): The Project had no M&E system.

M&E plan implementation will be considered a critical parameter for the overall assessment of the M&E system. The overall rating for the M&E systems will not be higher than the rating on M&E plan implementation.

All other ratings will be on the following six-point scale:

HS = Highly satisfactory Excellent

S = Satisfactory Well above average

MS = Moderately satisfactory Average

MU = Moderately unsatisfactory Below average

U = Unsatisfactory Poor

HU = Highly unsatisfactory Very poor (appalling)