



UPACMIC - LIFE12 ENV/FI/000592

KAP (Knowledge, Attitudes, Practices) Final report

Description of work

The baseline study started in 2014 with a review of the situation in the waste and secondary materials in Finland as compared to some other countries, as well as with a review of the current situation in the secondary materials' sector. The KAP (knowledge, attitude, practices) questionnaire was placed at the project website and distributed via project newsletter and at international conference WASCON 2015. The questionnaire was distributed to approximately 750 persons. The preliminary results of the Action were presented in the Inception Report.

At the final stage of the project another KAP questionnaire was implemented and distributed via website, newsletter and events during spring 2022. The exact number of recipients could not be calculated, but it has been estimated that it would be approximately 750.

UPACMIC project partners Fortum Waste Solutions Oy (later Fortum) and Skarta Finland Oy (later Skarta) acted as a constructor at projects piloting sites. Partners representatives, construction site managers, were interviewed in April 2022 and their encountered challenges and good practices were collected for KAP final report. The results of this Action including the analysis of the replies to the KAP questionnaires and the interpretation of the focus group discussions and overall conclusions is reported.

The UPACMIC project's final webinar "Uudet mahdollisuudet kaivosympäristöjen kiertotaloudessa ja kestävässä kehityksessä" was organised in cooperation with two other mining projects; ERDF and LIFE-funded mining environment projects KAIVASU and LeKaT. The joint seminar was carried out online on March 16, 2022. During the webinar Mentimeter-tool was used to collect information about participants' views, knowledge, attitudes, and practices. As the webinar was joint event for three projects, the space for questions was limited. Thus, it was not possible to ask all questions of the KAP survey as it was seen important to give enough space for open discussion as well. The link to the complete KAP questionnaire was distributed to the attendees after the webinar.

The results of the KAP questionnaire and project's final webinar are analyzed and reflected with baseline study and results of the KAP survey in 2014.

Background information about the respondents

In the KAP questionnaire following background information of the respondent was asked

- Sector of operation
- Country of operation

- Position in the organization

In both surveys (2014 and 2022) most respondents came from private sector (Figure 1), but some public sector respondents were also present.

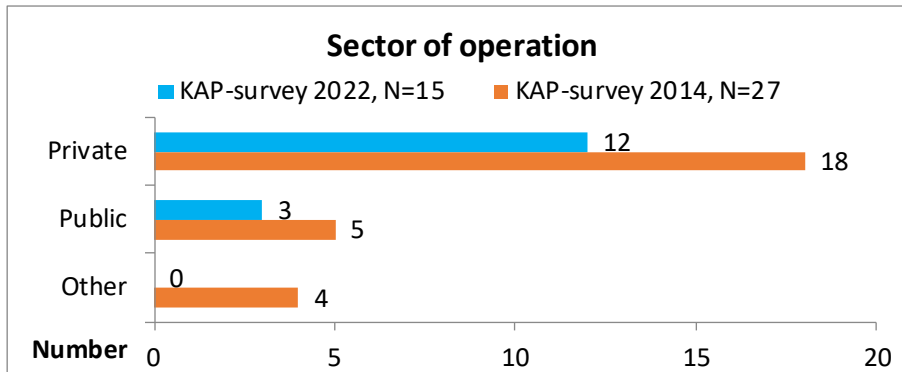


Figure 1. Distribution of responses in KAP surveys of 2014 and 2022 about respondent's sector of operation

The total number of respondents in 2022 KAP survey was 15 and all of them were operating in Finland. In 2014 survey the total number of respondents was 27. In addition to 15 respondents operating in Finland, there were respondents from following countries: Sweden (7), Estonia (2), Norway (2) and Poland (1).

Due to Covid situation there were no major international events towards the end of the project where KAP questionnaire could have been presented and the only way to reach respondents was via website, newsletter and events in Finland. This could be one reason why no responses from people operating in other countries was obtained in 2022 survey.

In the following there is a summary about respondent's position in the organization.

In 2014 survey

- manager (14)
- operational officer/engineer (11)
- other (2)

In 2022 survey

- Manager (3)
- Project manager (2)
- Engineer / designer (6)
- Specialist (4)

Out of approximately 140 project's final webinar participants, 51 persons replied to the Mentimeter questions about background information. 23 persons were operating in private sector and 28 in public sector. Thus, compared to the survey, there were more public sector representatives present. Webinar participants' positions varied from specialist to researchers and research assistants, engineers, managers, environmental lawyers, senior inspectors and managing directors. The wide representation of people from different fields of work from public to private sector in the webinar

shows that the topics are of interest to many. It also increases the spreading of knowledge and opportunities to share ideas and different viewpoints surrounding the topics.

Expectations for the project's final webinar

In the beginning of the project's final webinar participants were asked to tell their expectations for the webinar. Expectations to obtain new information and develop one's knowledge were high, as can be seen from the list of topics that were mentioned

- new information to support regulation
- information to support decision making
- information on the latest research data
- information on the latest environmental solutions in the mining industry
- Insights and information on issues related to mine closure and exploitation
- nice to hear where you are going in RDI work in this field
- practical solutions
- to learn more about mining
- new innovations
- new ideas to apply
- to learn something new
- Status overview of existing solutions.
- New applications for the utilization of side streams
- Functionality of the use of recycled materials
- Hear about the results of the projects
- get more information about mining sites (eg Hitura)
- sustainable mining
- Developing one's own expertise in mining environmental research
- Knowledge
- New contacts

Knowledge about the use of alternative building materials

In the 2014 KAP questionnaire there was a question "How do you assess your current knowledge about the possibilities to use secondary materials in mine waste storage construction?" By looking at the responses below, it can be seen that in the beginning of the project the knowledge level was relatively low as the distribution of responses was the following:

- Good (2)
- Average (4)
- Little (17)
- None (4)

In the 2022 KAP survey the respondents were asked "How well do you identify opportunities for the use of alternative building materials in the field of mining construction?". Most of the respondents stated they identified opportunities moderately or quite a lot (Figure 2). Although it is not possible to fully compare the results as the surveys were anonymous and the total number of respondents is rather low, a growing trend in the knowledge development can be seen.

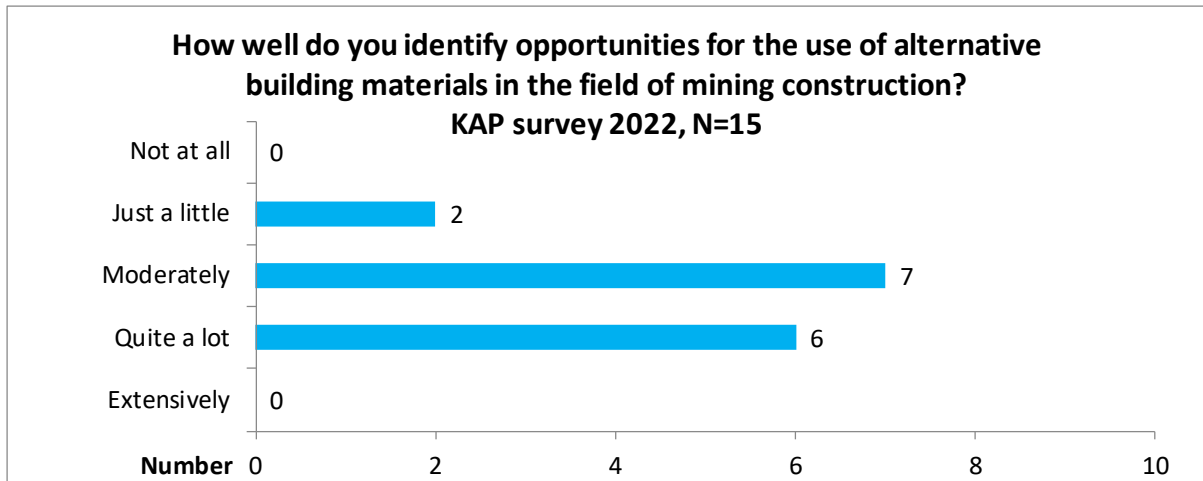


Figure 2. Distribution of responses in the KAP 2022 survey about respondents’ ability to identify opportunities for the use of alternative building materials.

In 2022 KAP survey and in project’s final webinar respondents were asked more generally to evaluate the level of information the mining sector has about the use of alternative building materials (Figure 3). Although many thought the knowledge level was already moderate, there were also many that had the opinion that the level of knowledge was still low. Only few respondents thought that the level of knowledge in the sector was high.

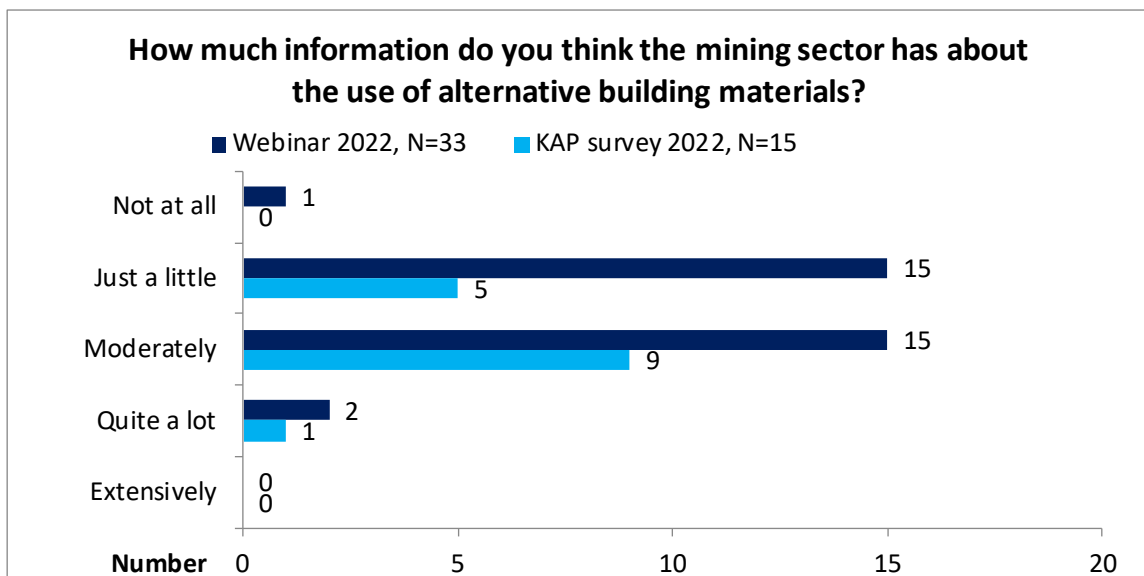


Figure 3. Distribution of responses in the KAP 2022 survey and project’s final webinar about the level of information the mining sector has about the use of alternative building materials.

Below are the free-form text answers from KAP 2022 survey giving more insight into the responses about the knowledge level.

- Depends on the situation. On the other hand, the mines mainly use materials that can withstand heavy use for as long as possible.
- There is probably information, but are there any fears? Perhaps traditional methods are used and perceived to be safer, as there is not yet much practical experience with alternative methods.

- There is already some information on simple or technically easy and cost-effective recovery sites. The availability of various recycled materials in more challenging applications (e.g., reactive structures) is still relatively limited.
- The structures that can be used and accepted are also very much guided by the environmental permit, ie the possibility for the authorities to promote different solutions

In KAP 2022 survey respondents were asked how to raise awareness about alternative construction solutions in the field of mining sector. Following suggestions were given in the free-form comments:

- Particularly in more challenging environmental structures, the long-term durability and technical performance of structures is key, and such validated design information is still relatively limited for alternative materials. Of course, there are certainly uses for such materials and they should be instructed more widely, for example at national level.
- With good examples, piloting and demonstration, and presentation of these results. One could also look for international examples and perhaps bring to the world the solutions that work for us.
- Information for authorities defining acceptable solutions as well as consultants planning different implementations. Of course, information is also provided to operators through an industry association. The pilots' English-language reports contribute to the wider dissemination of good practice in the industry.
- The mining sector needs to be shown facts and test results that are convincing
- With events and guidelines that also include results
- with alternative materials for construction.
- Research, publications
- Through training sessions
- A practical pilot has already been done at UPACMIC and the results are interesting. Material testing and practical piloting could be done even more. The more good experiences, the safer it would be to adopt alternative solutions. Seminars are a great way to share information.
- The green image of alternative building materials could be better marketed, which could add to the invisible benefits to the materials.
- Could some sort of study on the subject and opportunities be required already at mine's start-up stage? As a way to force reflection on the subject.

Barriers for the use of alternative materials

In both surveys there was a question about possible barriers for the use of alternative building materials in the mining sector (Figure 4). In the 2022 survey it was decided to add more response options compared to the 2014 survey, that is why the distribution of responses in the 2022 survey are limited in the picture. In 2022 survey the biggest barriers are lack of knowledge, lack of examples, legislation, transportation costs and tight schedule.

In a free-form comments the uncertainty of the acceptability of new materials was listed as one of the barriers. In the comments it was also stated that there is need for information about long-term performance of the built structures as well as clear manuals for design and use. One also thought that conventional solutions may be still easier to get approved by permit authorities.

One problem can also be the availability of the alternative materials. This came up in the interview with Fortum. Fortum could have used even more of the alternative material (fiber clay) in the implementation of pilot structure, but the availability was limited.

However, use of alternative materials does not always create barriers. There is a lot of agriculture in the Nivala area, which made it possible for the area to have both off-road vehicles (e.g. tractors and other vehicles) and local labor available locally. This had a positive impact especially on the second phase during the Skarta pilot. Without local farming, getting facilities and vehicles would have been more difficult. As the equipment was easily available locally and did not need to be imported from further afield, it could be used flexibly at short notice, if necessary. The piles were not accessible by truck, but as tractors could be used, no additional loading was required separately. The use of off-road vehicles allowed for smoother work and movement in the mine area.

Although fiber clay was used for the first time in the mining environment in Finland in cover structures, it was possible to work it using conventional machinery. No special tools were needed for the works. This meant that construction was relatively easy and locals, who had no prior experience on it, could work on the cover structures. During the UPACMIC project many locals from Nivala area were employed to work both short- and long-term during the construction activities. The project also increased their capacity and experience in working with alternative materials.

The attitudes for using alternative materials have improved clearly and the answers compared to the 2014 questionnaire shows that the will towards this development has increased. Also, legislative situation has improved during this project which lowers the threshold significantly. Overall knowledge has also improved but it is clear, that even more practical piloting and credible results are needed.

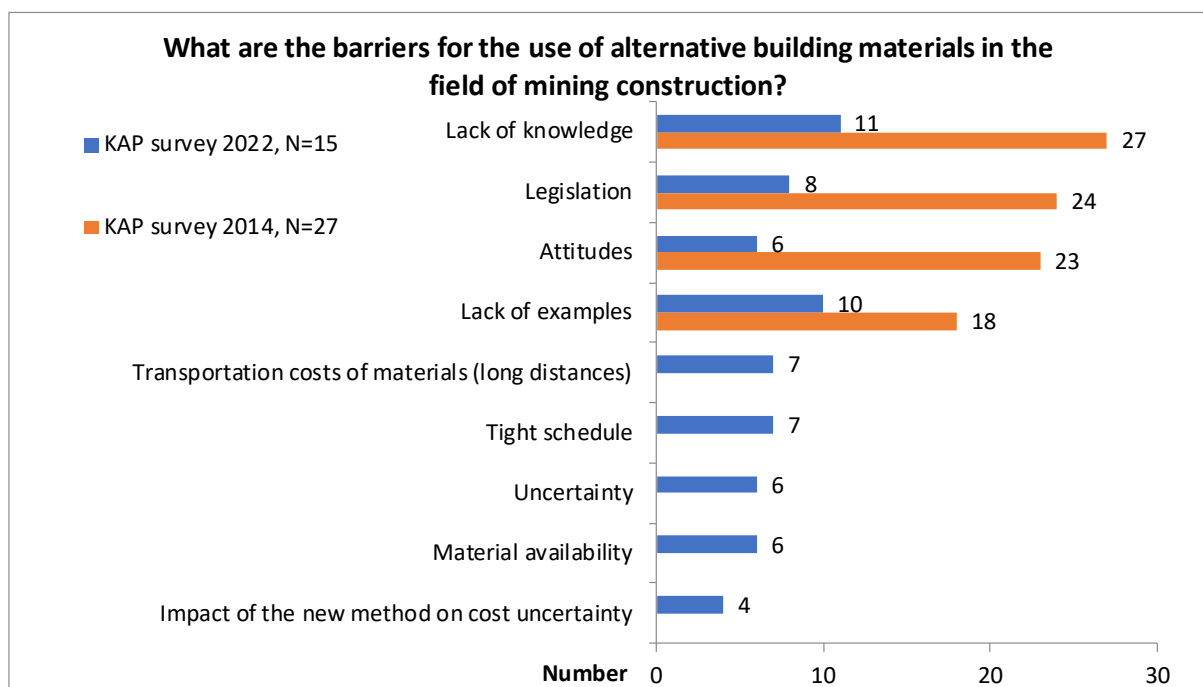
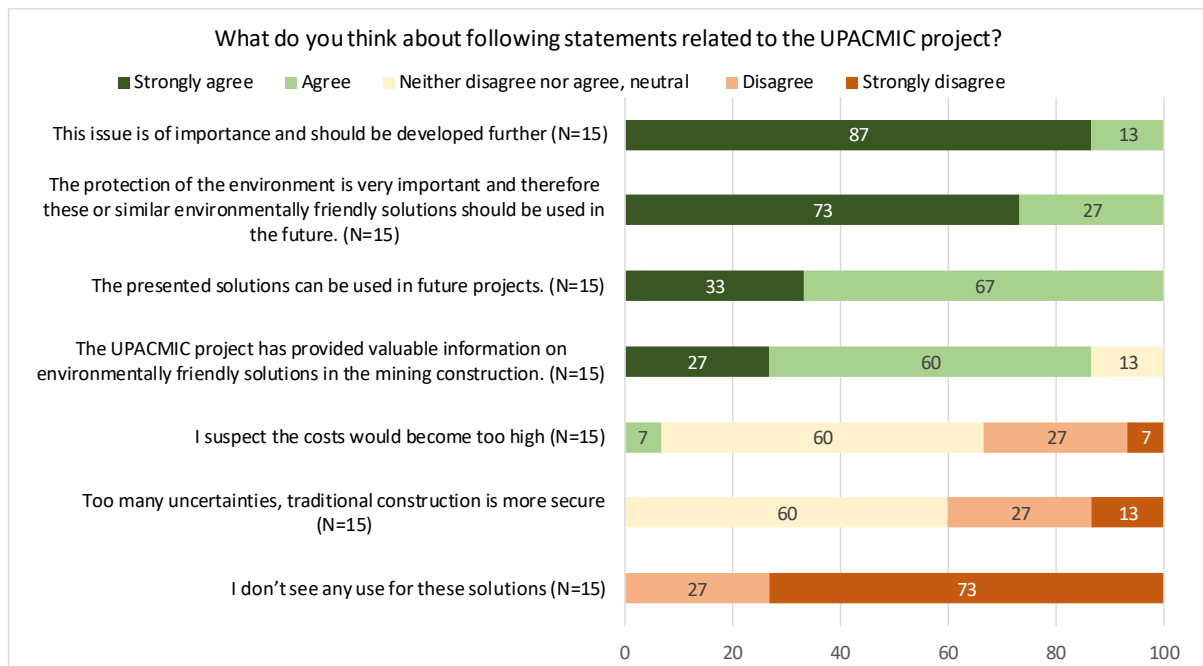


Figure 4. Distribution of responses in the KAP 2022 and 2014 surveys about the barriers for the use of alternative building materials.

Views on the UPACMIC project

In the KAP 2022 survey there was a section to collect views about the UPACMIC project. Respondent's opinion about seven different statements about the project were asked (Figure 5). In general respondents were very positive about the use of alternative building materials in the project and though they should be used also in the future projects. In the statement "I suspect the costs would become too high" only 7% of the respondents agreed, 60% were neutral and 34% disagreed.

Thus, it can be said that the cost issue does not seem to raise so much concerns at this phase. Also, it seems that respondents don't think there would be more insecurities in the use of alternative materials compared to the traditional construction.



In KAP 2022 survey and in the project's final webinar the respondents were asked what development needs or opportunities for further development do they see in the solutions presented by the UPACMIC project. Here are the free-form answers:

- Good experiments only become a practice when they can be commercialized or otherwise transformed from "pilot status" to a normal solution - here's the hard work, scaling!
- I think it is very important that more "waste" from mining can be recovered. At present, even the side rock from quarrying may not be used in road construction or in other civil engineering sites.
- Long-term follow-up is important
- A long follow-up period should be ensured for the implemented structures in order to ensure the results.
- Even more systematic monitoring, especially for the most technically demanding structures (eg bottom structures).
- More model examples to increase the experiences of using alternative materials even more
- Even wider mapping of by-product materials to avoid long distances.
- A pilot would also be needed for the bottom structures.
- Application of the treatment to larger amounts of water
- testing more in new areas
- Absorption of air moisture into structures and investigation of oxygen permeability
- additional construction
- new items
- How the duration of the benefits of water treatment methods can be extended in pilots?
- There are certainly opportunities for further development, but we should get to know the interesting results even more deeply.
- In the presentation, the structural solutions were intact. Has it been taken into account when the structure breaks, for example in the form of cracks. Has this been thought of?
- How can piloted cover materials be used more widely?

- Reactive passive structures from sidestream materials are certainly an interesting and environmentally friendly development.
- In addition to water permeability properties, gas permeability properties should also be investigated (not necessarily optimized simultaneously).
- Development of frost protection layers.

In the project's final webinar participants were asked what units of the UPACMIC project were most interesting. Votes of 17 respondents were distributed as follows:

- Cover structure (6)
- Bottom structure
- Water treatment/reactive structure (11)

They were also asked which material solutions are the most interesting for the future. Votes of 27 respondents were distributed as follows:

- Tailings (9)
- Geopolymer (6)
- Fiber clay (3)
- Lime products (3)
- Reactive mats (2)
- Gypsum (2)
- Ash (1)
- Surplus soil (1)
- Foundry sand/-dust (0)

In the end of the KAP 2022 survey respondents were able to share their thoughts about UPACMIC project. Here are the free-form comments

- A very useful and topical theme. I haven't heard about the project before.
- Very interesting and I hope the project continues.
- An interesting project! Great that alternative materials have been studied in the mining environment.
- An interesting study on the use of alternative materials. Hope the development work will continue after the end of the project!
- Awesome project with a really ambitious goal.

Feedback of the project's final webinar

Based on the feedback received after the project's final webinar it seems that it was successful in meeting the expectations and in bringing new information and to increase the knowledge level of participants.

- A versatile and wide-ranging seminar
- easy to use, good visual presentation of results
- Good performances
- well met expectations.
- A good and comprehensive information package on all three projects. Thank you!

- Good and interesting seminar. Pleasant to follow, as there was a clear red thread during the day and the investigations moved in the same subject and locations. Thank you! More of this kind of events!
- Exceeded expectations with the amount of information. You managed to gather a good herd of experts. Perhaps there would be room for improvement in a unified presentation, e.g. some of the performers did not use pp in the presentation mode.
- Thank you! An interesting seminar. Using Mentimeter was a nice addition!
- It's a pity that all project results were not completed in time for the final seminar
- The joint seminar was a success
- It was a good seminar. Maybe there could have been time for questions and discussion separately. There were a lot of people there and there would probably have been a conversation.
- Thanks to the organizers for a good program. I mainly attended the event to get a good overview of the current situation of these topics in Finland. Possibly this information can be used in the international development cooperation projects, ie to add a package of Finnish mining expertise to them, if necessary. There is certainly a wider demand for this kind of expertise, which we heard about at the seminar.
- Thank you! Such distance seminars on several projects at once are a great training opportunity.
- Very interesting topics and well implemented seminar!

Many of the participants thought it was good that the seminar included three projects and all of them dealt with the same topics and acted at the same mining site. It was also seen very practical that the seminar was arranged remotely so it was easier to join despite the long distances. The participants received a lot of information, and the schedule was tight. Some of the participants hoped more time for questions and discussion, especially when there were representatives from different organizations.

Summary

The knowledge and attitudes towards using the alternative constructing materials in the field of mining has increased. There is a will to use these methods but the road from piloting stage to commonplace method is long. The applications presented by UPACMIC project are needed in the field. The UPACMIC project has developed an easy-to-use guide for the stakeholders and Material matrix to facilitate the selection of the suitable materials. All the results and guides produced by UPACMIC project are available at projects website. Dissemination of projects results will continue after the project and the project team negotiates future projects where these solutions can be utilized. For example, KAJAK project has stated that there are 19 abandoned mines in Finland that are in need for operation. Also, national UUMA-program will disseminate practical information of UPACMIC project. UUMA is an acronym of program name "alternative material utilization in earth construction purposes".