BIM4EEB

BIM based fast toolkit for
Efficient rEnovation in Buildings

D1.8 Report on societal impact RP2

This project has received funding from European Union's H2020 research and innovation programme under grant agreement N. 820660

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D1.8 Report on societal impact RP2

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0.5	17/06/2022	Internal review and final updates, WP Leader's approval	G. Tola (Region Lombardy) G. Canzi (FPM/PoliMi) M. Signorini (PoliMi) M. Lucky (PoliMi)
1.0 FINAL	24/06/2022	Final and formal review, plagiarism check, submission	B. Daniotti (PoliMi) M. Signorini (PoliMi) G. Canzi (FPM/PoliMi)

BIM4EEB action has received funding from the European Union under grant agreement number 820660.

EXECUTIVE SUMMARY

The report describes the assessment of social impact of BIM4EEB results. A specific questionnaire was developed and spread among people belonging to Architecture, Engineering and Construction (AEC) industry in order to receive a feedback regarding the obtained values of project's KPIs.

This document is a direct application and output of the Social Impact Assessment (SIA) analysis conducted in D1.5 *Report on societal impact RP1.* Specifically, KPIs values, obtained in the validation process during the demonstration activities on the demo sites, will be analysed and assessed from a technical experts group. The analysis of their outputs will allow to elaborate and assume the impact that BIM4EEB results have from a social view.

PUBLISHING SUMMARY

The research activities for social impact assessment started from the analysis of the different types of impact such as environmental, economic as well as social that a construction intervention generates. The social impact can be assessed applying the Social Impact Assessment (SIA) methods. BIM4EEB project studied and drew on SIA methods with the aim to exploit it to evaluate the results of the BIM-based toolkit developed within the project.

The document presents the assessment of BIM4EEB results from a panel of experts and the analysis of their contribution will enable the authors to estimate the project's impact from a social perspective.

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1 Introduction

The objective of this report is to analyse the outputs of BIM4EEB and validate them by the Social Impact Assessment (SIA) methodology as explained in D1.5 in order to measure the social effect of the project on the stakeholders potentially involved.

The document contains reference to the content of a developed and spread survey direct to a panel of experts of Architecture, Engineering and Construction (AEC) sector, necessary to validate the BIM4EEB results from a social point of view.

The report has the following structure: after a brief introduction in the first section with reference to the relevant BIM4EEB deliverables correlated to the present document, the Section 2 regards the methodology used and applied for the Social Impact Assessment and finally, Section 3 represents the validation and assessment of KPIs results.

1.1 Relevance to other BIM4EEB deliverables

This document represents the output of D1.5 *Report on societal impact RP1*, where the SIA methodology has been defined [BIM4EEB, 2021].
Furthermore, this report contains references to D3.5 *Measurement and Verification protocol* for the Key Performance Indicators (KPIs) definition and their calculation method to assess BIM4EEB results [BIM4EEB, 2019].
Finally, D8.2 *Report on demonstration in Italy* [BIM4EEB, 2022a], D8.3 *Report on demonstration in Poland* [BIM4EEB, 2022b], D8.4 *Report on demonstration in Finland* [BIM4EEB, 2022c] are considered, since they include the KPIs results that have to be evaluated from the social impact perspective.

2 Methodology for societal impact assessment

In the social impact assessment process, BIM4EEB project analysed standards to get definitions of specific recurring concepts.
The term *Social Impact* means a "change to society or quality of life, whether adverse or beneficial, wholly or partially resulting from social aspects" [European Standard, 2010].
Social aspect indicates "aspect of construction works, assembled system (part of works), processes or services related to their life cycle that can cause change to society or quality of life" [ISO International Standard, 2008].

A questionnaire for the assessment of social impact of BIM4EEB project has been set. Different Key Performance Indicator (KPIs), outlined and introduced in D3.5, have been taken into consideration to validate the level of success of BIM4EEB project. The results of BIM4EEB project regarding each of the KPIs have been presented in the questionnaire in order to be evaluated by a panel of experts.

2.1 Changes in the predefined methodology

In D1.5, the methodology considered the Social KPI as SIA, but the methodology was modified by introducing the questions regarding the mean value of the results of three demo sites. This change has been made assuming that these related questions will reflect the most appropriate aspects of the BIM4EEB project.

2.2 Methodology

All the KPIs have been structured in an excel file, where the values have been taken from the demonstration process carried out on the three demo sites from Italy, Poland and Finland. Then the mean value has been taken as shown in an example in Table 1. The assumption relies on the fact that these mean values represent the assessment results and presenting these values to the experts will help them understand how BIM4EEB affects the construction industry in renovation scenarios. The involved actors are expected to give their valuable comments regarding the presented results.

Table 1 - Example of KPIs results according to D8.2, D8.3 and D8.4, their mean value and survey questions.

KPI	Name	Demo Site	Value	Mean Value	Survey Question
REP 1	Renovation Time Reduction	Italy	28	29,3	I think reduction of 29.3% renovation time will have a social impact
		Poland	27		
		Finland	33		
REP 2	Renovation Cost Reduction	Italy	28	17,3	I believe, 17.3% cost reduction through renovation will have a social impact
		Poland	19		
		Finland	5		

Following the excel file, the questions characterising the questionnaire were developed. At the starting of each of the questions related to KPI such as REP1, REP2, etc., the KPI definition was added to make it more understandable to the respondents of the survey. Then, the results of the demo sites were presented to get the responses in a Likert scale assessment as showed in Figure 1 and Figure 2.

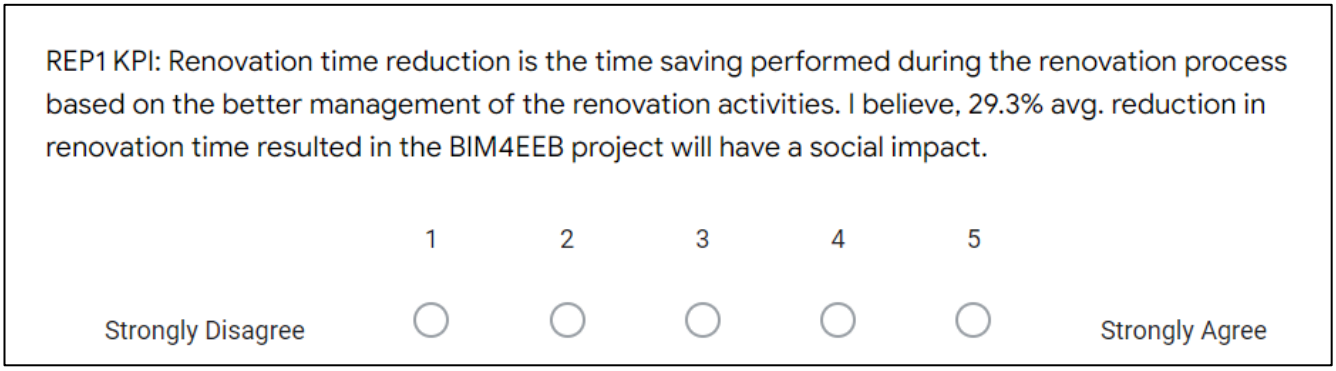


Figure 1 - Example of question contained in the survey.

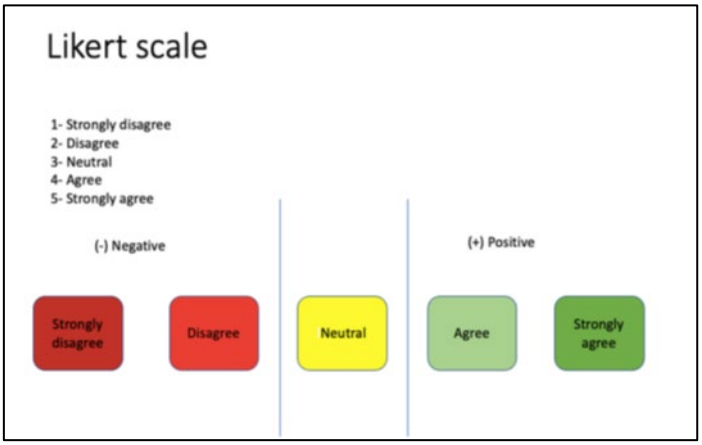


Figure 2 - Defined Likert scale and assigned values.

Regarding Social KPIs, the survey results from D1.5 has been shown in the questionnaire. Each of these questions have been set for each of the demo sites considering different roles such as designers, facility managers, occupants, etc.
After getting the responses from the experts involved in the survey, the data were analysed for consolidating meaningful information that will help to understand the acceptability of the BIM4EEB project.
Pivot tables were created to compare the data considering different attributes, such as number of emloyees, roles, number of positive or negative responses for each KPIs, etc. Moreover, the comparison between SMEs and Non-SMEs has been shown for each KPIs that qualify the aim of this project.

2.2.1 Survey description

To assess the social impact of the project, a proper questionnaire was created and distributed to the public of experts. In addition, to obtain more feedbacks it was spread by email to people who could not participated to the meeting. For the sake of clarity, the link to the complete survey is the following: https://docs.google.com/forms/d/1IfU-f39te2xfbNWPIqnUFm5l-OhC86jBqVLyJ6HNUPY/edit

This survey aims to assess the KPIs results that have been identified according to BIM4EEB project objectives.

The KPIs have been associated and experimented in the three demo sites of the project, respectively in

Italy, Poland and Finland in order to validate the impact of the BIM4EEB toolkit.

All the results obtained, as shown in the deliverables of WP8 - Demonstration in relevant environment (D8.2, D8.3, D8.4 - Demonstration on a best practice and case study in Italy, Poland, Finland), have been consolidated and presented in this survey to get the responses from the experts to know how KPIs values resulted from BIM4EEB will have a social impact or not. The mean value of KPIs results has been calculated and represented through questions. In this survey, the Likert scale has been used for the assessment of social impact through experts' views.

As the questionnaire for the anonymous respondents has been set, at the beginning of the questionnaire, a filter was introduced to identify the background of the respondents, such as their role in the company, size of the company to get know where the expert comes from (e.g., Micro enterprises, SMEs, Large enterprises, etc.), their annual turnover and the country the company is residing in.

2.2.2 Actors involved in the assessment

On May 16th, a workshop was held in order to validate and collect more in-depth insights about BIM4EEB project results (usability, user-friendliness, future application and development, etc.) with the collaboration of experts from different technical-scientific sectors.
Actors involved have a fundamental role for the social impact evaluation. For this purpose, a questionnaire was created and distributed to a panel of experts and the received feedback were analysed. The analysis and elaboration of feedback is presented in Chapter 3.2.
During the meeting the project partners, who were responsible for carrying out the activities in the BIM4EEB demo sites, made short presentations to support experts in discovering and validating the project results. The first part of the workshop was intended to show the BIM4EEB toolkit and the related results to the participants.

3 Social Impact Assessment results

The following chapter is subdivided into two parts. In the first one, KPIs results collected from the demonstration on the Italian, Finnish and Polish demo sites are shown. In the second, part of survey's results is presented by graphs.

3.1 Validation process of Primary and Secondary KPIs

This section represents the list of collected KPIs that have been subdivided into primary and secondary KPIs according to the main project objectives and in different categories conforming to specific topics, with projected values collected from the three demo sites of BIM4EEB project. The definition of each KPI is presented in D3.5, while the value of KPIs as well as their calculation is contained in the set of WP8 deliverables "Demonstration on a best practice and case study in Italy, Poland, Finland."

Table 2 - Projected Values of Comfort KPIs (COM KPIs)

KPI	Projected Value
COM1 Adaptive Predicted Mean Vote (PMV)	-0,19
COM2 Predicted Percentage of dissatisfaction (PPD)	7,3 %
COM3 Thermal discomfort factor	22,48 °C
COM4 Operative Illuminance	143 lux
COM5 Visual discomfort factor	169 lux
COM6 Average noise level	45,9 dB
COM7 Occupancy Profiling Accuracy	90,63 %

Table 3 - Projected Values of Renovation Process KPIs (REP KPIs)

KPI	Projected Value
REP1 Renovation time reduction	29,3 %
REP 2 Renovation costs reduction	17,3 %
REP3 Actual/planned conformance – time	96,5 %
REP 4 Actual/planned conformance – cost	72 %

Table 4 - Projected Values of Energy KPIs (ENE KPIs)

KPI	Projected Value
ENE 1 Energy Savings	31 %
ENE 2 Energy Savings (per building component)-outside wall renovation	29,5 %
ENE 3 Primary Energy Savings	23,4 %
ENE 4 Energy performance Accuracy	4,55 %

ENE 5 Total Use of Primary Energy	8545 MWh

Table 5 - Projected Values of Economic KPIs (ECON KPIs)

KPI	Projected Value
ECON 1 Annual Cost Savings	24 %
ECON 2 Net Present Value (NPV)	361383 € is reached after 25 year
ECON 3 Pay-back Period	14,1 years
ECON 4 ROI - Return on Investment	more than 10% in a mid-term time frame
ECON 5 Life Cycle Cost (LCC)	2'025'064,69 €

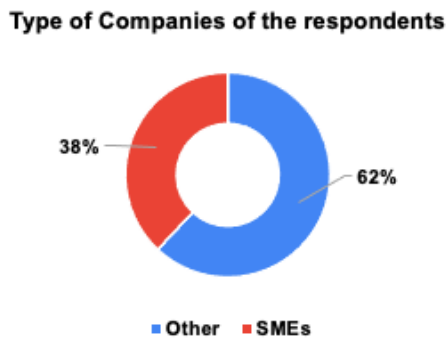
Table 6 - Projected Values of Environmental KPIs (ENV KPIs)

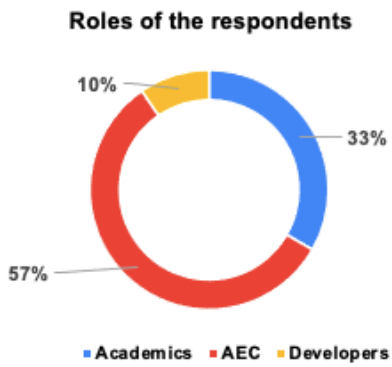
KPI	Projected Value
ENV1 CO_2/ CO compounds reduction	695 ppm
ENV4 Greenhouse Gas (GHG) emission reduction	106877 kgCO_2 or 34% reduction

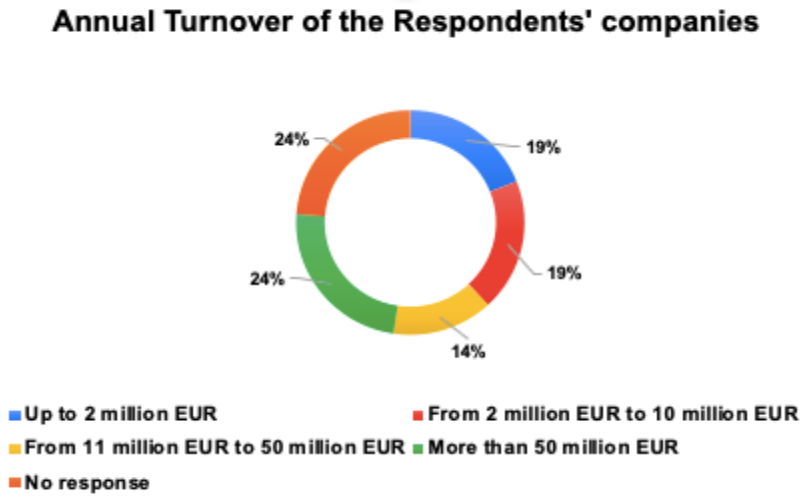
3.2 Results of the KPI assessment Survey

The first four questions of the survey aim at understanding the background of the respondents. The companies were divided into two groups “SMEs” and “Others” according to their size (SMEs for companies with less than 250 employees, Others means the companies with more than 250 employees).

Among the respondents, three groups have been identified (Academics, AEC sector, Developers). Researchers, professors and teachers fall under the category of Academics. Account manager, Construction lead, Contract administrator, Evaluator, Facilities management (FM) adviser, Site surveyor, Work supervisor, Project leader are respondents that belong to AEC sector. Finally, ICT experts have been considered as Developers.







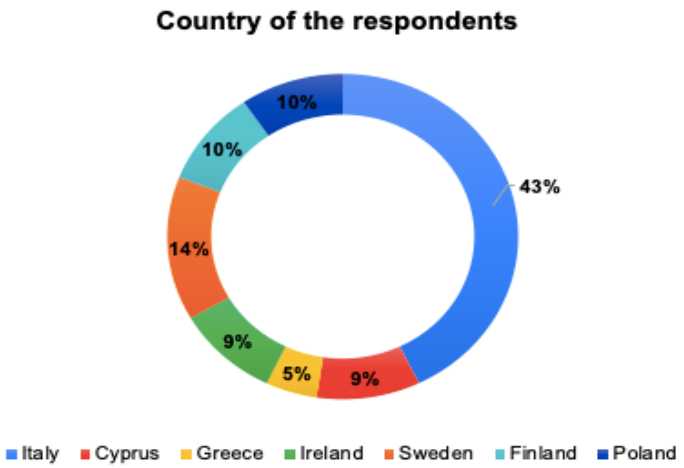
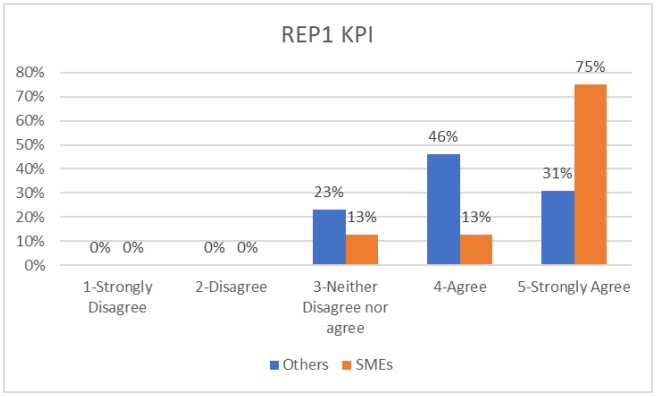
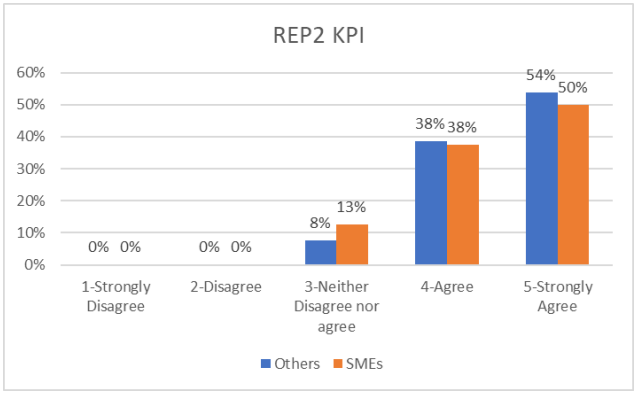


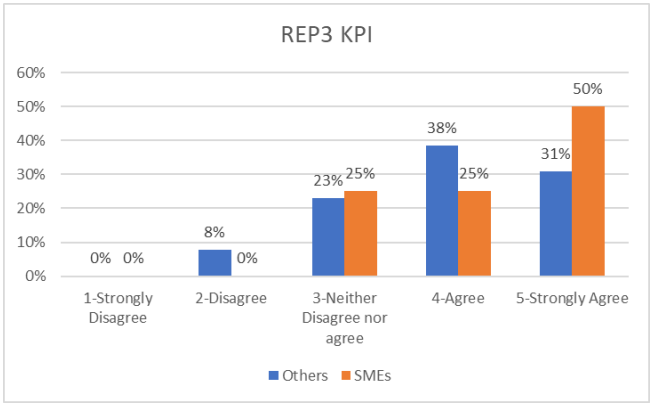
Figure 3 - Respondents' profile according to the survey.

As shown in Figure 3, 62% respondents are from big companies and 38% are SMEs, whereas 24% of the respondents' companies are having annual turnover of more than 50 million euro. The 57% respondents are from AEC industry, 33% are from academics and remaining are developers. Moreover, 43% of the respondents are from Italy and remaining are from other european countries.
The complete list of results related to each KPI is cointaned in the ANNEX I - Evaluation of KPI assessment. To give an example, the graphs from Figure 4 to Figure 6 concern the results about the Renovation Process KPIs group. Both of the results indicates the positive responses from the experts. Firstly, respondents have been divided into SMEs and in Others, respectively considering the size of the company as previously stated. Results have been represented outlining the differences between these two groups.

A first type of graph aims at showing the percentage of experts that agree or disagree, according to the defined Likert scale, with question related to a specific KPI result.







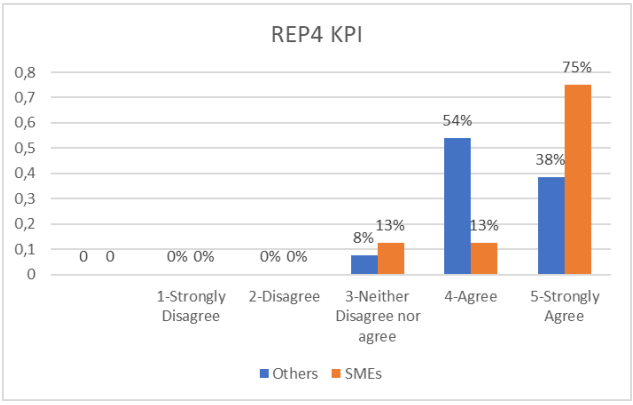


Figure 4 - Survey results related to Renovation Process KPIs.

Figure 4 shows the responses for four Renovation process KPIs and indicates that most of the respondents are agreed with the fact that the reduction in renovation time, cost and accuracy of renovation process time and cost has a social impact. Comparing the type of companies, SMEs are more strongly agreed to have social impact. The responses for other categories of KPIs such as Comfort KPIs, Energy KPIs, Economic KPIs, Environmental KPIs and Social KPIs also have been identified as a positive result for social impacts of BIM4EEB. All of these results in graphs have been included in Annex I.

A second type of graph has been created considering the average of the obtained values. The mean has been calculated considering the responses for each KPI. Figure 5 shows the responses for the Economic KPIs considering the mean value of the responses (1 to 5 in the Likert scale). A comparison between SMEs and other companies has been presented here. The mean value of the responses for each Economic KPIs indicates a positive resonse towards Social imapct of BIM4EEB.

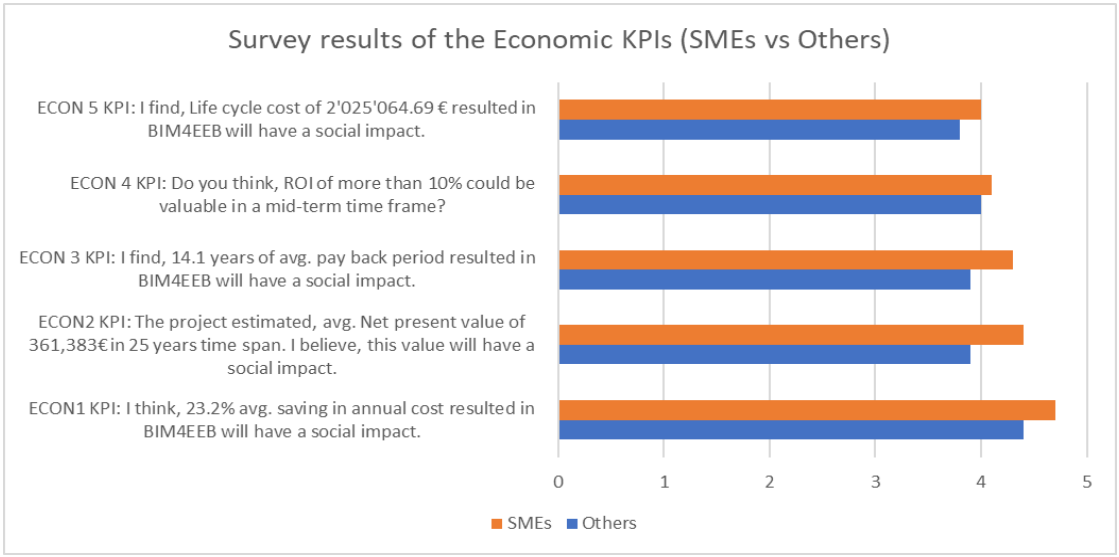


Figure 5 - Survey results for Economic KPIs (SMEs vs Others) based on the mean value of responses

Figure 6 and Figure 7 represents the responses for Energy KPIs respectively for SMEs and other companies. These data has been gathered by counting the number of responses on different Likert scale for each Renovation process KPIs. These graphs also show the positive indications on social impact for SMEs and Non-SMEs.

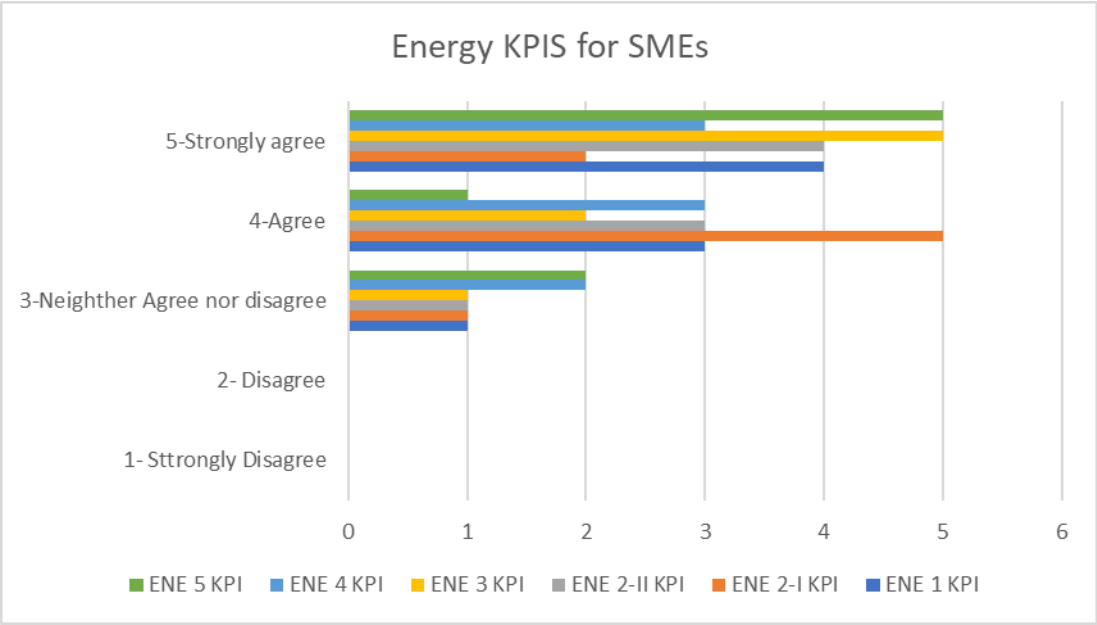


Figure 6 - Survey results for Energy KPIs for SMEs based on the count on number of responses.

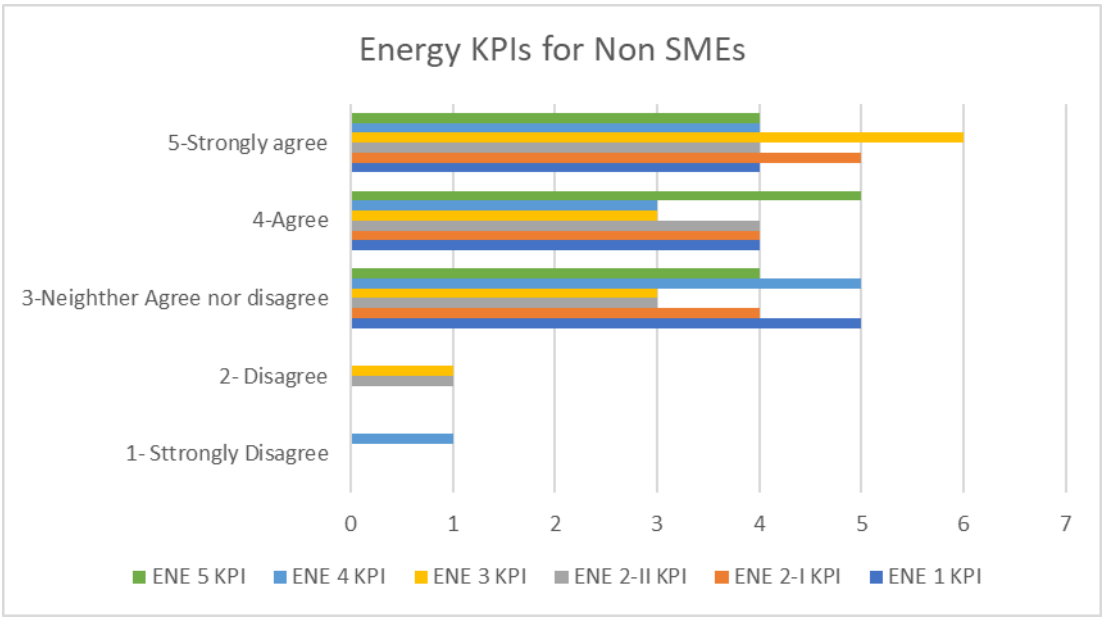


Figure 7 - Survey results for Energy KPIs for Non-SMEs based on the count on number of responses.

A deep analysis on the data gathered from the experts' opinion has been represented in different ways in ANNEX I and it depicts that the values for each of the KPIs resulted in BIM4EEB have a social impact.

4 Conclusions

This deliverable represents the social impact of the BIM4EEB project. As data from different demo sites have been collected and presented in Deliverable 8.2, 8.3 and 8.4, this deliverable (D1.8) aims to use these collected data. In the process of social impact assessment of BIM4EEB project, the methodology has been changed regarding D1.5, assuming that the experts' opinions should be taken into consideration as they are playing active roles in the AEC industry. A survey with related questionnaire has been set to get the responses from the experts working in the AEC industry. Also, responses from academics and developers have been taken into consideration. After collecting data from the survey, an analysis has been done to represent the comparison between the SMEs and Non-SMEs for each of the KPIs. Moreover, different representations have been shown to qualify the social impact of the BIM4EEB project. The responses for different categories such as Renovation process KPIs, Comfort KPIs, Energy KPIs, Economic KPIs, Environmental KPIs and Social KPIs indicate that the analysis on the results from the demo sites (e.g. 29.3% time reduction, 17.3% cost reduction, 29.5% annual energy savings etc.) are having positive indications towards the social impact of BIM4EEB. Thus, the overall results as presented in different representations (included in ANNEX I) shows that BIM4EEB has got positive responses from the experts regarding social impact.

5 Bibliography

[BIM4EEB, 2019] BIM4EEB, 2019. *D3.5 Measurement and Verification protocol*.

[BIM4EEB, 2021] BIM4EEB, 2021. *D1.5 Report on societal impact RP1.*

[BIM4EEB, 2022a] BIM4EEB, 2022a. *D8.2 Report on demonstration in Italy.*

[BIM4EEB, 2022b] BIM4EEB, 2022b. *D8.3 Report on demonstration in Poland.*

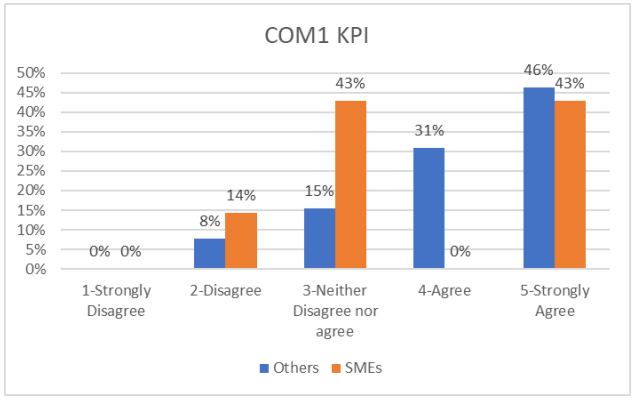
[BIM4EEB, 2022c] BIM4EEB, 2022c. *D8.4 Report on demonstration in Finland.* Ref. EN 15643-1:2010 - Sustainability of construction works, sustainability assessment of buildings - Part 1, General framework.

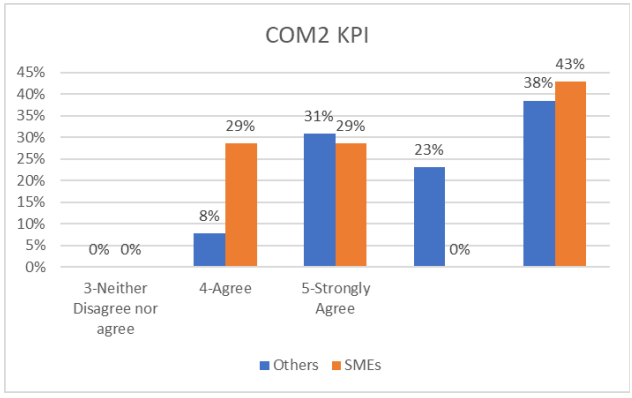
[EN, 2010] European Standard, 2010. *EN 15643-1:2010 - Sustainability of construction works, sustainability assessment of buildings - Part 1, General framework.*

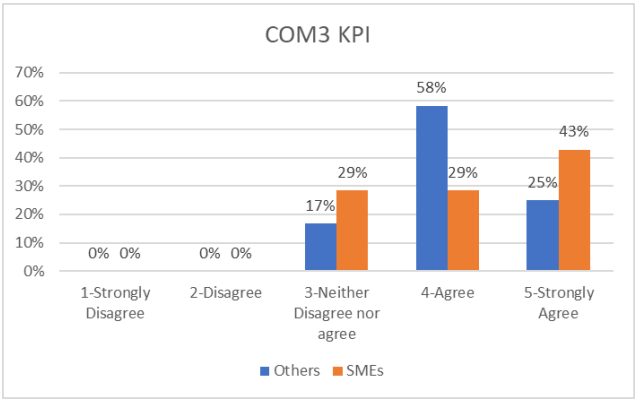
[ISO, 2008] ISO International Standard, 2008. *ISO 15392:2008 - Sustainability in building construction - General principles.*

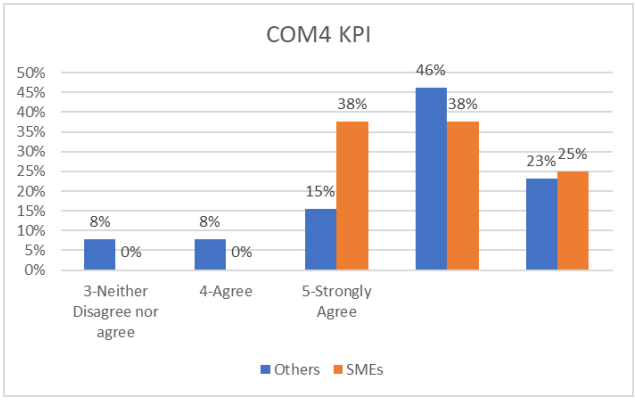
ANNEX I - KPIs assessment results

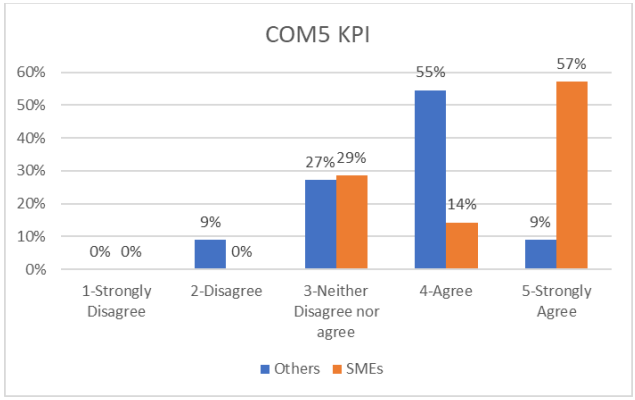
Figure 8 - Survey results related to Energy KPIs

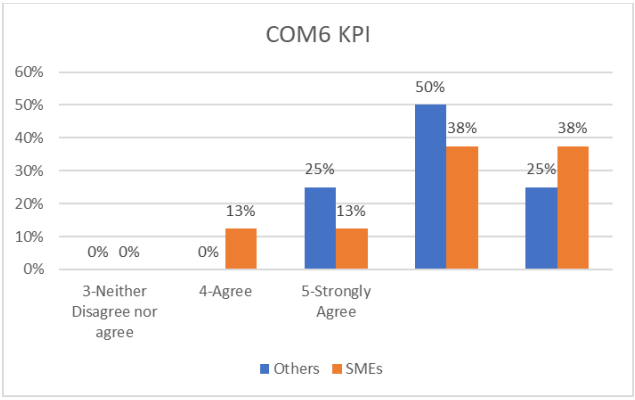












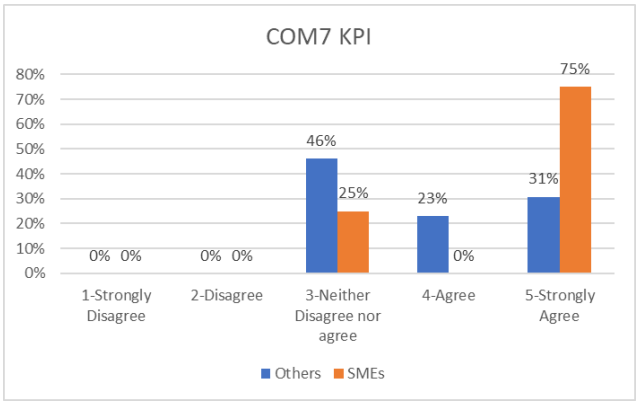
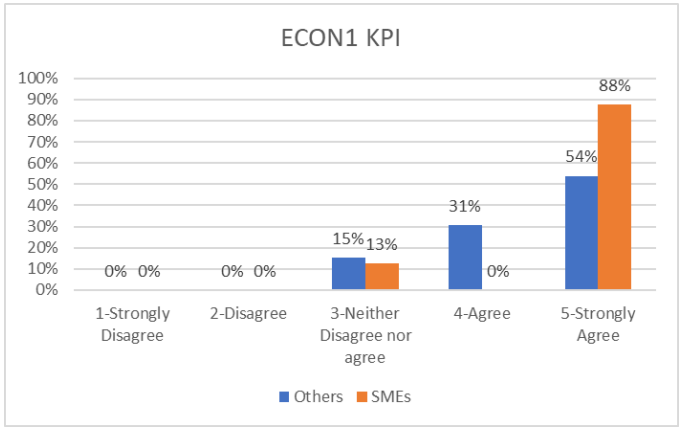
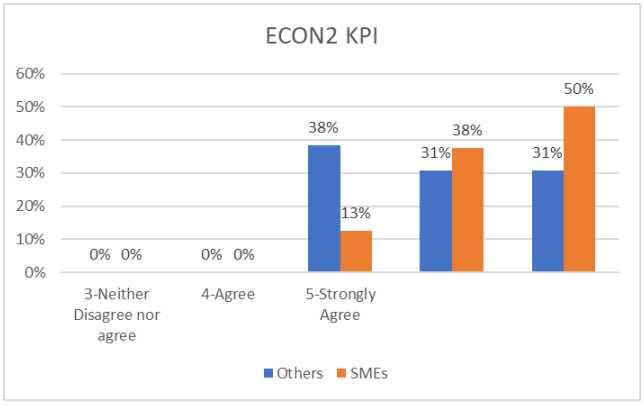
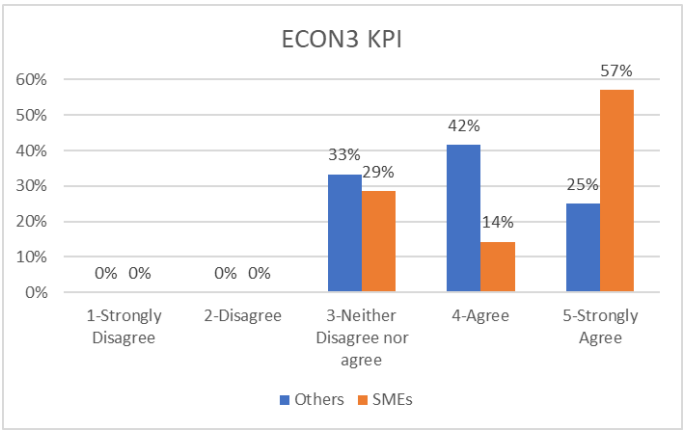
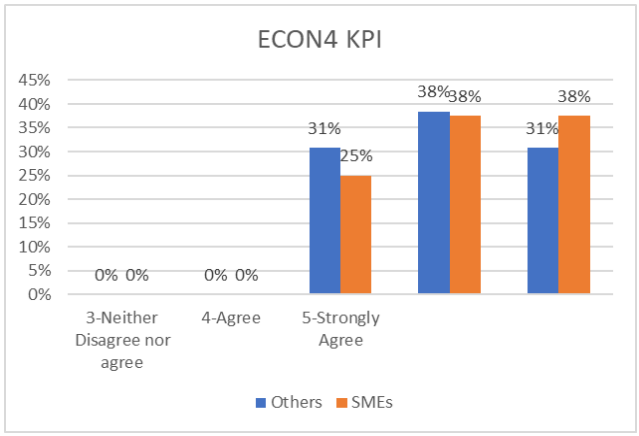


Figure 9 - Survey results related to Comfort KPIs









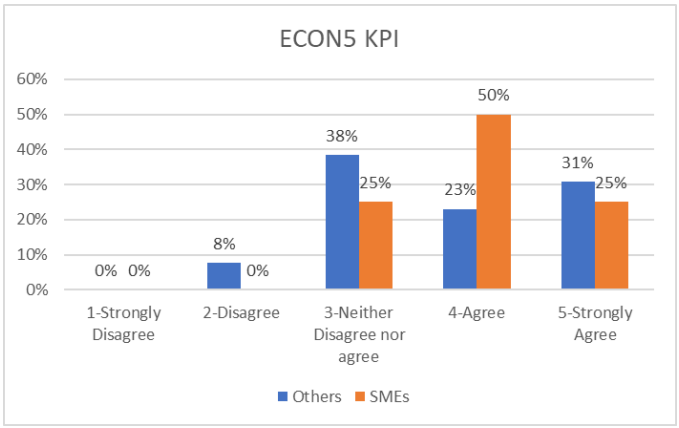
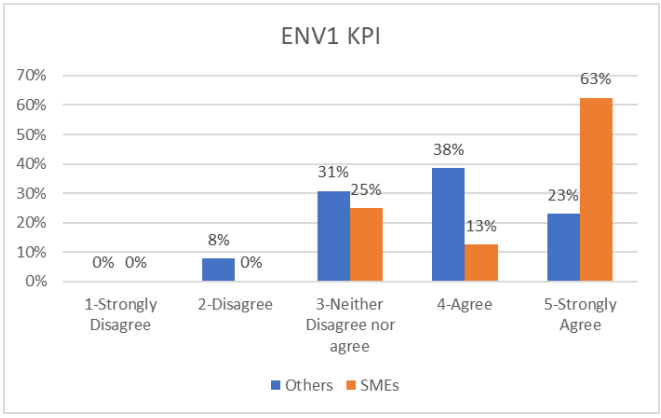


Figure 10 - Survey results related to Economic KPIs



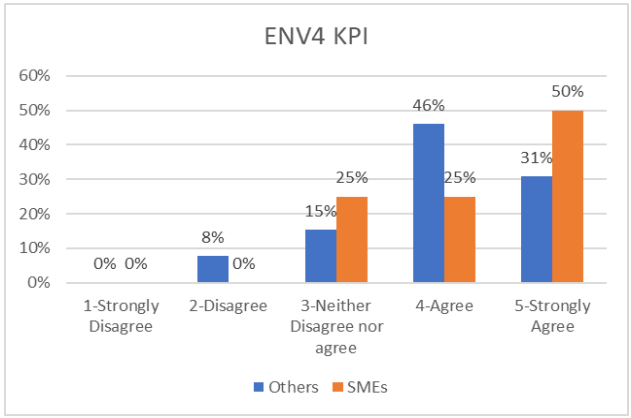
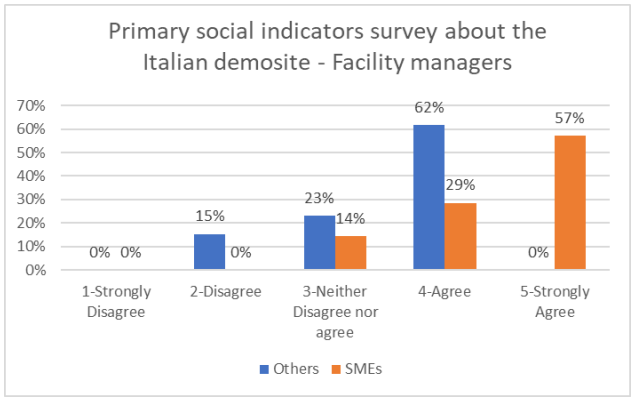
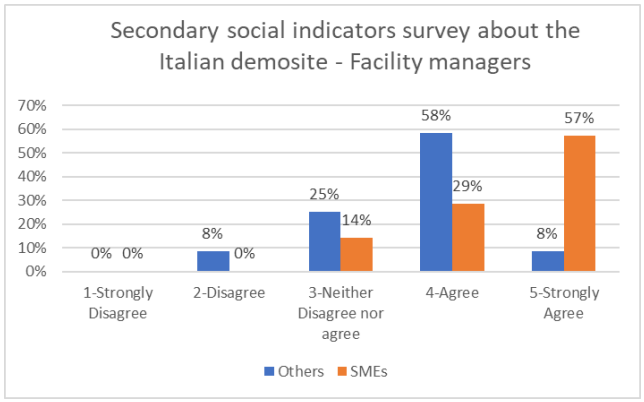
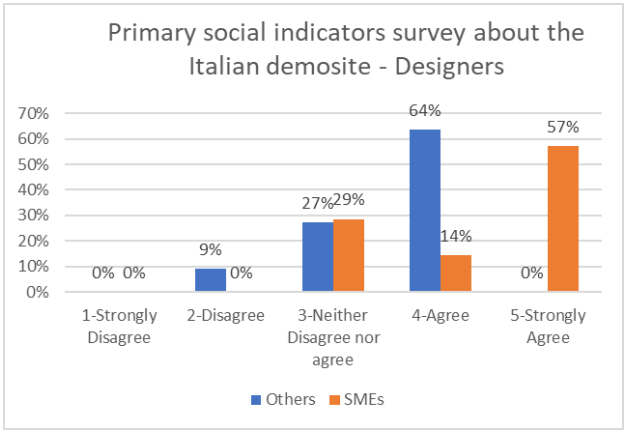
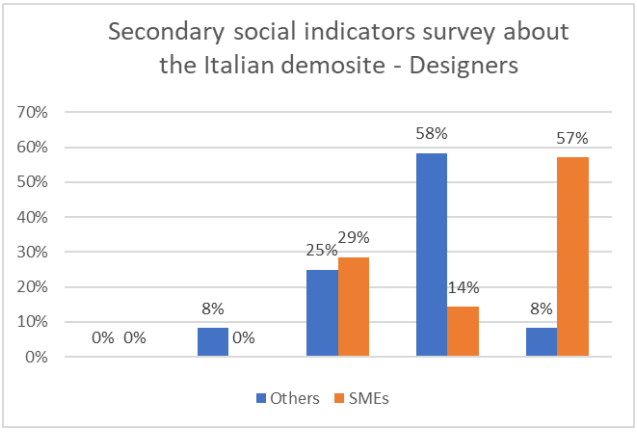


Figure 11 - Survey results related to Environmental KPIs









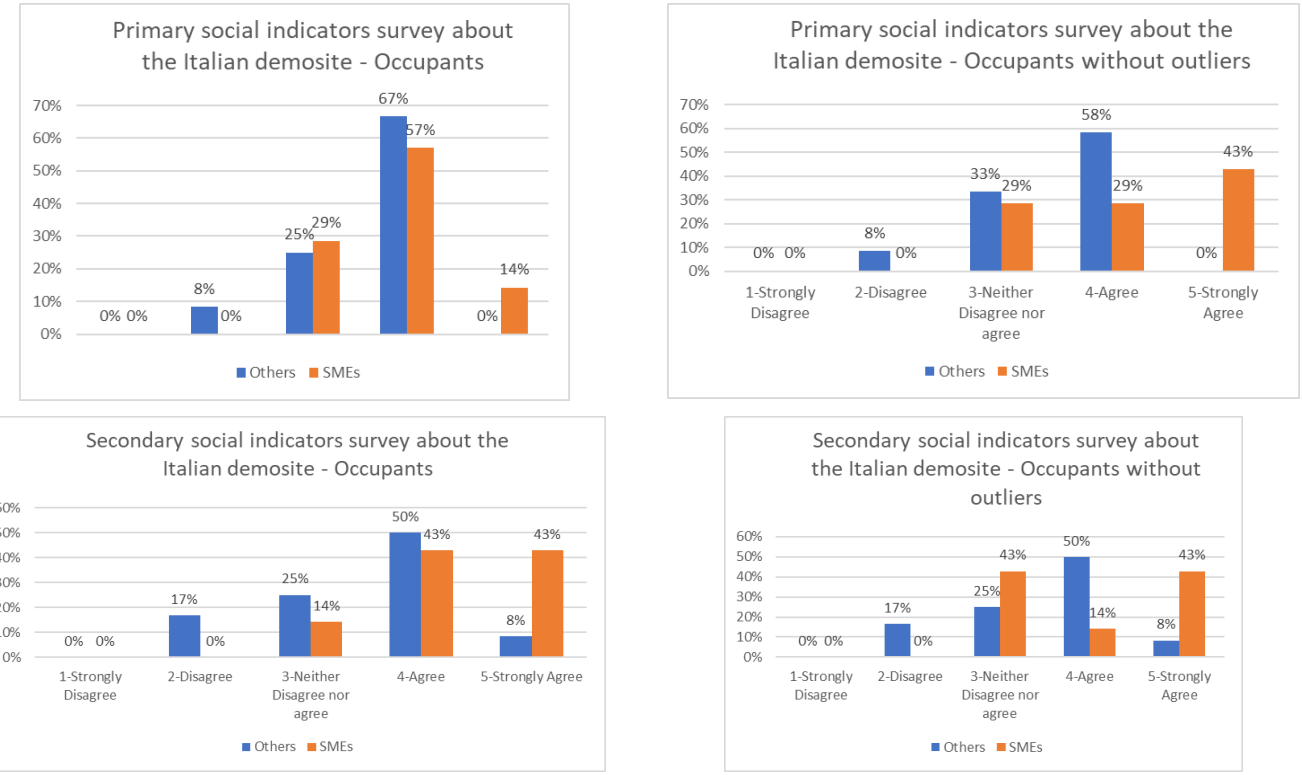


Figure 12 - Primary and secondary social indicators survey about the Italian demo site related to Facility managers, Designers and Occupants

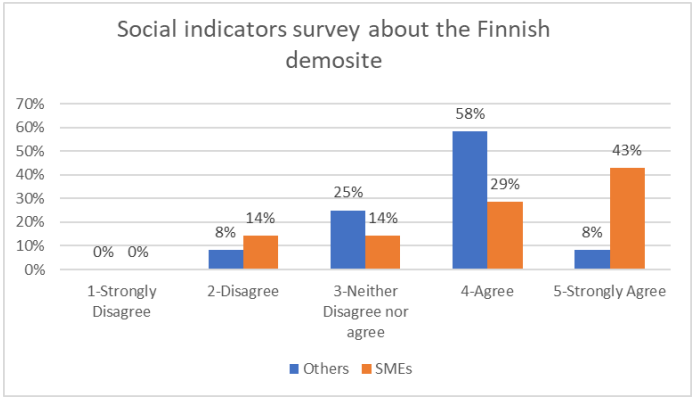


Figure 13 - Primary and secondary social indicators survey about the Finnish demo site

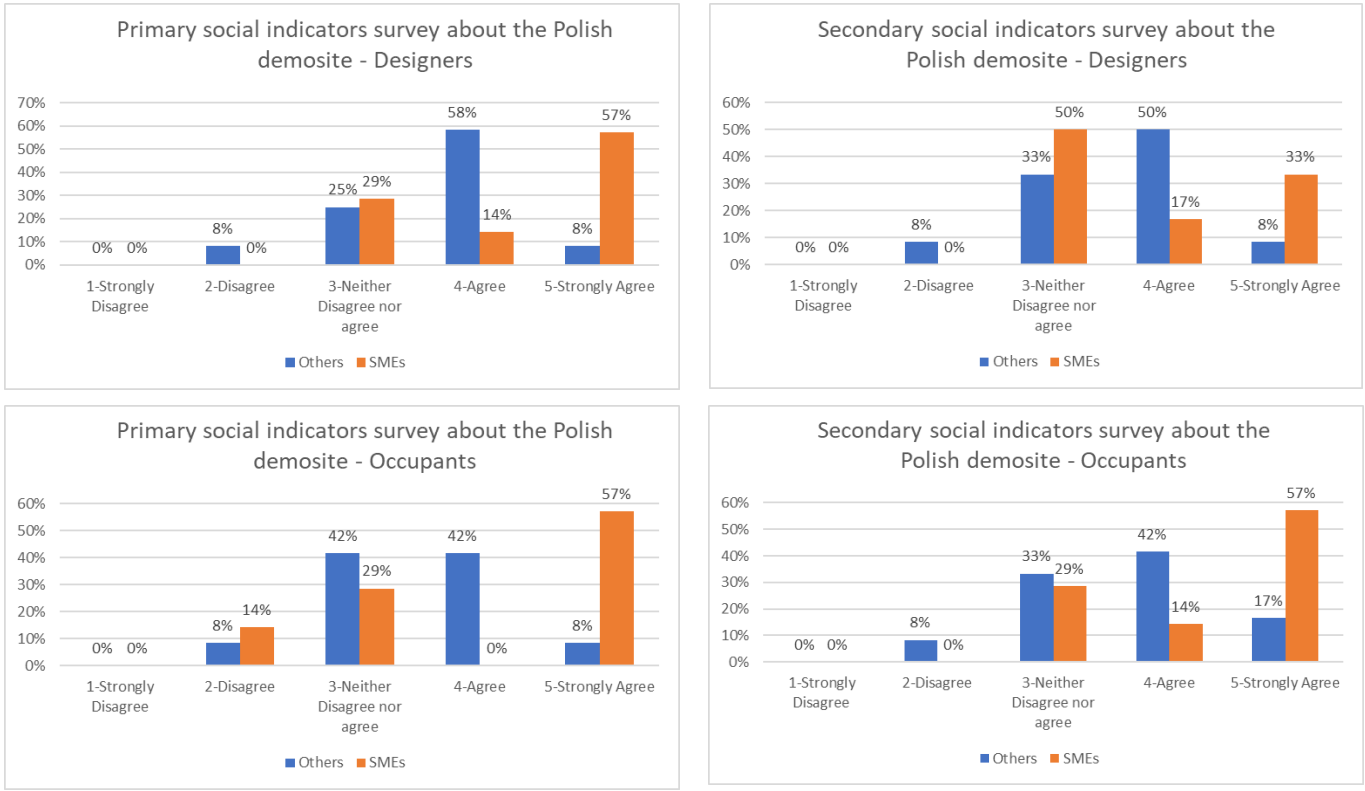


Figure 14 - Primary and secondary social indicators survey about the Polish demo site

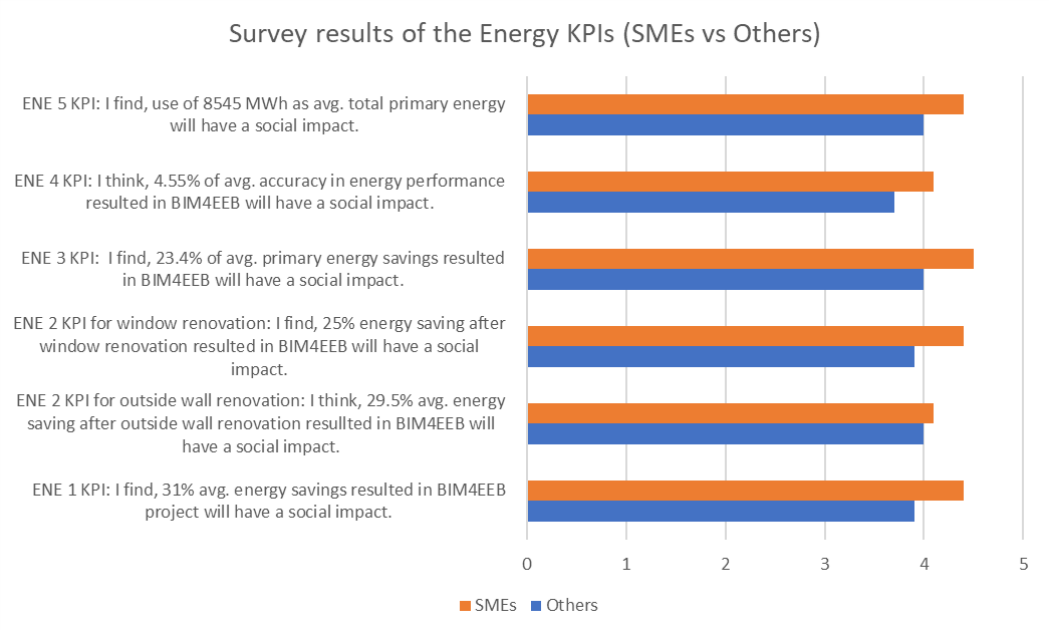


Figure 15 - Survey results for Energy KPIs (SMEs vs Others) based on the mean value of responses

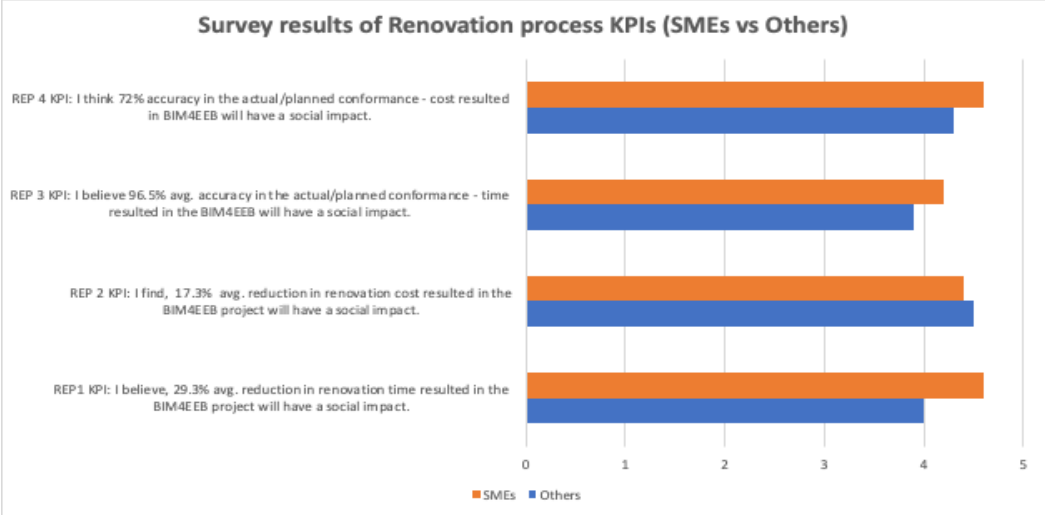


Figure 16 - Survey results for Renovation process KPIs (SMEs vs Others) based on the mean value of responses

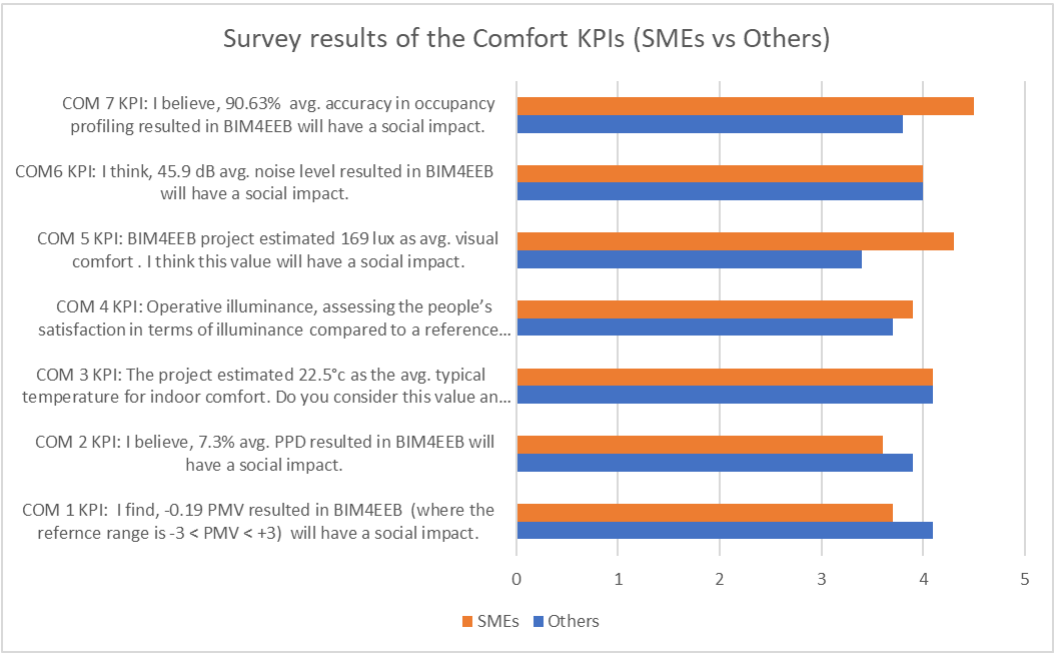


Figure 17 - Survey results for Comfort KPIs (SMEs vs Others) based on the mean value of responses

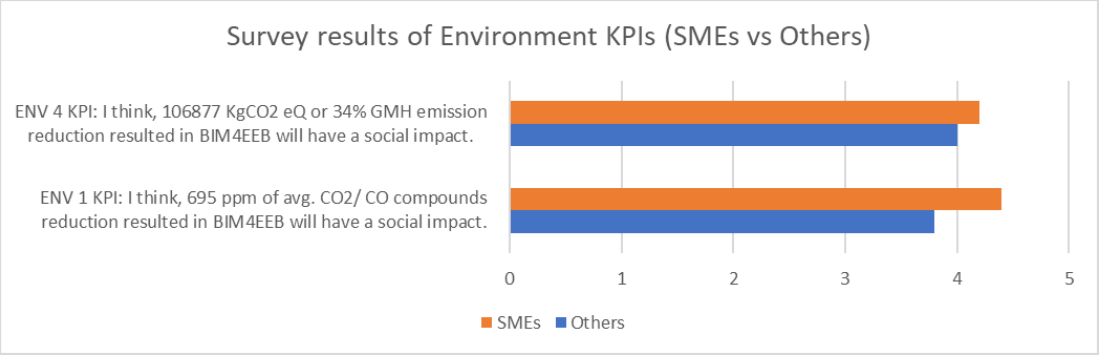


Figure 18 - Survey results for Environmental KPIs (SMEs vs Others) based on the mean value of responses

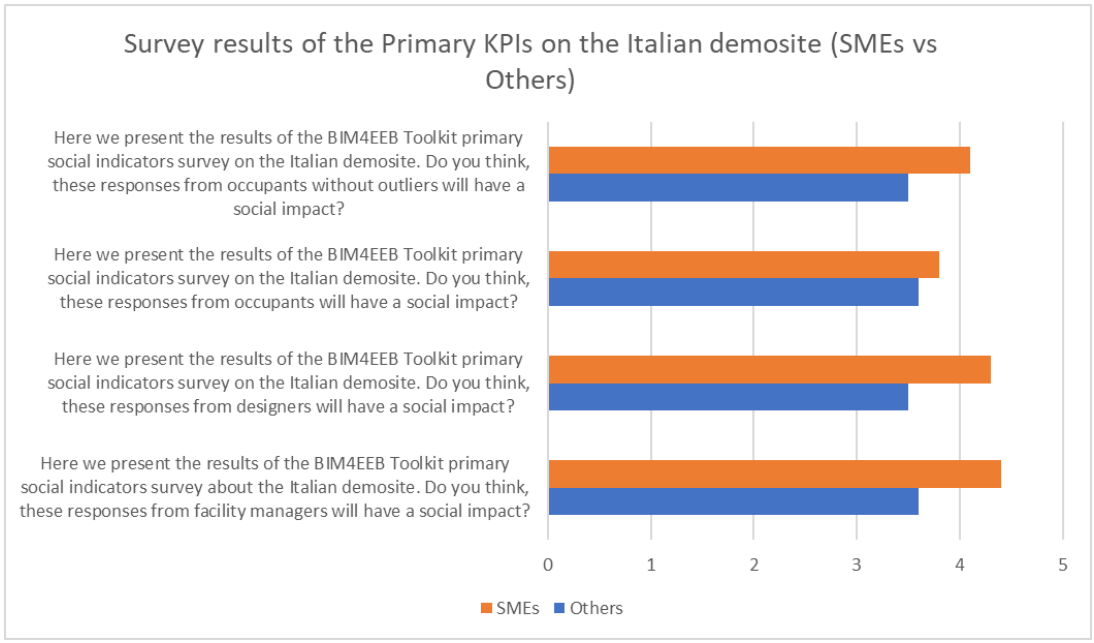


Figure 19 - Primary social indicators survey about the Italian demo site based on the mean value of responses

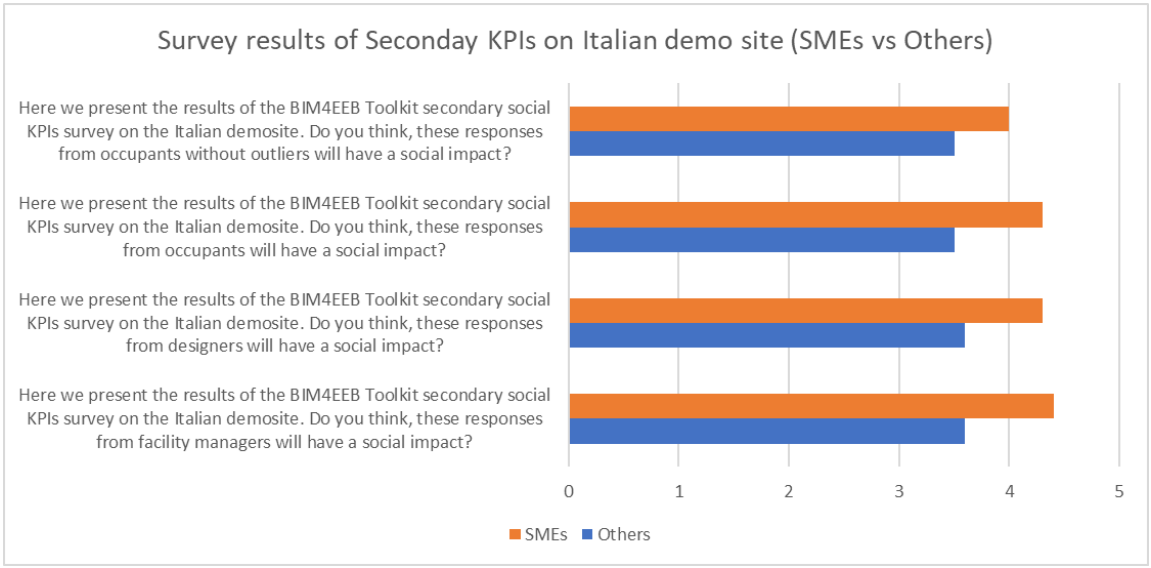


Figure 20 - Secondary social indicators survey about the Italian demo site based on the mean value of responses

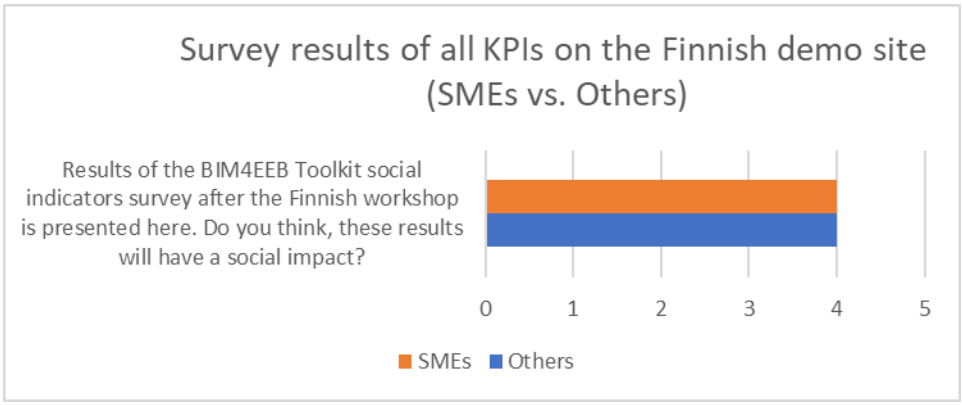


Figure 21 - Social indicators survey about the Finnish demo site based on the mean value of responses

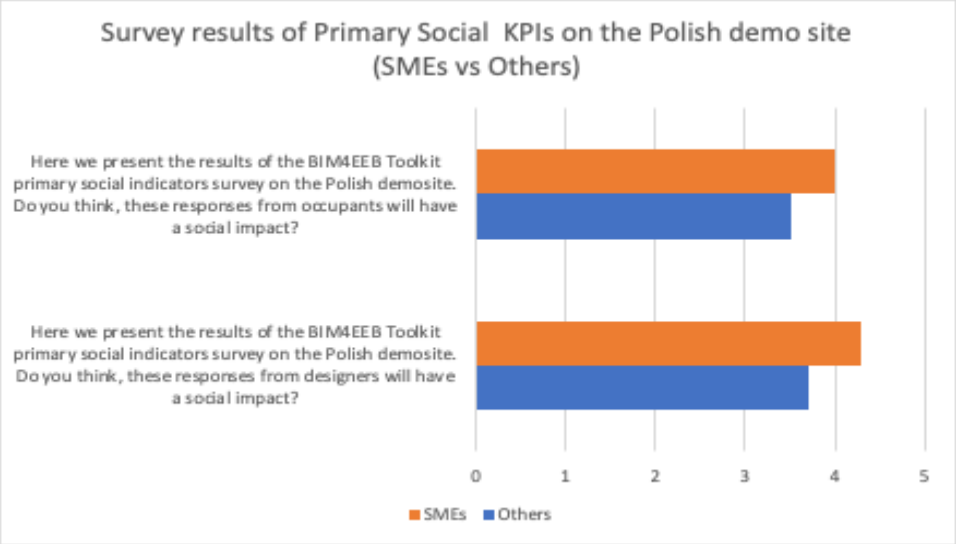


Figure 22 - Primary social indicators survey about the Polish demo site

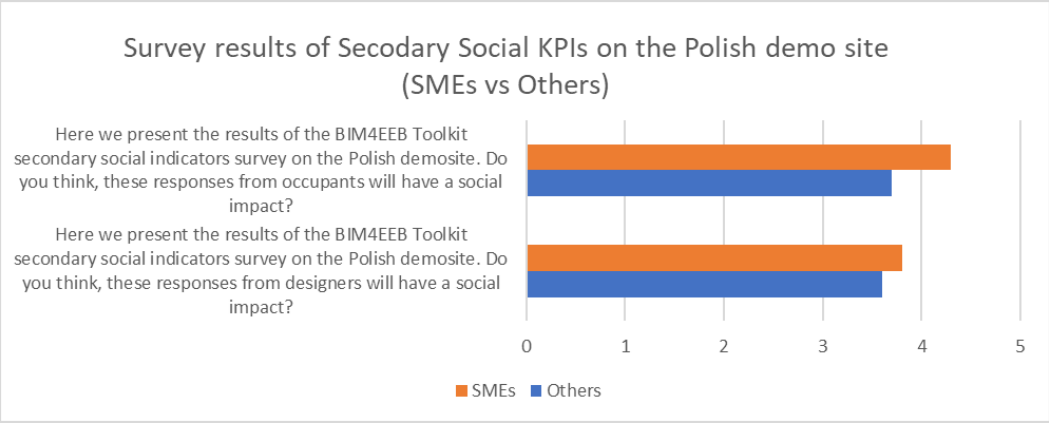


Figure 23 - Secondary social indicators survey about the Polish demo site