Completion Report

NABIN - New and Affordable Building Materials Promoting Sustainability in Nepal

NCF-C7-131

Grantee: DanChurchAid (DCA)

Local Partner: Build up Nepal (renamed as Community Impact Nepal in 2020)

Other Partner: Practical Action

Project start date: 01*/09/2018*

Project end date*:* 30/04/2021

28/09/2021
Date

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EXECUTIVE SUMMARY

1.1 Overview and Purpose

The project – New and Affordable Business promoting sustainability in Nepal (NABIN) – supported the sustainable post-earthquake construction in Nepal through strengthened supply chain of climate friendly construction material and the establishment of self-sustaining micro and small enterprises (MSEs) to produce Compressed Stabilised Earth Brick (CSEB). Compared to the conventional construction materials such as fired bricks and cement blocks, the CSEB technology is low-cost, locally adaptable, environmentally sustainable, earthquake resilient, and easy to use with strong climatic adaptive characteristics. The project focused on creating a strong local business environment to rebuild infrastructure in a socially sustainable way in hard-to-reach areas.

More specifically, the project contributed to (1) creating an enabling business environment for climate-friendly construction material, (2) reducing the impact of climate change through mitigation (reduced emissions) and partly, through adaptation and resilience, (3) job creation and livelihood promotion in rural areas and support to poor and vulnerable groups, and (4) climate change advocacy and policy influence to secure a low-emission pathway for the Nepalese public and private sector. The project achieved two outcomes which were supported by six outputs, as initially targeted. The first outcome focused on enhancing livelihoods through promotion of climate friendly construction materials and local business creation. The second outcome focused on creating an enabling business environment to scale up CSEB through strengthened supply chain, awareness raising, advocacy and capacity building for green construction. The project also contributed to SDG 9 "Industry, Innovation, and Infrastructure" and SDG 13 "Climate Action".

During the project implementation, the following key results were achieved:

- 96 CSEB micro-enterprises were established and are now functional
- 2,669 local jobs were created
- Approximately 3.6 million CSEBs were produced
- 635 masons and fried bricks makers were trained
- 2,103 houses were built using CSEB (1,443 from NABIN project and 660 from 26 enterprises established by other projects)
- 68% of CSEB entrepreneurs had access to financial services. Loan products were developed together with the Microfinance Institutions (MFI) (Mero Microfinance) and bank (Laxmi Bank and Machhapuchchhre Bank) and increased access to financial products by CSEB entrepreneurs
- 40% of the targeted people have increased knowledge and awareness on CSEB technology for house construction
- 25% increase in demand of CSEB
- 10,934 MT of CO_2 were saved
- 7 Local Governments (LGs) included CSEB on their annual development plans
- 57 CSEB distribution points were established
- 56 municipalities within 19 districts served by CSEB enterprises in the project

The project was successful in achieving majority of the output results. However, some of the quantitative targets of the project were not reached. A key reason for this was that during the design phase, it was assumed that all the planned enterprises would be established at the beginning of the project, but in reality, this was not achievable. In addition, the COVID-19 related lockdown in the country affected the planned activities and the project's key results as the production and supply of CSEBs decreased due to the slowdown of construction work, unavailability of raw materials, lack of

workers, untimely repair works, etc. COVID-19 restricted the ability of the project to establish new enterprises. It is expected that the enterprises established by the project will keep growing and building new houses over the long-term. During the implementation period, the project observed several cases of CSEB enterprises being replicated and scaled up in the geographical areas, that were beyond the scope of this project. Therefore, we expect the quantitative targets to be met by mid-2022.

1.2 Key conclusions and lessons learned

- **Enterprises:** It takes 6-8 months to establish a new CSEB enterprise. Once established, the enterprise acts as a sustainable economic engine, building on average 15 houses or equivalent construction works per year, creating 4 jobs and saving 9.52 MT of CO_2 per house/structure.
- **Consumers:** The highest adoption has been in rural and semi-urban areas by low-income groups. Enterprises have reported increasing demand throughout the project and the main driver for adoption is the 20-30% cost saving by the CSEB technology.[1]
- **Government:** The local government (LGs) have been very positive towards the project and CSEB technology, seeing how it can help achieve local targets of jobs, housing, and development. Owing to LGs support and buy-ins, the CSEB technology has been replicated in other municipalities.
- **Green construction:** As a result of the project, the CSEB technology is now a well-established alternative to fired bricks in 19 out of 77 districts in Nepal. The partners estimate that CSEB can replace 10% of fired bricks in the next 5-10 years with further scale-up efforts.

1.3 Scale-up/replication potential

The experience and evaluations of the project highlight that CSEB has potential to replace a large share of fired bricks in Nepal provided that a robust market system is developed, including trained masons, increased government endorsement and stakeholder awareness.

As a result of the project, the interest and private sector's buy-in for the CSEB technology has increased rapidly both within and outside the 19 project districts. The partners are now working actively to scale up and build a robust market-system across Nepal (all 77 districts) to ensure that existing and new enterprises can establish and scale-up. Likewise, the technology has also been replicated in the DCA's regular DANIDA funded programme/projects and few other donors funded projects (i.e., European Union) in the western and far western regions of Nepal. The CSEB technology has been replicated in six municipalities of Kanchanpur and Dailekh District and additional three municipalities of Bardiya and Kailali districts with strong support and buy-ins from the LGs. The next three years will be crucial for the continued scale-up of the technology and specific attention is needed on: i) ensuring quality at scale, ii) training masons and government engineers, iii) enabling government policy, and iv) ensuring that enterprises succeed long-term.

[1] The cost saving depends on the size of the house. It is estimated that the cost reduced by 15% for larger city houses and larger projects. 30% for small 2-room houses. The smaller the house the more cost savings as the walls are big part of the cost. In a large house there will be tiles, concrete roofing and other more expensive parts.

1. ACHIEVEMENT OF RESULTS

1.1 Achievement of outcomes and outputs

Expected outcomes and outputs	Indicator(s):	Target (s):	Achievement of outcomes and outputs:
Outcome 1: Livelihood of the people from the selected municipalities of earthquake affected districts enhanced through promotion of climate friendly construction materials and local business creation	1.1 Amount (MT) of carbon emission reduced as a result of production of CSEB bricks for use in construction in target districts 1.2 Increase in income of CSEB entrepreneurs by NPR 20,000 (EUR 200) 1.3 Number of CSEB bricks produced by CSEB enterprises during the project 1.4 Number of direct jobs created through the establishment of CSEB enterprises 1.5 Number of HHs who saved 20% expenses for housing construction by using CSEB material compared to brick cement masonry	1.1 – 16,231 MT CO_2 1.2 – EUR 200 1.3 – 21 million 1.4 – 1,650 jobs 1.5 – 3,500 HHs	1.1 15,966 MT of CO_2 was reduced in total of which 10,934.06 MT of CO_2 was directly reduced through the project and 5032.83 MT of CO_2 was reduced by other projects.[2] 1.2 EUR 274 (NPR 27,426) 1.3 To date 3,608,600 bricks have been produced. The application incorrectly assumed that 100 micro, small and medium enterprises (MSMEs) would be up and running and producing bricks from the very first day of the project, however the enterprises were created gradually over 2.5 years. Though the CSEB bricks produced by the enterprises did not meet the original target, they were still able to significantly reduce carbon emission as the CO_2 saving was much larger than originally estimated in the application (based on new reports). 1.4 2,669 jobs created. This includes jobs created in both production and construction 1.5 1,053 HHs (73% of the total 1,443 HHs). The adoption of CSEB was higher in areas where the project was able to create high level of awareness on the technology and there was availability of trained masons.
Output 1.1: Established self-sustaining and commercially viable CSEB enterprises	1.1.1 Number of CSEB enterprises established 1.1.2 Number of CSEB entrepreneurs who participate as trainers' trainees	1.1.1 – 90 enterprises[3] 1.1.2 – 30	1.1.1 – 96 CSEB enterprises 1.1.2 – 12. The "training for trainers" idea often resulted to poor quality trainings; therefore, the project only supported those entrepreneurs with extensive experience in construction

[2] NCF agreed to let the consortium count the number of bricks produced by the other 26 enterprises established by Community Impact Nepal/BuN and Practical Action in the same locations through different projects. The already established enterprises received mason trainings, demo-buildings, government policy, etc. support from NABIN. To avoid double counting, it was agreed that the consortium would only count those bricks produced by these enterprises after December 2018.

[3]Originally the project had planned to establish 100 enterprises, however the target was revised to 90 enterprises.

Output 1.2: Increased demand of climate responsive and resilient construction materials	1.2.1 % increase in demand of CSEB relative to fired brick in project area 1.2.2 % of earthquake affected people in target districts with increased knowledge and awareness on CSEB technology for house construction	1.2.1– 30% 1.2.2 – 40%	1.2.1 – 25%. There is a growing demand for CSEB, consequently it has been scaled up in many other places. Awareness is a key factor that determines the level of demand. In areas where the project was able to create mass awareness, the demand was higher. The demand and success of the CSEB enterprises also largely depend on entrepreneurs' business acumen and availability of trained masons. Entrepreneurs who actively marketed their products and focused on the whole construction cycle with trained masons were successful in creating demand for CSEB 1.2.2 – 40%
Output: 1.3 Strengthened supply chain of CSEB in rural areas	1.3.1Number of districts and municipalities served by CSEB enterprises 1.3.2Number of local distribution points in rural areas established for CSEB material	1.3.1 – 20 districts 1.3.2 – 50 points	1.3.1 –19 districts (56 municipalities were supported within these districts) served by CSEB enterprises in the project 1.3.2 – 57 distribution points developed, but most are not functioning effectively
Outcome 2: Business enabling environment created for wider scale up of CSEB	2.1 Number of CSEB enterprises scaled up outside the project districts	2.1 – 10 enterprises	2.1 – 160
Output 2.1 Business enabling environment created for wider scale up of CSEB	2.1.1 Number of municipal authorities that have included the provision of promoting climate resilient construction materials in their development plans and strategies	2.1.1 – 10 municipal authorities	2.1.1 – 7 municipal authorities have included CSEB in their development plans and strategies. Though the municipal authorities are positive, the government process is slow, and it takes time influence their plans and strategies.
Output 2.2 Increased access to business development services to CSEB entrepreneurs	2.2.1 Number of loan products developed by commercial banks targeting CSEB business 2.2.2 % of local CSEB entrepreneurs that have accessed finance to enterprise set-up/development	2.2.1 – 2 products 2.2.2 – 80% access	2.2.1 – 2 loans by commercial bank and 1 loan by microfinance institution (MFI) accessed by CSEB entrepreneurs 2.2.2 – 68% of entrepreneurs have access to finance. Many of the entrepreneurs did not need external finance support as they had savings from working abroad or from other sources. Thus, the project support those entrepreneurs that needed financial support to access them
Output 2.3 Increased supply of masons trained on CSEB utilization	2.3.1 Number of trained masons in CSEB construction methods	2.3.1 – 280 persons	2.3.1– 635 persons. This was a high priority activity as the trained mason was key to promote demand and construction of CSEB houses and structures.

1.2 Deviations from the planned outputs and activities

All the envisioned outputs and activities took place during the project implementation period, and the overall progress was reviewed and discussed for further improvements by the consortium. However, based on field learnings and severe impacts of COVID-19 pandemic, the consortium

identified few additional sub activities within the same project deliverables, which were updated and included in the implementation plan and funds were reallocated in the revised budget. The prior approval from NCF was obtained for executing the additional and changed outputs and activities during the project period. Please find below some of the added and changed activities in the project.

Outcome	Output	Project deliverables	Additional line items	Justification
1	1.1	Activity 1.1.5C: Develop and promote portrait and success stories as part of awareness raising campaign on CSEB technology and potential for SME business development.	-Develop communication materials (production & print of interlocking brick houses catalogue) - Develop social media / Radio campaign /Media to promote CSEB entrepreneurs to sell more bricks	Communities lack of awareness was identified as one of the barriers to sales of the CSEB. Therefore, the activities focused on awareness raising, promotion of enterprises and marketing of bricks through social media, television, print media, and advertising.
1	1.1	Activity 7B: Provide entrepreneurship skill development training to CSEB entrepreneurs	-Training on customer service & how to promote house construction	Entrepreneurs needed to improve on customer care and sales. The project planned an extra business training to teach them on these subjects as well as to boost sales.
1	1.1	1.1.4 Establish business start-up fund to promote business at municipality level	-Strengthening of existing enterprises during COVID-19 -Short mason training support -Strengthening of existing enterprises during COVID-19 - Demo building support	Established few demo structures with few rapid mason trainings at specific locations especially focusing on CSEB distribution points. This made it easier for CSEB distribution agencies to advertise the bricks and understand the technology as well as help to train masons.
1	1.2	Activity 1.1.4: Promote research and development to improve the efficiency of machine and ensure sustainability of rural CSEB enterprises	- Compression tester for selected enterprises 4/5 location	The compression testers test the quality of the bricks, and five compression testers were provided to strategic enterprises to ensure quality of bricks. Locations with 12-13 enterprises were selected so that they could share the compressor.
1	1.3	Activity 1.3.2B: Conduct 7 orientation to distribution agencies on multifaced benefits of using CSEB technology	-Demo structure for distribution points	Small demo buildings were constructed to show the bricks to potential buyers as well as strengthen the distribution point.
1	1.3	1.3.1 Establish and strengthen CSEB distribution points through identification and surveying of distribution points	- Customized production training for distribution centres	CSEB distribution centres needed to improve on customised production and sales. The project planned an extra training to teach them more about this as well as to help boost sales.
2	2.2	Activity 2.2.3: Formation of district level CSEB enterprise network with regular meetings	- Association support fund	A challenge fund was provided for specific projects (radio advertisement, demo building compression tester) as well as to strengthen each association. For the sustainability of this association and to scale the CSEB, DCA and Partners will continue to work with and

				support the association in future through other funding sources.

1.3 Achievement of NCF indicators

NCF core indicator	Results (quantitative)			Clarifications/Means of verification
Number of beneficiaries reached	Women		3,671	1,443 Houses X 4 person per hh = 5,772 96 enterprise X 4 employees = 384 96 X 1.25 entrepreneur jobs = 120 (As some of them are in partnership and both are working full time in the business. Note: Entrepreneur job is the owner of the enterprise and employees are people s/he employs). 1,443 Houses X 1.5 construction jobs = 2,165 It is estimated that 31% entrepreneurs are women. Source: Endline Survey. However, Build Up Nepal (BuN) maintains an internal database on all the CSEB enterprises, which is updated every 6 months. The data from Endline Survey were cross-checked with BuN's internal database which suggested that the endline's data and estimation were quite accurate.
	Men		4,770	
	Total		8,441	
Number of people with increased resilience to climate change	Women		4,321	26 meetings X 50 people The project assumes that out of the total individuals targeted, at least 50 people in each meeting will have increased knowledge on climate change Approximately, 5,772 individuals benefited from disaster resilient houses (1,443 houses * 4 members per house) Source: Endline Survey
	Men		5,420	
	Total		9,741	
Number of people with improved livelihoods	Women		339	96 enterprise X 4 employees = 384 96 X 1.25 entrepreneur jobs = 120 1,443 Houses X 1.5 construction jobs = 2,165 120+384+2165= 2,669 As most of the construction job are performed by men, the number of men beneficiaries are seen considerably higher. Source: Endline Survey
	Men		2,230	
	Total		2,669	
New decent jobs created	full-time	Women	156	Full time- employed for more than 20 days in month Part time/seasonal- employed for 10-12 days in or seasonal in the construction season. The endline survey found that nearly 31% of the entrepreneurs were women. The consortium also found that higher number of women were engaged in production compared to construction as production work was done in one location and could be combined with their housework, whereas construction required women to be mobile and move between villages. Source: Endline Survey
		Men	348	
		Total	504	
	part-time/seasonal	Women	216	
		Men	1949	
		Total	2165	

2. CLIMATE CHANGE

According to a recent World Bank[4] report (2020) fired bricks are responsible for 37% of CO_2 emissions from combustion in Nepal through 1,700 kilns burning 5 billion bricks yearly. In Kathmandu, brick kilns are responsible for 28% of total PM10 concentrations and 40% of Black Carbon in winter and contributing 10-11% of GDP yet has a massive CO_2 footprint. The situation of brick industry in Nepal is worse than expected and the demand for bricks is likely to continue to grow due to strong preference for brick-cement houses among consumers and rapidly growing urbanisation with increased infrastructural development. At the same time, a recent report by Max Fordham shows that the CO_2 savings of CSEB in Nepal is even greater than first estimated, 40-80% compared to fired bricks. These two reports combined highlight that reducing emissions in the brick industry is one of the most effective ways to reduce the CO_2 emissions in Nepal. Despite the available reports on the benefits of switching to CSEB technology, the government has been slow to adopt this technology. The primary reasons for this are the lengthy bureaucratic processes, lack of political priority, and the frequent change in government.

During the design phase, the project had set the target of reducing 16,231 MT of CO_2. At the time, it was assumed that all the enterprises would be established by the beginning of the project, which was not the case, as the enterprises were established throughout the project period. This is one of the prime reasons as to why the project was unable to achieve the set target. Nevertheless, the enterprises we supported during the project, significantly reduced the amount of CO_2 emissions and most of them are reporting very positive results. It was estimated that each CSEB brick saves approximately 0.00303 MT of CO_2(refer to Annex 6). The 96 enterprises supported by the project produced around 3.6 million CSEB bricks, whereas the other projects produced around 1.7 million CSEB bricks, therefore it is estimated that in total the project reduced about 15,966 MT of CO_2 of which the project directly contributed to the reduction of 10,934 MT of CO_2 and other projects reduced 5032.83 MT of CO_2.

Climate impact Quantified	Project target	During project period	Per year onwards
CO_2 emissions saved	16,231 MT	10,934 MT *(3,608,600 bricks * 0.00303 MT= 10,934)*	10,908 MT (*96 enterprises*37,500 bricks *0.00303 MT = 10,908)*
Estimated savings per year from project enterprises	96 enterprises produced 3,608,600 CSEB bricks and built 1,443 houses during the project. Once established, each enterprise builds on avg. 15 houses per year. On average, each brick saves 0.00303 MT CO_2 whereas each house saves 6.925 MT CO_2.		
Estimated savings per year from other enterprises (BuN/DCA supported)	26 enterprises were established under LNOB and other projects	During the project period, these 26 enterprises produced 1,661,000 CSEB bricks, which supported to reduced 5,032 MT of CO_2	Next year = 2,954 CO_2 saved (26 enterprises* 37,500 bricks* 0.00303 MT= 2,954)

3. DEVELOPMENT IMPACTS AND CROSS-CUTTING ISSUES

The project has development impact and cross-cutting issues at its core value. The Endline Survey conducted in April 2021 found[5]:

[4] Eil, Andrew; Li, Jie; Baral, Prajwal; Saikawa, Eri. 2020. Dirty Stacks, High Stakes : An Overview of Brick Sector in South Asia. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/109s86/33727 License: CC BY 3.0 IGO

[5] The study collected information from 22 enterprises, 21 CSEB users, 18 trained mason, and 5 LG representatives

- **Environmental sustainability*:*** Compared to fired bricks, CSEB are environmentally friendly as they use 50% less cement and use locally sourced materials saving on transportation and reducing carbon footprints. The traditional brick-making process also consumes large amount of clay which leads to removal of topsoil and land degradation, therefore switching to CSEB can reduce associated degradation. It is estimated that compared to fired bricks, CSEB can save 30-40% CO_2.
- **Gender equality and social inclusion**: The construction sector is dominated by men and the project worked systematically to include, engage, and advance women, youth, and disadvantaged group throughout the project activities. Each enterprise created on an average 5 jobs in production (4 brick-makers + 1 entrepreneur) and additional jobs in construction. Out of the 22 surveyed enterprises, 32% were led by women, 48% indigenous and 15% Madhesi (disadvantaged groups). Likewise, the analysis of the 96 enterprises indicated 31% of the total enterprises were led by women. The project team learned that women's participation was higher in production as the production was mostly done in one location in the village and could be easily combined with their housework, whereas it was challenging to engage women as masons as it required them to be mobile and travel to different villages for construction work.
- **Labour rights:** The project supported CSEB enterprises which are deeply embedded within their communities and uphold good labour standards and do not employ children, unlike the fire kilns in Nepal which are infamous for child labour and poor working conditions. The CSEB enterprises created employment for women, youth, and disadvantaged groups, and prevented forced migration from rural villages due to poverty. Labour rights abuses are not tolerated by the communities the enterprises operate in. The average monthly salary for entrepreneur is approx. EUR 348 (NPR 49,926) and brick-makers is approx. EUR 122 (NPR 17,546), which is well above the Government Norm which is EUR 104 (NPR 15,000). The project has continuously monitored the age of trainees (to avoid child labour) as well as guiding the enterprises on good labour practices.
- **Good governance**: Government officials' capacity was built on climate change and climate friendly behaviours, supported them to develop policies that consider climate friendly bricks such as CSEB, coordinated with the central body (National Reconstruction Authority) and encouraged engineers and institutions (through LG) to reach their goals and advance climate friendly construction, local jobs, and resilient housing.

4. ASSESSMENT OF THE RESULTS AND IMPACTS OF THE PROJECT

4.1 Relevance

During the design of this project in 2017, Nepal was undergoing massive reconstruction efforts to recover from the 2015 earthquake, which destroyed 800,000 houses. At the time, most houses were being rebuilt using conventional materials such as fired bricks. However, the project succeeded in contributing towards a green transition in Nepal's construction sector through piloting of new and green CSEB technology in Nepal. The results of the project show that it is possible to transform even one of the oldest and most well-established industries in Nepal: the carbon-intensive fired brick industry.

In 2017 and 2019, two massive floods hit Nepal, further highlighting the need for safe, affordable housing. The recent report of National Planning Commission of Nepal[6] highlights the risk of future earthquakes in Nepal, especially in the western part of the country. The experience of the project and recent events highlight that more action is needed to address the gap in safe, affordable housing in Nepal while also ensuring that new houses are built with minimal climate impact and good working conditions. This is in line with government policies, strategies and priorities as seen in:

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- An act made to provide reconstruction of the earthquake affected structures – Act no. 11. Of 2015 (2072)
- Course, Directions and Standards of National Reconstruction Authority – Part 2. 2019.
- Earthquake Housing Reconstruction Programme in Nepal (Third Revised Edition) – April 2020

The project has targeted three relevance areas to respond to the needs of the population and the country as a whole:

Low-cost disaster resistant housing: By introducing CSEB technology, the project has enabled 1,443 families to build new, safe houses at a lower cost. By establishing 96 self-sustaining CSEB enterprises, thousands of more houses will be built in the coming years. However, more action is required to fully address the need for safe housing in Nepal.

Poverty reduction through green jobs: 28.6% of Nepal's population lives in poverty, of which 95% reside in rural areas[7]. COVID-19 has setback poverty reduction and inclusive growth in Nepal[8]. Women, returning migrants, youth, and disadvantaged groups have been hit the hardest – returning to unemployment in poor villages. The project has targeted women, youth, and disadvantaged groups specifically through trainings and project activities. As the CSEB technology is gender friendly, it has been successfully in attracting women in construction sector, which is otherwise a male dominated sector.

Supporting the implementation of second Nationally Determined Contribution (NDC): By promoting and scaling up the CSEB technology, the project contributed to Nepal's target of adopting low emission technologies in brick and cement industries to reduce coal consumption and air pollution. Compared to fire bricks, CSEB uses 50% less cement and reduces CO_2 emission by 30-40%.

4.2 Effectiveness

Overall, the project achieved many of the outcomes, outputs and impacts envisioned. The project helped develop a model for scaling up CSEB enterprises which can lower cost in the future. One of the key success of the project is that it was able to create awareness and demand for the CSEB technology. The project found the following activities effective to help establish the enterprises and scale up CSEB technology in Nepal:

- **Mason trainings**, to increase access to masons that can build disaster resistant houses for interested families and consumers.
- **Quality control**, low quality construction is widespread in Nepal. To ensure safe houses and wide adoption of the material it has been critical to ensure the quality in the scale-up, through trainings, compression testers, training government engineers and more.
- **Awareness raising,** the project found that the combination of community meetings/field activities with social media has been very effective in increasing awareness of climate friendly building materials and reaching new potential entrepreneurs.
- **Enabling government policy** (norms and district rates), is very important for enterprises to be able to use CSEB for public construction and procurement. In many areas of Nepal, LG is doing a lot of construction and being able to use CSEB opens a large market for the enterprises.
- **Ongoing support to enterprises**, the entrepreneurs are very interested to get timely and flexible support targeted at the problems they are experiencing in any given moment. This has been very effective to help them overcome challenges.
- **Association,** the project has established the CSEB Association of Nepal, which has brought together more than 50 entrepreneurs in the same association to share learnings, strategies and plans for how to improve and scale-up further.

[7] - Nepal Planning Commission, 2018: https://www.npc.gov.np/images/category/Nepal_MPI.pdf
[8] - International Policy Centre for Inclusive Growth, 2020 - *COVID-19 and social protection in South Asia: Nepal*: https://uni.cf/30dzUPv

- **Identification of enterprises through local government/community meetings**: It has been much more effective to find new potential entrepreneurs through referrals and social media (entrepreneurs that find us are more intrinsically driven and motivated).

Moreover, the Endline Survey (conducted in April 2021) found that the project was successful in increasing demand, interest, and income from the CSEB technology. The report confirmed that the 22 sampled enterprises invested around EUR 195,000 (NPR 26.73 million) and that 68% were able to establish linkage with financial institutions for credit services. CSEB has been viewed as a profitable enterprise with entrepreneurs making an average income of approx. EUR 350 (NPR 49,926) and providing employment opportunities to 2,669 people. Moreover, youth have also expressed interest to invest their foreign employment's income in CSEB technology. According to the Endline Survey, 83% of the consumers have confirmed reduction in cost for construction and have expressed satisfaction in the design of the house. It is estimated that CSEB reduces cost in construction by 20-30%.

Though the project was able to achieve most of the envisioned interventions, it was unable to meet all the outcome targets (e.g., number of enterprise establishment, number of bricks production, number of houses constructed, number of local employment creation, tonnes of CO_2 saved). The primary reasons for this are as follows: first, the project assumed that all 100 enterprises would be established and be operational at the beginning of the project. However, this was not the case as the enterprises were being established throughout the project period, which caused a delay in CSEB production and associated targets. Second, the project initially targeted earthquake-affected districts. As part of the post-earthquake reconstruction, the government supported impacted families to rebuild their houses, consequently there were fewer families/households that still required reconstruction support than originally thought. Considering this, the project had to be expanded to Province 2. Third, the COVID-19 related lockdown in the country affected the planned activities and the project's key results. The CSEB entrepreneurs faced a lot of struggles because production and supply of the interlocking bricks, including CSEB, were decreased due to the slowdown of construction work, unavailability of raw materials, lack of workers, untimely repair works etc. Furthermore, COVID-19 restricted our ability to establish new enterprises.

4.3 Efficiency

Overall, the project delivered its results in an economic and timely way. However, the project had to seek for 8 months extension due to COVID-19. As several components were innovative and piloted within the project, there has been a factor of risk involved such as high adoption barrier, lack of affirmative policies, low awareness of CSEB, etc. CSEB has proven to be energy efficient, cost-effective, and adaptable, thus catering to the local needs.

- **Cost-efficient**: CSEBs are made mixing local soil and sand with cement. As the brick uses locally sourced materials, its saves on transportation, time, and money, thus lowering the cost of production. Similarly, compared to the fire bricks, CSEB uses 50% less cement (the most expensive component of the brick) and sand, further lowering the cost. The Endline Survey revealed that 86% of the 635 local masons found CSEB to be cost-effective.
- **High adaptability:** Since CSEB is produced locally, both the brick and the raw materials can easily adapt to various needs (technical, social, cultural, etc.). The monitoring and verification report noted that entrepreneurs introduced and promoted multiple products- flower pots, cement tile, blocks, etc. – along with CSEB. This was a key strategy adopted by entrepreneurs as a back-up for the industry in terms of business and cash flow requirements.
- **Technological transfer:** CSEB is a simple technology requiring semi-skills and is easy to learn. The project mobilised the trained CSEB masons to promote the CSEB technology. The Endline Survey, which also had the scope of evaluating the project using DAC OECD criteria found that 59% CSEB

entrepreneurs (13 out of total 22 surveyed entrepreneurs) had facilitated training to 125 potential entrepreneurs about CSEB technology to encourage them to scale up the CSEB technology in wider range. The study also found that the trained masons acted as important agents for generating and disseminating information about CSEB in their localities.

4.4 Impact

Social Impacts:

- **Gender equality,** 28 of the total enterprises supported in the project are led by women and on an average 2 women brick-makers per enterprise have been trained. By providing women with the tools and resources to start and engage in the enterprises, the project enabled them to participate in an industry, that was traditionally male dominated. The women were equipped with skills and confidence to compete with male entrepreneurs, creating domino effects by encouraging other women to engage in this industry.
- **Human rights,** access to safe, affordable housing is a fundamental human right and a core requirement for dignified life. CSEB provides opportunities for poorer families to own affordable houses that are safe and disaster resilient. The project trained enterprises on labour rights and decent working environment, ensuring labours receive fair wage.
- **Well-being,** unsafe, overcrowded housing is unhealthy and creates vulnerability to disasters, disease, and social conflict. The project has found that safe, affordable housing improves health and creates a solid foundation for a better life for poor and vulnerable groups.
- **Reduced migration and developing local economy** by establishing long-term self-sustaining enterprises as drivers for jobs, housing and economic development.

Environmental Impacts:

Climate effects of traditional fired bricks in Nepal	Climate effects of CSEB Bricks
1. Coal is transported from India to Nepal. 2. The coal is burned in a traditional brick kiln with poor filtration and environmental performance. 3. To make the bricks, the soil around the brick kiln is dug away and the immediate environment and eco-system is destroyed. 4. The bricks are then transported several hours up the Himalayas on very poor roads, breaking 20-40% of the bricks on the way (wastage).	1. CSEB Bricks are made by mixing local soil and sand with cement. The mix is compressed in a manual machine. The main climate effect is the cement used (10%), which is usually made in Nepal, and transported to the village by truck for 2-12 hours. 2. Soil is sourced locally, and sand is transported to the production site (usually 1-10 km) on small tractors/trucks carrying 1-10 MT depending on road conditions. 3. The production is done on small scale. Fertile topsoil is not used and when extracting soil, it is common to build terraces for farming or use left-over soil from road construction, reducing land degradation. 4. 50% less cement and sand are used for mortar in the construction as CSEB Bricks are hollow interlocking, and the mortar is poured in holes through the bricks without thick layers of mortar in between the courses of bricks.

4.5 Sustainability

Through a growing network of self-sustaining CSEB enterprises, trained masons, and engineers, endorsing government stakeholders and awareness raising, the project has propelled a shift towards safe, greener and low-cost housing in Nepal's brick and construction industry. In the 19 project districts, there is now a supportive market-systems that enables existing and new enterprises to start and expand on their own. On the national level, the project has been pioneering in demonstrating that it is possible to successfully introduce, pilot, and scale-up a greener, innovative technology in an otherwise well-established and outdated industry resisting change. The project has identified that

following critical factors are contributing to the long-term sustainability of both the project and CSEB enterprises.

- **Government endorsement and recognition of technology**: The LGs have incorporated CSEB into their annual development plan along with the approved specific district rates for CSEB. This has enabled CSEB to compete with fired bricks in equal terms in certain locations of the project area. Furthermore, in Chitwan District, the LG under the "Mayor Housing Programme" promoted CSEB to build houses for indigenous people, person with disability (PwDs), other marginalised social and ethnic groups.
- **Strengthening of CSEB networks**: The entrepreneurs have utilised both formal and informal association to exchange best practices, lessons, and experiences among entrepreneurs as well as ensuring quality management of products from the initiation of network.
- **Access to adequately trained masons**: Trained masons are important agents for disseminating information of CSEB to potential users, business promoters, and new masons. Potential users generally consult with masons and enquire about the feasibility of CSEB when constructing a new building. Consequently, through trained masons, many users have adopted the CSEB technology.
- **Diversification of production using construction materials**: Many of the CSEB enterprises have adopted multi-product modality where they produce different products from construction materials – flowerpots, cement tile, blocks, etc. to ensure continue stream of income, while disseminating information of CSEBs to buyers.
- **User awareness and high market demand**: The Endline Survey found that 73% of the 22 sampled entrepreneurs were planning to expand their production capacity. It was also noted that over 120 machines were sold during 2020 from the existing and new entrepreneurs, indicating good interest in the CSEB enterprises and increased demand for CSEB.

4.6 Coherence

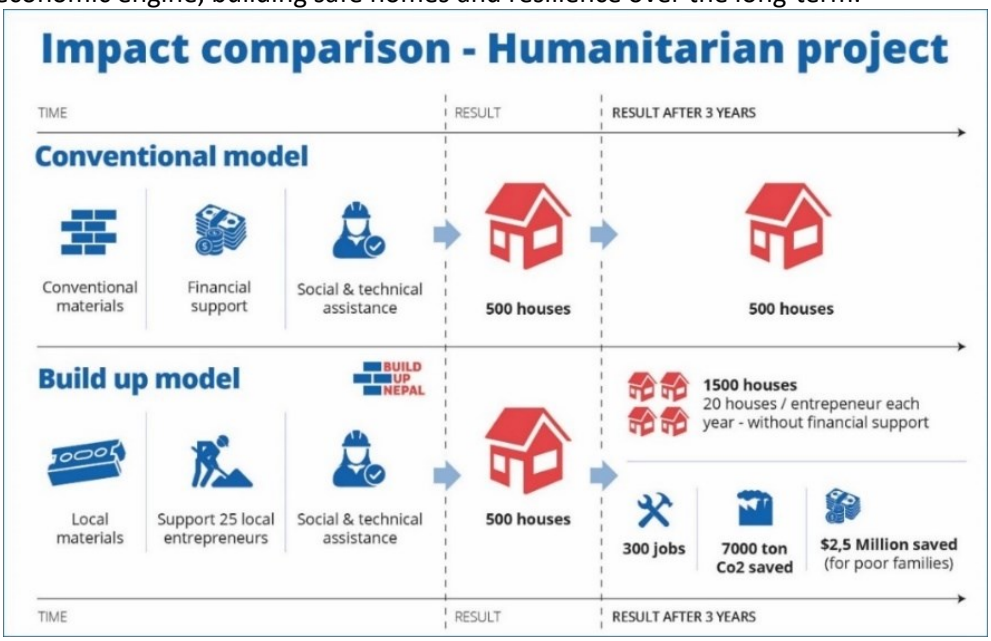
- Nepal's recent shift to federalism has decentralised funding and decision making. This has created a unique opportunity to engage and build capacity of local and municipal governments to take lead and champion for sustainable housing. As a result of the project, LG Unit has given recognition to CSEB product in few hilly districts as in Gorkha, Sindhuli, Kaski and Makwanpur.
- The project has increased awareness and interest for green construction and CSEB technology among government, multilateral organisations and development partners on several levels in Nepal. An increasing number of INGOs and development organisations are using CSEB for building schools, health posts etc. Another example is, USAID/DAI recently adopted the CSEB technology in one of their programmes focusing on disaster preparedness-TAYAR Nepal – which will scale up the technology in a few municipalities of Western Nepal. This was done after series of consultation and discussions with DCA and BuN.
- As part of Nepal's NDCs to the UNFCCC, the government has put forward ambitious goals to curb GHG emissions in transport, industry, agriculture and forestry, yet goals related to the construction sector are lacking in detail, especially considering it as Nepal's largest emitter of GHG emissions. Progress is being made with the National Urban Policy including the need to adopt green building technologies, but this is yet to be actioned through an updated Urban Development Act. Similarly, Nepal's Department for Urban Development and Building Construction (DUDBC) has shown interest in promoting green building but requires further support to bring this to action.
- In 2017, the National Urban Development Strategy highlighted the additional need for strategies to encourage the private sector to help address the gap of resilient, affordable

housing through the promotion of innovative and environmentally friendly strategies for housing. However, very few development organisations are actioning this opportunity and supporting the government and private sector to adopt green construction remains an unutilised opportunity.

5. INNOVATION

The project combined two integrated solutions to improve the life for vulnerable people and tackle climate change in Nepal:

- **Low-cost, resilient technology:** The project specializes in CSEB, a recognised disaster resilient and affordable construction technology that uses local materials. The technology lowers the cost of construction by 20-30% and CO_2 emissions by 30-40% compared to conventional carbon-intensive fired bricks. CSEB uses locally extracted material, which strengthens the local economy and reduces transportation costs and emissions. It can also adapt to local needs.
- **Innovative enterprise model:** In contrast to conventional development methods, and other projects using CSEB, the project has scaled up an innovative micro-enterprise model by systematically recruiting and empowering private sector entrepreneurs to start their own eco-friendly brick enterprises. The entrepreneurs invest their own money and hard work securing a strong incentive to build, sustain and grow over the long-term. The entrepreneurs operate more effectively than any outside organisation can and reduces the cost of construction by 20-30%. The project has supported each enterprise to ignite as a sustainable economic engine, building safe homes and resilience over the long-term.



6. POTENTIAL FOR SCALING UP AND FOLLOW-UP INVESTMENTS

The consortium members have taken swift action to build on the momentum created in the project. DCA has launched the following projects to scale up the technology in the West and Far-west of Nepal and to increase the adoption:

- ***UTHAN* – Enhanced Action of Inclusive CSOS for Participation in Climate Resilient Economic Growth** with funding of European Union. The goal of the project is to promote inclusive, sustainable, and climate resilient economic growth through meaningful CSO participation and accountable local governance.

- ***EMPOWER* – Empowering Rural Entrepreneurs and Communities to Build Safe and Affordable Low-Cost Housing**. Building on the successes and lessons from the NABIN, the project introduces three new innovations and value-additions to promote the CSEB technology making it more cost-effective, eco-friendly, and lowering adaptation barrier. First, it will promote a gender-friendly machine to produce both CSEB interlocking and diversified non-interlocking bricks. Second, it will reduce the cement content, the most expensive component in brick mix, by adding a stabilizer. Third, it will use innovative on-site soil test (sieving method) for accuracy and utilise ICT technology (a low-cost compression tester) to improve the brick quality in 7 days against the pre-existing timeline of 30 days.
- ***CSEB as a Gift to the vulnerable population* –** DCA is working to promote CSEB micro enterprises to increase access to low cost (by 20 to 40%) and climate resilient construction materials in rural areas in far west, where youth and marginalised community are benefiting.

BuN is implementing the USAID Tayar project which seeks to promote affordable and sustainable building material, while also establishing a sustainable enterprise and supporting disaster resilient building technologies. Furthermore, BuN support on an average 10-12 new enterprises to start production and construction with CSEB monthly. This is ongoing, mostly without grant financing. A strong learning in the project, however, has been the importance of grant financing in building a supportive market system and ensuring the enterprises can succeed long-term (including access to trained masons, government endorsement, stakeholder awareness etc.). We have seen that each enterprise that succeeds results in 2-3 new enterprises starting in that area within a year or two, while each enterprise that fails has the opposite effect.

This highlights the need for building a supportive market system. The project has successfully built this market system in 19 districts and the partners are now working to scale the technology and build a supportive market system across Nepal's 77 districts. In this endeavour further grant financing could become a critical catalyst for ensuring a successful scale-up and adoption of CSEB for climate-friendly construction nationwide. For instance, in the NABIN areas where CSEB is well-established, less support it required, whereas areas outside NABIN require more support. Similarly, additional grant is required to build an effective ecosystem around them ensuring the enterprises will sustain long-term. This includes getting endorsement from local and national government, quality control, awareness raising, etc.

7. RISKS

Project risk description	Impact on project	Mitigating measures and responsibility
People's adaptation for regular product (fired brick, stone)	High	Mitigation measures: Project has recently innovated and tested a new type of machine that can produce both CSEB interlocking and diversified CSEB non-interlocking bricks as well as floor/pavement tiles. The new machine will increase work efficiency, productivity while reducing drudgery. Interlocking bricks are very cost effective and diversified bricks lower adoption barriers as it is very similar to traditional fired bricks.
Limited demand of CSEB after reconstruction of earthquake affected districts	High	Mitigation measures: Post earthquake reconstruction work is almost completed. The NRA has announced to end reconstruction grant in earthquake affected districts, which has severely impacted family's ability to afford new houses. Further, the project has promoted the technology, not only for reconstruction, but also as a cost-effective construction material for urban and semi-urban construction. Likewise, the project has continued to push LG to approve/own the technology and integrate it in their regular development plan.
Project implementation risk materialised during current milestone		
Impact of COVID-19 on project key results i.e.,	High	Mitigation measures: NCF has approved a 2nd request of no cost extension (NCE) of the project by four months till April 2021 (January – April 2021). At the same time, NCF

number of CSEB interlocking bricks production, number of house construction, number of local employment creation, tonnes of CO_2 saved		also approved to adjust the target of the enterprises from 100 to 90 and redirected funds to strengthen the established enterprises. These solutions have helped the project to create a better opportunity to meet the project's key results and to sustain and strengthen the existing enterprises and expand the production as well as supply of CSEB interlocking bricks.
Limiting Government regulation and awareness (Government not serious in approving the construction norms – CSEB guideline)	High	Mitigation measures: Limited government regulations and lack of awareness make it hard for the enterprises to bid for big tenders and get approvals, restricting their market and growth. Work to finalise the CSEB guidelines, which is already developed, and get it approved by Department of Urban Development and Building Construction (DUDBC). Once the guideline is approved by the Nepal Government, it enables CSEB to compete on equal terms with fire bricks.
Inconsistent CSEB quality/specification among various manufactures	High	Mitigation measure: There is a need of standard specification for CSEB. This is used when preparing documentation for tenders and building specifications and used together with norms and district rates. The project submitted an application to Nepal Bureau of Standards & Metrology along with relevant information to get Nepal Standards Quality Award. Nepal Bureau of Standards & Metrology (NBSM) is the National Standards Body of Nepal. It is one of the departments under Government of Nepal, Ministry of Industry.
Lack of skilled mason	High	Mitigation measure: Masons are the key actors in building construction. Lack of skilled mason is causing serious obstacle in swift implementation of reconstruction and rehabilitation in project locations. To overcome this issue, the project increased the number of mason trainings from the original 14 to 26. This was deemed necessary in order to improve the mason's skills and quality of work. Most of the LGs in project location has also initiated to provide trainings as part of their regular development plan to teach modern earthquake-resistant techniques of construction for construction sector workers.
Unhealthy competition among the producers and negative message about the product from the specific group of people particularly by the owners of the brick kiln	High	Mitigation measure: To overcome this issue, the project organized series of meetings among the CSEB producer and owner of the fired brick kiln to create healthy environment and healthy competition. Now after intervention of the project, the situation has improved a bit and the future efforts could offer the possibility to change or add this technology to the traditional ones as well.

8. MONITORING AND EVALUATION

The project was consistently monitored to ensure that the project was on track.

Project steering committee meetings – four steering committee meetings were organised to share the project achievements, risks, lessons learnt, recommendations, COVID-19 and its implication on the project and ways forward. The key discussion points of the meeting were as follow:

- Entrepreneurs must be trained on sales skill and business management skill to make more efficient and good performance
- Project team must consider more to have influencing activities with Government stakeholders to incorporate CSEB in district rates and building guidelines
- The committee suggested to carry out situation assessment of the project focusing on market function, local economy, status of existing enterprise, LG priorities, issues and challenges due to impact of COVID -19 in the project
- The committee suggested to slowdown the project activities because of lockdown
- The committee suggested to request for four months (Jan – April 2021) NCE

The joint consortium visits to the field – two joint consortium visits to project area were organized to review the project progress, interact with partners and local government representatives, and identify possible bottlenecks and divergences from the main course of action. The key discussion points and recommendations from the visits were as follow:

- The partners should discuss with local government and agree on some collaborative action on model community infrastructure demonstration to promote CESB technology.
- The partners should work together to identify an appropriate approach/strategy for social mobilisation and demand creation.
- DCA must coordinate with BuN and Practical Action to better understand the Guidelines and government certification process of structures using CSEB and to more closely manage this process of advocacy with the government in collaboration with District and National CSEB Association.
- In close collaboration with DCA and consortium partners, develop different visibility and market products such as short video(s) of CSEB owners, workers, and also the Deputy Mayor in Sarovar, IEC materials, stories, etc. to promote CSEB.
- Consortium members should discuss with the District and National level Association to identify advocacy issues and strategies and implement to influence policy and certification processes.

The NCF visit to the field – NCF visited Nepal from 15th to 19th September 2019 with the objective to review the project progress, meeting with partners and local Government representatives and explore the opportunity to scale up the project. During the visit the following key discussion points were approved:

- No cost extension of the project by four months till December 2020 (September – December 2020)
- NCF agreed to let the consortium count the number of bricks produced by the other 26 enterprises established by BuN and Practical Action in the same locations through different projects to meet the 21 million CSEB bricks target by the project period. To avoid double counting, it was agreed that the consortium would only count those bricks produced by these enterprises after December 2018.
- Expand the project locations in seven new districts affected by flash flood under province number 2, beyond the earthquake affected locations.

Monitoring and verification of CSEB enterprises – as a purpose of assessing the status of CSEB enterprises and its associated interventions and results, the project assigned So Tech Engineering Consultancy P. Ltd. for conducting "Monitoring and Verification of CSEB". The objective was to conduct monitoring and verification of the status of CSEB enterprises and its interventions and results. The report was based on literature review, field observations and interviews with 41 CSEB enterprises and 56 house owners, 17 trained masons, and 5 representatives of local government in 15 districts (refer to Annex 7).

Endline Survey, with the provision of evaluation using DCA criteria: So Tech Engineering Consultancy Pvt Ltd. carried out the endline survey in April 2021. The purpose of the study was to collect quality data which can be measured and compared against the baseline value, overall objective indicators, and expected results. The study also follows standards of project evaluation as outlined in OECD[9] which defines six evaluation criteria – relevance, coherence, effectiveness, efficiency, impact and

[9] https://www.oecd.org/dac/evaluation/

sustainability. The study collected information from 22 enterprises, 21 CSEB users, 18 trained mason, and 5 LG representatives (refer to Annex 8).

9. LESSONS LEARNT

- **Importance of large geographic area:** Initially the project was focused on 12 (considering Kathmandu, Lalitpur and Bhaktapur as 1 district) districts and after the 2019 floods, 7 flood affected districts were added. In this process we learned the importance of operating in a large geographic area as it then becomes easier to identify driven entrepreneurs (key success factor in scaling CSEB).
- **Importance of flexible project activities**: The entrepreneurs wanted support tailored after their needs while the project had pre-planned activities that needed to be delivered. Some entrepreneurs need more support on training masons while others really struggle to get local government on board. Higher flexibility in project activities would ensure better match with the needs on the ground.
- **Initiate joint monitoring (or consultation) from government representatives**: The joint monitoring visits from concerned government representatives became an opportunity to make them aware of the technology, and exposure to the positive perception of users satisfied with the technology. Such events may create pressure for recognition of technology.
- **Government endorsement**: in the areas where government has given its endorsement for the technology it has made a huge difference for the enterprises operating there. Further district and central level endorsement will make it easier to families to choose to build using climate friendly CSEB bricks.
- **Refresher trainings/exposure to masons:** Many trained masons are out of the community and disconnected with the entrepreneurs. Similarly, the existing masons who received training require technical follow-up support. Likewise, experience sharing events can be organized between trained masons.
- **Continuous experience and learning sharing events among entrepreneurs**: The experience sharing events was very useful for new entrepreneurs to learn successful approach of business promotion. From such types of events, the beginners will learn from successful entrepreneurs and they will be able to replicate successful approaches for promoting their enterprises.
- **Distribution points**: Limited interest from hardware stores and depots as selling CSEB means selling less cement as CSEB required 50% less cement during construction compared to fired bricks.
- **Lengthy workshops with government officials**: It was found that government officials have very busy schedules and limited time. Compared to the initially planned multi-day workshops, short meetings and workshops would have been much more effective.
- I**mprove quality control at scale:** The more we scale the more important it becomes to have a model to ensure quality at scale at low cost.

10. OUTREACH

The project has made outreach through a combination of field activities, IEC materials, social media and digital channels. The project collaborated with National Television of Nepal to get visibility on CSEB technology as part of the awareness raising campaigns. The project wanted to disseminate information on this technology with relevant stakeholders in order to promote and establish it on wider horizon through a discussion show. The name of the discussion show was **SAJHEDARI**, which was a community-based discussion programme (see Annex 4 for more information and links to the videos). During the entire project period, eight episodes were aired with focus on Nepal's experiences towards post-earthquake reconstruction work as well as on the use and importance of alternative

construction materials such as CSEB. The show was appreciated by people and provided an opportunity for interactive learning as well as to raise awareness and debunk concerns from the show's guests. In addition to that, as part of the project, three short videos have been produced (Annex 4).

Further, the consortium members became very active on social media, which become very important after COVID-19 hit as it became harder to reach out through field activities. As part of the awareness raising campaigns on CSEB technology and potential for SME (Small and Medium Sized Enterprises) business development, the project had disseminated results through the following Information, Education and Communication (IEC) materials throughout the project period (Annex 4).

11. FINANCIAL SUMMARY

Table 1. Project financing per partner

	Financing, EUR				
Expenditures, EUR	**NCF**	**DCA**	**BuN/Community Impact Nepal**	**Practical Action**	**Total**
DCA	65,283.69	94,496.29			159,779.98
Community Impact Nepal	255,682.93		29,950.89		285,633.82
Practical Action	127,860.88			28,853.87	156,714.75
Total	**448,827.50**	**94,496.29**	**29,950.89**	**28,853.87**	**602,128.55**

12. CONCLUSIONS AND RECOMMENDATIONS

The project has been successful in establishing a market system and entrepreneur model around CSEB interlocking bricks in 19 districts of Nepal. The consortium members have seen a great market potential going forward, especially for low-cost housing which is in large demand in Nepal as people are working their way out of poverty. The project has shown that CSEB interlocking bricks has a real potential to replace fired bricks in low-cost housing as well as reduce CO_2 emissions significantly on a national scale as fired bricks are responsible for 37% of the CO_2 emissions in Nepal.

DCA has taken swift action to build on the momentum created by NABIN and incorporated CSEB technology in its flagship projects funding by the EU, DANIDA and DCA's own fund to scale up and adoption the CSEB technology to the West and Far West of Nepal. Likewise, BuN is working to expand the technology beyond the project areas. In total, the partners have already supported 110 enterprises outside the project areas.

The consortium members see a great potential to scale up this initiative with the goal of:

- Replacing 5% of fired bricks in Nepal by 2025, which would lead to a reduction of Nepal's total CO_2 emissions by 1%.

- Build 10,000 low-cost, earthquake resistant houses keeping people save for the next disaster and create jobs in rural areas.

To reach there, the project makes the following recommendation:

1. Replicate the NABIN project across whole of Nepal: The project was implemented mostly in earthquake affected areas. There is high potential to replicate the model in the west and east of Nepal, where lack of housing is widespread and there is elevated risk of earthquakes. It is also important to ensure that existing MSMEs can scale-up.
2. A scale-up project should be less focused on grants to the enterprises (only for women, marginalized groups and youth entrepreneurs) and instead focus on creating an environment and market system where the entrepreneur can succeed by providing trainings, quality control, business and technical support. The technology has now developed to a level where entrepreneurs dare to invest without grant support as the market for the CSEB bricks are growing quickly all over Nepal.
3. Quality control is the most important issue for long-term success of the technology. The future projects should:
    - Train masons in resilient construction as a pool of qualified builders to the MSMEs.
    - Promote compression testers for on-site testing of brick quality, improving long-term quality.
    - Train and sensitize government engineers on CSEB and housing quality control.
4. Mass awareness raising campaign to increase knowledge of importance of resilient housing and how it can be achieved through low-cost, eco-friendly materials. In new areas especially outside earthquake affected regions the awareness of the technology and the concept of disaster resilient housing is low. We have found an efficient method for awareness raising though a combination of social media, community meetings and local mobilization.
5. Support existing enterprises to scale up – Develop efficient methods for enterprises to scale up their production using low-cost, low electricity mixer, hydraulic machines etc.
6. Business training, increased marketing skills and financial literacy for MSMEs.
7. MSME start-up support, additional support for women, youth, and disadvantaged enabling them to overcome barriers and successfully establish MSMEs.
8. Invest in R&D to improve quality, durability, and cost-effectiveness for increased scalability, better serving customer needs and driving adoption and impact at scale:
    - Redesign machines to reduce costs through effective assembly and increase durability by using high tensile steel reinforced, easy-to-replace wear and tear parts.
    - Brick R&D – Increase CSEB brick strength and lower production costs through R&D to improve brick composition and identify new stabilizers (rice husk ash, polymers).
    - Construction R&D – develop more effective construction process to reduce costs and increase housing resilience (faster construction methods, low-cost flooring options).
9. Develop CSEB contractors: Contractors are critical to the development of CSEB technology as they are the ones building the highest number of houses. We need to develop more contractors focusing exclusively on CSEB as we have seen that in areas where we have good contractors the technology has been much more established.

Annex 1 Project completion fact sheet

Project Name:	**NABIN – New and Affordable Building Materials Promoting Sustainability in Nepal**		
Project no.	**NCF-C7-131**		
Country:	Nepal	**Financing:**	
		EUR	**%**
Nordic Partner:	DCA	94,496.29	4.974169
Local Partner:	Community Impact Nepal/BuN	29,950.89	4.791978
Other Partner:	Practical Action	28,853.87	15.69371
	NCF grant disbursed	448,827.50	74.54015
	Total	**602,128.55**	**100**
Classification:	Mitigation, Adaptation and partly Resilience		
Project cycle:	Project start date: 07 September 2018 Original closing date: 31 August 2020 Actual closing date: 30 April 2021		
Short project description:	The NABIN project aimed to promote livelihoods through promotion of climate friendly construction materials and local business creation. It promoted compressed stabilized earth brick (CSEB) as a green alternative to carbon intensive fired bricks in Nepal. The project strengthened Nepal's capacity to mitigate and adapt to climate change through viable rural initiatives with strong social and climate impacts		
Project performance:	**Expected Outcomes and Outputs**	**Achieved**	**End-of-project status**
	Outcome 1: Livelihoods through promotion of climate friendly construction materials and local business creation	Yes and no	Some of the key outcomes/outputs were achieved while some lagged behind.
	Output 1.1: CSEB enterprises established	Yes	96 enterprises were established
	Output 1.2: Increased demand of resilient and green materials	Yes	
	Output: 1.3 Strengthened supply chain of CSEB in rural areas	Yes	57 distribution points developed
	Outcome 2: Enabling environment for scale up of CSEB	Yes	
	Output 2.1 Municipalities trained on CSEB technology	Yes	56 municipalities within 19 districts were served by CSEB enterprises in the project
	Output 2.2 Increased access to finance for CSEB entrepreneurs	Yes	68% of CSEB entrepreneurs had access to financial services. Loan products were developed together with the Microfinance Institutions-MFI (Mero Microfinance) and 2 banks (Laxmi Bank and Machhapuchchhre Bank)
	Output 2.3 Increased supply of masons trained on CSEB	Yes	635 persons
Climate change outcomes and impacts:	The project has been effective in climate change mitigation and greenhouse gas emissions reduction. Through the establishment of 96 CSEB enterprises and production of 3,608,600 CSEB bricks, the project directly reduced 10,934 MT of CO_2.		
Development outcomes and impacts:	• **Environmental sustainability**: Contributed to reduction in CO_2 emission by 30-40% as compared to fired bricks. It is estimated that CSEB will continue to reduce 10,908 MT CO_2 annually. CSEB also uses locally sourced materials, saving on transportation. • **Gender equality and social inclusion**: Increased women's participation in the construction sector, which traditionally a male-dominated sector. Approximately 31% of the supported enterprises were led by women. • **Labour rights:** The CSEB enterprises promoted good labour practices and paid fair wages. An average monthly income for entrepreneur is EUR 348 (NPR 49,926), ranging from EUR 51 (NPR 7,368) to EUR 1,115 (NPR 160,000). Whereas the average monthly income for brick-makers is EUR 122 (NPR 17,546), ranging from EUR 42 (NPR 6,000) to EUR 178 (NPR 25,500), which is which is well above the Government Norm which is EUR 104 (NPR.15,000). • **Good governance**: Government officials' capacity was built on climate change and climate friendly behaviours, supported them to develop policies that consider climate friendly bricks such as CSEB, coordinated with the central body (National Reconstruction Authority) and encouraged engineers and institutions (through LG) to reach their goals and advance climate friendly construction, local jobs, and resilient housing.		

NCF core indicators

NCF core indicator	Results (quantitative)			Clarifications/Means of verification
Number of beneficiaries reached	Women		3,671	1,443 Houses X 4 person per hh = 5,772 96 enterprise X 4 employees = 384 (entrepreneur job is the owner of the enterprise and employees are people s/he employs) 96 X 1.25 entrepreneur jobs = 120 (As some of them are in partnership and both are working full time in the business) 1,443 Houses X 1.5 construction jobs = 2,165 It is estimated that 31% entrepreneurs are women. Source: Endline Survey. However, Build Up Nepal (BuN) maintains an internal database on all the CSEB enterprises, which is updated every 6 months. The data from Endline Survey were cross-checked with BuN's internal database which suggested that the endline's data and estimation were quite accurate.
	Men		4,770	
	Total		8,441	
Number of people with increased resilience to climate change	Women		4,321	26 meetings X 50 people The project assumes that out of the total individuals targeted, at least 50 people in each meeting will have increased knowledge on climate change Approximately, 5,772 individuals benefited from disaster resilient houses (1,443 houses * 4 members per house) Source: Endline Survey
	Men		5,420	
	Total		9,741	
Number of people with improved livelihoods	Women		339	96 enterprise X 4 employees = 384 96 X 1.25 entrepreneur jobs = 120 1,443 Houses X 1.5 construction jobs = 2,165 120+384+2165= 2,669 As most of the construction job are performed by men, the number of men beneficiaries are seen considerably higher. Source: Endline Survey
	Men		2,330	
	Total		2,669	
New decent jobs created	full-time	women	156	Full time- employed for more than 20 days in month Part time/seasonal- employed for 10-12 days in or seasonal in the construction season. The endline survey found that nearly 31% of the entrepreneurs were women. The consortium also found that higher number of women were engaged in production compared to construction as production work was done in one location and could be combined with their housework, whereas construction required women to be mobile and move between villages. Source: Endline Survey .
		Men	348	
		Total	504	
	part-time/seasonal	women	216	
		Men	1,949	
		Total	2,165	

Annex 2 Results Framework

An updated results framework presenting the achieved results in the project should be attached. The attached results framework should include the changes agreed during project implementation. This is only relevant for NCF6 projects; NCF7-9 projects should update the results framework in the SmartME system's monitoring section.

- 96 CSEB micro-enterprises were established and are now functional
- 2,669 local jobs were created
- Approximately 3.6 million CSEBs were produced
- 635 masons and fried bricks makers were trained
- 2,103 houses were built using CSEB (1,443 from NABIN project and 660 from 26 enterprises established by other projects)
- 68% of CSEB entrepreneurs had access to financial services. Loan products were developed together with the Microfinance Institutions (MFI) (Mero Microfinance) and bank (Laxmi Bank and Machhapuchchhre Bank) and increased access to financial products by CSEB entrepreneurs
- 40% of the targeted people have increased knowledge and awareness on CSEB technology for house construction
- 25% increase in demand of CSEB
- 10,934 MT of CO_2 were saved
- 7 Local Governments (LGs) included CSEB on their annual development plans
- 57 CSEB distribution points were established
- 56 municipalities within 19 districts served by CSEB enterprises in the project

Annex 4 Other supplementary deliverables/documentation/links

Links to SAJHEDARI:

Episode_01 https://www.youtube.com/watch?v=zRMY8Oq0k9E
Episode_02 https://www.youtube.com/watch?v=0KbTS-X5g5s
Episode_03 https://www.youtube.com/watch?v=2aKBqo_kz9g
Episode_04 https://www.youtube.com/watch?v=XlJlTaMFnTs
Episode_05 https://www.youtube.com/watch?v=Jddhm-rQkr0
Episode_6 https://drive.google.com/file/d/1bUBRW3cixqN8bZbEhnj69qK1yqUkmxk2/view?usp=sharing
Episode_07 https://drive.google.com/file/d/1ZwC516S8Ig9Qn2tJisE0Uo2mlHmHacOH/view?usp=sharing
Episode_08 https://drive.google.com/file/d/1EsZaAZLBmJ4x8nOCsA74SfVh_k3bcSj8/view?usp=sharing

Links to videos

- https://youtu.be/O81-tB5WCVg
- https://youtu.be/myEn_6PWNzQ
- https://youtu.be/6w9LWh9U3FY

Annex 5 Impact story (Building Blocks for Success)

Rajapani Three Sisters Interlocking Brick Industry (Udhyog) was established in March 2020. The company has five shareholders, three of them women. Prior to this, these women were mostly involved in farming and household chores.

"*A year ago, my husband came across a Facebook post about the NABIN project. Post-earthquake, many houses had to be rebuilt and the video talked about how you could build an earthquake-resistant home at an affordable price*," informed Subhadra Karki, one of the shareholders. Subhadra along with her husband pitched the idea to some of their family members who agreed to join the company.

Sarswati Bhujel, another shareholder of the company shared: "*when we went to purchase the machine at Build up Nepal (BuN), they informed us about the grant provided by NABIN project for women entrepreneurs. It further motivated us to start our company*."

All five of the shareholders received training on the production of CSEB and further technical support from BuN as part of the NABIN project. "*Initially, when we started learning about production, it was extremely challenging. I did not know how to use the machine and had trouble taking the brick out of the machine. We received training for four days, but the constant technical support helped us hone our skills*," stated Saraswati.

Figure 1 and 2: Women Entrepreneurs making bricks

When they first started producing inter-locking bricks, the company struggled to find buyers. To make people aware of the bricks, they placed boards with their company's information and about the benefits of CSEB bricks in the community. This helped tremendously in market outreach. "*One of the attractive features of CSEB to the prospective clients was the affordability and earthquake-resistant technology. When people saw the board, they would call us to enquire about it*," informed Subhadra.

Now, on average, the company produces nearly 3,000 bricks per month. In the last five months, the company has supplied bricks for the construction of four houses. They have received purchase demand for an additional three houses.

Within a year of operation, they have recovered their initial investment. Till date, they have earned around NPR 3,00,000 (approx. EUR 2,100) and supplied bricks on loans to several households. To increase their market outreach, the entrepreneurs have also purchased a tractor to deliver the bricks to the client's location. "*When people call us for orders, we can now deliver the bricks to their doorsteps*," stated Subhadra.

This year the Rajapani Three Sisters Interlocking Brick plans to increase their production and outreach to the neighbouring villages as well.

Annex 6: Calculation of CO2 reduction

GHG calculation research:	
959.13	Total tCO2 footprint of 54 houses, health post including toilets and a community building built with CSEB (pg. 9, ex. summary)
1492.2	The total emission of the burnt brick houses was 1.6-fold larger than the corresponding value for CSEB houses (pg. 9, ex. summary)
533.07	Total tCO2 saved by using CSEB instead of burnt bricks
9.52	tCO2 saving per house/structure built
175700	total CSEB used - "about 175,700 blocks were produced and used in the project" (pg. 26)
0.00303	tCO2 saved per CSEB
Source: Carbon Footprint of lnterlocking Cement Stabilized Earth Brick Houses at Dhungentar, Nuwakot, Nepal, Asian lnstitute of Technology & Management https://bit.ly/3gQcOYE	