



SANITSER LIFE12 ENV/IT/001095

Deliverable Action C<sub>3</sub>

## S-LCA evaluation matrix

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## 1. Introduction

A Social Life Cycle Assessment (S-LCA) aims at assessing the social aspects of products and their potential impacts along their life cycle, encompassing extraction and processing of raw materials; manufacturing; distribution; use; re-use; maintenance; recycling; and final disposal. The approach used all over the S-LCA is similar to the environmental LCA approach.

The aim of the application of S-LCA methodology within the SANITSER project is to provide an overview of any detectable social implications of the project, by carrying out a comparison between the innovative and traditional technologies for sanitary ware production.

This document introduces fundamental methodological aspects as well as assumptions made for the definition of the evaluation matrix, which is the core of the S-LCA implementation for classification and characterization used for the assessment (as it will be shown in PAR 3.3.3).

## 2. Glossary

S-LCA	Social Life Cycle Assessment
LCA	Life Cycle Assessment
PCR	Product Category Rules
EPD	Environmental Product Declaration
UNEP	United Nations Environment Programme
SETAC	Society of Environmental Toxicology and Chemistry
ISO	International Organization for Standardization
MI	Minerali Industriali
LCE	Life Cycle Engineering
ASL	Azienda Sanitaria Locale (local sanitary agency)



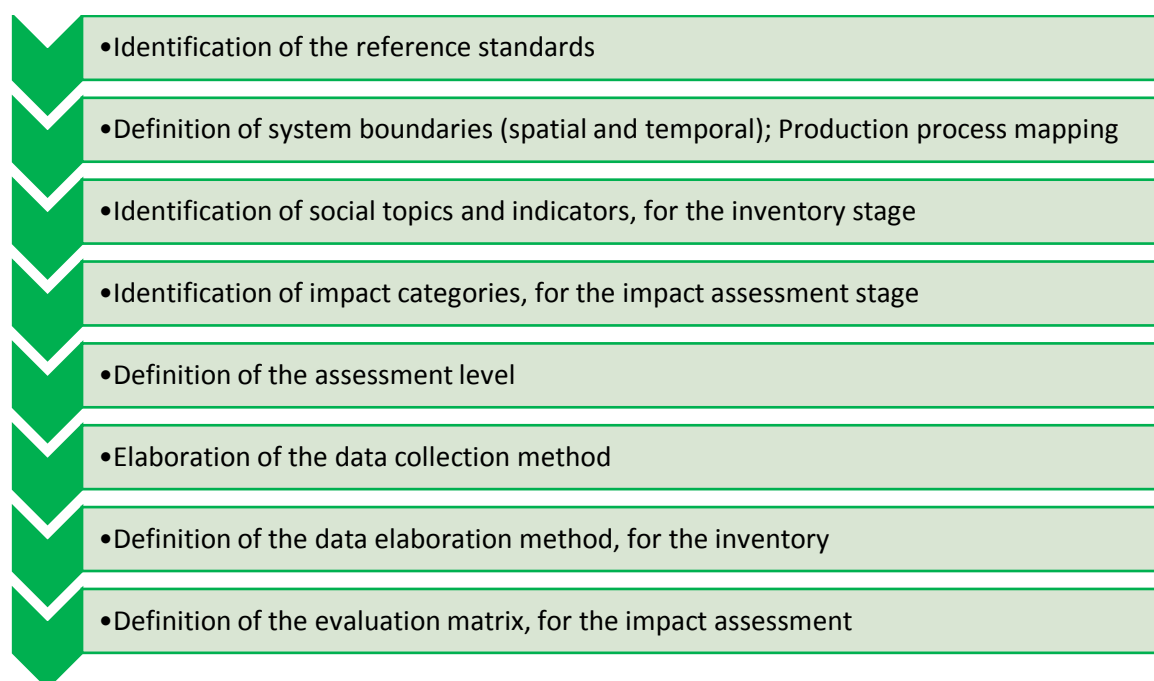
### 3. Goal and Scope Definition

#### 3.1. Goal of the study

The aim of the study is to compare traditional vs innovative systems for producing sanitary ware, in order to identify pros and cons of utmost importance of the two systems from a social point of view.

The study was carried out through the following steps (FIGURE 1), described in detail later on.

FIGURE 1 LIST OF THE MAIN STEPS FOR THE DEFINITION OF THE EVALUATION MATRIX



#### 3.2. Reference standards

The method applied in this study is based on the Guidelines for Social Life Cycle Assessment of Products (UNEP/SETAC 2009), here referred to as the “Guidelines” and the Handbook for Product Social Impact Assessment, version 3.0 (Roundtable for Product Social Metrics 2016), named as the “Handbook”. Moreover, S-LCA follows the ISO 14044:2006 which is the LCA framework. In order to give homogeneity with the LCA results, the Product Category Rules (PCR) 2012:01 for Construction products was kept into account for the development of some aspects



(i.e. system boundaries). In fact, this document contains all rules for the development of an Environmental Product Declaration (EPD) within the International EPD System, thus it represents a good framework for the development of all LCA-related studies.

### 3.3. Scope and system boundaries

The scope of this study is the utilization of recycled raw materials as input for ceramic sanitary ware production process, with a comparison between innovative and traditional production technologies.

All production process stages identified are localized in Europe, most of the processes takes place in Italy.

The reference period for the traditional process is 2015, while for the innovative one is 2016. Even if reference periods are different, the comparison is meaningful since traditional processes are very stationary along time, so it is reasonable to assume that 2016 production characteristics (energy consumption, raw materials, etc.) are almost equal to 2015.

The S-LCA boundaries reproduce the “cradle to gate” system, from raw materials production to finished product at the production plant gate (FIGURE 2). Subsequent stages (e.g. transport to installation place, installation and use phase) are not considered in the analysis because they are assumed to be equivalent for both systems.

FIGURE 2 SYSTEM BOUNDARIES

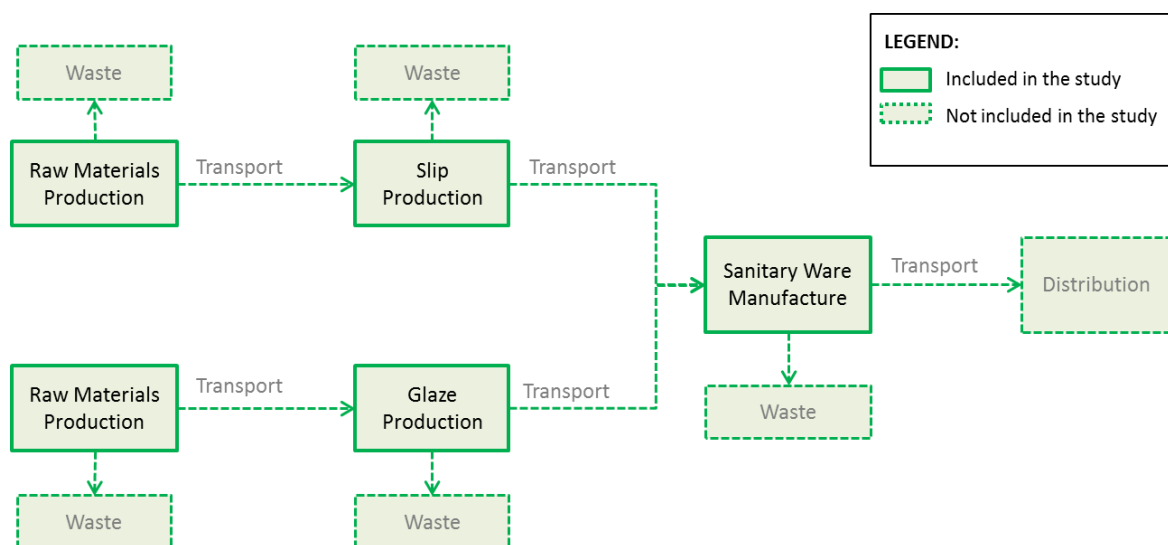




TABLE 1 RAW MATERIAL PRODUCTION PROCESSES CONSIDERED WITHIN UPSTREAM STAGE

	BOTH SYSTEMS	ONLY TRADITIONAL	ONLY INNOVATIVE
SLIP	Clay (Hycast)	Quartz	Glass Filler GS-VF
	Clay (Samblend)	Feldspar	Pitcher BVC-VF
	Kaolin		Feldspar F60-PB VF
			Talk
GLAZE	Zircosil (Zircobit)	Magnesite	Glass VB-FF
	Zinc oxide		Glass VBI-FF
	Kaolin		
	Calcium carbonate		
	Quartz		

### 3.3.1. Upstream processes

Upstream processes are those related to the raw materials production. Some materials are used both in traditional and innovative systems, while others are process specific. The considered raw material production stages are reported in TABLE 1. For secondary raw materials, the boundary from previous life is fixed at the beginning of the recycling process; all previous social implications are allocated to the waste generator.

### 3.3.2. Core processes

Production processes included in this part are:

- Slip production process
- Glaze production process
- Sanitary ware production process

Slip and glaze production processes are included in the core stage since they are “pre-product”, following the stages subdivision foreseen by the Product Category Rules (PCR) 2012:01 for Construction products.

### 3.3.3. Cut-off rules

The transportation activities that are needed for all stages have been excluded, since they are the same for both systems (traditional and innovative) and are conducted by the same external companies, which would not benefit from raw materials variations. Only small benefit might be generated by the reduction of covered distances, however it has relatively low impacts compared to other life cycle stages.

The production of oils and fuels for maintenance of the production machineries (which are upstream processes) and all waste treatment processes have been excluded for the same reason.







## 4. Methodology

### 4.1. Stakeholder

First of all, it was necessary to identify the target stakeholder groups on which to base the analysis. Starting from the experience of internal experts, which was shared during various meetings among partners, workers and local communities have been chosen as stakeholder groups for the study. Other stakeholders' groups have not been considered since referring to life cycle stages out of the system boundaries, or not contributing to the aim of comparison between the traditional and innovative production processes.

Stakeholder groups selected per each stage of the system boundary are reported in TABLE 2.

### 4.2. Social topics and performance indicators

The choice of relevant stakeholder groups allows to identify the social topics on which the data collection should be based on.

Relevant social topics are identified as those potentially generating an impact on the business or influencing external stakeholders' perceptions of the product. For each social topic, one or more performance indicators were defined.

The selection of social topics and performance indicators (TABLE 3 and TABLE 4) is based on discussions among Partners' Consortium (SETEC, Minerali Industriali (MI), GEMICA and Life Cycle Engineering). Due to the involvement of people with deep knowledge of core operations, chosen topics and indicators are considered to give a good overview of impacts related to the sanitary ware production chain.

Given the goal of the present S-LCA, only social topics and performance indicators which could be useful for comparison purposes have been considered. Some specific issues, such as child labour or gender equality, have not been considered, as they have no reason for being affected by changes in slip or glaze composition, since most raw materials used in the two production processes are provided by the same Italian suppliers.

TABLE 2 STAKEHOLDER GROUPS CONSIDERED PER EACH LIFE CYCLE STAGE WITHIN SYSTEM BOUNDARIES

LIFE CYCLE STAGES	Raw materials production	Slip and glaze production	Sanitary ware manufacturing
STAKEHOLDER	WORKERS		
	LOCAL COMMUNITIES		



All chosen performance indicators were adapted to the specific goal of the study. Moreover, specific indicators were created to address some issues of extreme importance within sanitary ware production chain (i.e. Silicosis issue).

A Scales-Based approach was established: the use of qualitative indicators strongly decreases the risk of mistakes during the data collection, especially when stakeholders not directly involved in the production process (as local communities) are involved. To give higher homogeneity to the study, qualitative indicators are used for the “Workers” stakeholder category, too.



TABLE 3 SOCIAL TOPICS AND INDICATORS FOR THE "WORKERS" STAKEHOLDER CATEGORY, WITH INDICATION OF THE SOURCE AND KIND OF EVERY INDICATOR.

SOCIAL TOPIC	PERFORMANCE INDICATOR	INDICATOR SOURCE	KIND OF INDICATOR
Health and safety	Hours of health and safety training per worker	Handbook	Qualitative
	Rate of incidents	Handbook	Qualitative
	Rate of incidents due to Sliding	Own indicator	Qualitative
	Cases of Silicosis occurred	Own indicator	Qualitative
Fair Salary	Wages meeting minimum legal/industrial standards	Handbook	Qualitative
Social benefits and social security	Social benefits meeting legal/industry minimum standards and provision fully complying with all applicable laws	Handbook	Qualitative
Working hours	Hours per week worked with exposition to silica	Own indicator	Qualitative
	Preparation steps higher than 30 minutes	Own indicator	Qualitative
Equal opportunities and discrimination	Actions to increase staff diversity and/or promote equal opportunities	Handbook	Qualitative
Freedom of association and collective bargain	Workers members of associations able to organise themselves and/or bargain collectively	Handbook	Qualitative
Employment relationship	Workers with documented employment conditions	Handbook	Qualitative
Training and formation	Numbers of hours of training per employee during the reporting period	Handbook	Qualitative
Job satisfaction and engagement	Workers participating in a job satisfaction and engagement survey	Handbook	Qualitative

### 4.3. Impact categories

For social impact assessment, all data included in the inventory shall be aggregated within impact categories, by means of a classification step linking each social topic with the impact categories on which they have some effects. It is then followed by a characterization stage that quantifies this cause-effect relationship. Impact categories of type 1 (which aggregate the results for the social topics within a theme of interest to a stakeholder) were chosen.

For both stakeholder groups, the impact categories chosen were those proposed by the Guidelines as "Type 1 impact categories":

- Human rights
- Working conditions
- Health and safety
- Cultural heritage
- Governance
- Socio-economic repercussions



TABLE 4 SOCIAL TOPICS AND INDICATORS FOR THE STAKEHOLDER CATEGORY "LOCAL COMMUNITIES", WITH INDICATION OF THE SOURCE AND KIND OF EVERY INDICATOR.

SOCIAL TOPIC	PERFORMANCE INDICATOR	INDICATOR SOURCE	KIND OF INDICATOR
Safe and healthy living conditions	Adverse impacts on community health or safety	Handbook	Qualitative
	Assessment and monitoring of risks and impacts on community health and safety	Handbook	Qualitative
	Measures for adverse impacts on community health and safety	Handbook	Qualitative
	Programmes for community health or safety	Handbook	Qualitative
	Silicosis cases within local community	Own indicator	Qualitative
Access to tangible resources	Assessment and monitoring of risks and impacts on community access to tangible resources	Handbook	Qualitative
	Measures for adverse impacts or to restore community access to tangible resources	Handbook	Qualitative
	Proactive action for community access to tangible resources	Handbook	Qualitative
Local capacity building	Programmes targeting capacity building in the community	Handbook	Qualitative
	People in the community benefitting from capacity building programmes	Handbook	Qualitative
Community engagement	Programmes or events targeting community engagement	Handbook	Qualitative
	Opportunities and programmes for community support	Handbook	Qualitative
Local employment	New jobs created	Handbook	Qualitative

#### 4.4. Level of assessment

The aim of the assessment is to assign a final “score” to both production processes, indicating their positive or negative impacts on the two involved stakeholders. The literature provides different methodological approaches to get the final result. Moreover, the kind of result itself can vary too, depending on the assumptions made to carry out the analysis. Indeed, the result is one score per each indicator, while other cases achieve one single score for all stakeholders together, depending on the final goal and context of each study.

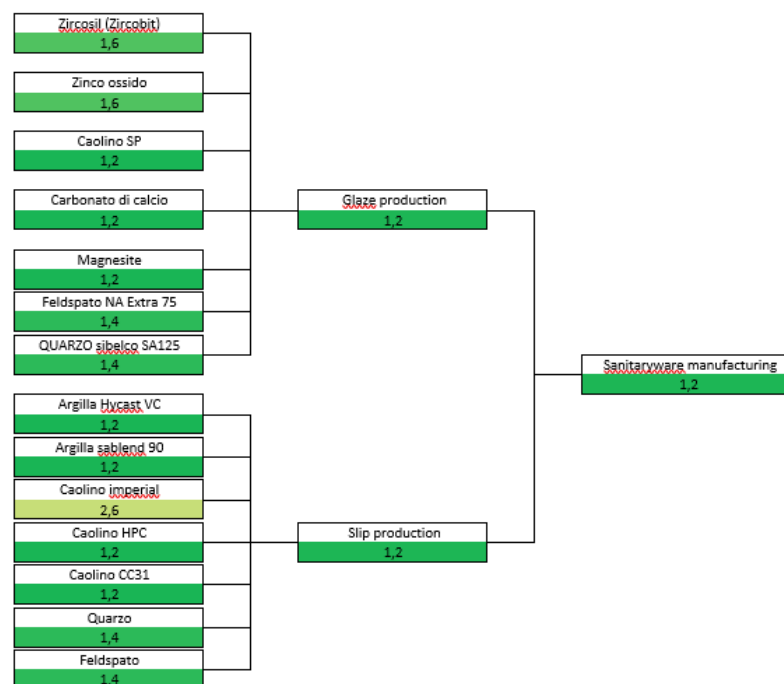
In present case, it was decided to get to a “life-cycle stage level”: a final score has been identified per each stage, so that a map of social impact all along the production chain could be



created (an example of a possible result is reported in FIGURE 3). A final product score, as a single number summarising the entire life cycle social impact, will be provided as well. However, it must be considered that this final score will come from an equal weighted average of the three main production stages, without further considerations on the relative importance of the different stages: raw materials production, intermediate product production (glaze and slip), final sanitary ware production.

Final results will be given separately for the two involved stakeholder groups. This decision is generated by the consideration that every stakeholder shall be considered separately, since good effects on one cannot balance bad effects on the other (e.g. good effects on local communities cannot balance a bad working condition).

FIGURE 3 EXAMPLE OF POSSIBLE RESULTS OF THE ANALYSIS:  
MAP OF SOCIAL IMPACTS THROUGH LIFE CYCLE STAGES



## 4.5. Weighting

In S-LCA studies it could be necessary to apply weighting factors in different steps, both for weighting data coming from different actors and scores related to different life cycle stages.

Literature provides different weighting methods among which working hours are considered as the best weighting factor.



Since the innovative process is still at a pilot stage, the real number of working hours is not stabilized on fixed values: for this reason, in present study was chosen to avoid mistakes due to unstable working hours values and to avoid the utilization of this weighting method, choosing to give equal weight. This consideration was applied all over the study.

## 4.6. Collection method

The data collection was organized through questionnaires, prepared by LCE and sent to all chosen addresses by LCE, MI, GEMICA and SETEC. Since most of the involved actors live and operate in Italy, the chosen language was Italian.

Addresses were chosen through a 2-steps process:


- Identification of all actors involved in the supply chain, both for traditional and innovative supply chain, covering every stage comprehended in the system boundaries;
- Focus on relevant life cycle actors, chosen as the ones present in only one of the two compared production processes or the ones to whom SANITSER process might lead changes.

For the “Worker” stakeholder group, the choice of addressees fell on workers’ health and safety managers present in every involved plant. Regarding the “Local Community” stakeholder group, questionnaires were sent to local sanitary agencies (ASL), to some workers living in the neighbourhood of plants and to any community associations in want to participate to this initiative.

The scale-based approach was chosen as it represents the easiest and most robust way for collecting data when dealing with people not directly involved in the production processes, as for local communities. Each social indicator was reported in a qualitative question requiring a yes-no answer, with the possibility of adding comments to better explain the answer (FIGURE 4 and FIGURE 5). A qualitative judgement scale (e.g. very much, not so much, etc.) was avoided in order to decrease the level of subjectivity in the answers.



FIGURE 4 QUESTIONNAIRE SENT TO ACTORS  
BELONGING TO STAKEHOLDER GROUP WORKERS



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## SOCIAL LIFE CYCLE ASSESSMENT

### Questionario per la raccolta dati

**STAKEHOLDER:**    **Lavoratori**


<b>Destinatario:</b>	
<b>Incaricato della compilazione:</b>	

<b>Periodo di riferimento:</b>	2015
<b>Fase del processo produttivo</b>	

Tema:	Risposta	Note (spiegare la risposta)
<b>Salute e Sicurezza</b>		
1 La formazione su salute e sicurezza è stata erogata a ciascun lavoratore almeno una volta nel periodo di riferimento?		
2 Sono stati registrati infortuni sul lavoro nel periodo di riferimento?		
3 Sono stati registrati infortuni dovuti a scivolamento nel periodo di riferimento?		
4 Nel periodo di riferimento sono stati registrati casi di silicosi?		
<b>Stipendio</b>		
5 Il salario dei lavoratori rispetta gli standard minimi (legali o industriali)?		
<b>Benefici Sociali</b>		
6 I sussidi sociali dei lavoratori rispettano gli standard minimi (legali o industriali)?		
<b>Orari di lavoro</b>		
7 I lavoratori svolgono parte del lavoro in condizioni di esposizione alla Silice?		
8 Le fasi di preparazione e spreparazione (i.e. doccia) impegnano i lavoratori per un tempo maggiore o uguale a 30 minuti?		
<b>Discriminazione</b>		
9 Sono state prese iniziative per aumentare la diversità dello staff e/o per promuovere eque opportunità?		
<b>Libertà di associazione e contrattazione collettiva</b>		
10 Vi sono lavoratori membri di associazioni in grado di autoorganizzarsi e/o di contrattare collettivamente?		
<b>Rapporto di lavoro</b>		
11 Tutti i lavoratori hanno un regolare contratto di lavoro?		
<b>Formazione ed addestramento</b>		
12 È stata fatta formazione (diversa da salute e sicurezza) a ciascun lavoratore?		
<b>Soddisfazione e coinvolgimento nel lavoro</b>		
13 Vi sono lavoratori che hanno partecipato ad almeno un sondaggio sulla soddisfazione ed il coinvolgimento sul lavoro?		



FIGURE 5 QUESTIONNAIRE SENT TO ACTORS  
BELONGING TO STAKEHOLDER GROUP LOCAL COMMUNITIES



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## SOCIAL LIFE CYCLE ASSESSMENT

Questionario per la raccolta dati

**STAKEHOLDER:** **Comunità locali**

<b>Destinatario:</b>	
<b>Incaricato della compilazione:</b>	

<b>Periodo di riferimento:</b>	2015
<b>Fase del processo produttivo</b>	

Tema:	Risposta	Note (spiegare la risposta)
<b>Salute e Sicurezza</b>		
1 Sono stati identificati impatti negativi dovuti al processo produttivo in esame su salute e sicurezza della comunità locale nel periodo di riferimento?		
2 Tali impatti negativi sono regolarmente valutati e monitorati?		
3 Sono state implementate misure appropriate per prevenire o mitigare tali impatti negativi?		
4 Sono stati implementati programmi per migliorare la salute e la sicurezza della comunità locale?		
5 Si sono verificati casi di Silicosi all'interno della comunità locale?		
<b>Accesso alle risorse materiali (acqua e paesaggio)</b>		
6 I rischi e gli impatti sull'accesso della comunità locale alle risorse materiali sono regolarmente valutati e monitorati?		
7 Sono state implementate misure appropriate per prevenire/mitigare tali impatti?		
8 Sono stati implementati programmi per aumentare l'accesso della comunità locale alle risorse materiali o alle infrastrutture?		
<b>Potenziamento delle capacità locali</b>		
9 Sono stati implementati programmi rivolti al potenziamento delle capacità delle comunità locali? (iniziative generali e/o programmi formali, per educazione/formazione)		
10 Persone della comunità locale hanno beneficiato di tali programmi?		
<b>Coinvolgimento della comunità</b>		
11 Sono stati implementati programmi/eventi per il coinvolgimento della comunità locale? (riunioni, dialogo aperto, etc)		
12 Sono stati implementati programmi atti al supporto della comunità locale? (economico, sociale, etc)		
<b>Occupazione</b>		
13 Sono stati creati nuovi posti di lavoro?		





## 4.7. Data elaboration: inventory

All data coming from received questionnaires were firstly converted from a qualitative yes/no format to the quantitative scale chosen for the assessment (FIGURE 6). Conversion factors are reported in TABLE 5 and TABLE 6.

The utilization of a 1 to 6 scale allows the determination of intermediate values when averaging the data collected from more than one actor for the same production stage. Moreover, it allows comparison with future studies, which might use a quantitative approach.

All converted answers were then reported within stakeholder socio-profiles (an example of socio-profiles is reported in TABLE 10), which represent the social life cycle inventory of the study, summing up all indicator values per single life cycle stage. Reported indicators represent the performance assessment of each life cycle stage.

In case of more than one filled questionnaire per each stage, a mathematical average was calculated to obtain one single indicator value for the stage, considering an equal weight for all received answers.

FIGURE 6 SCALE VALUES USED FOR THE PERFORMANCE INDICATORS

PERFORMANCE INDICATORS	CODE
Very good	1
Good	2
Satisfactory	3
Inadequate	4
Poor	5
Very poor	6



TABLE 5 CONVERSION FACTORS FOR PERFORMANCE INDICATORS OF STAKEHOLDER GROUP WORKERS

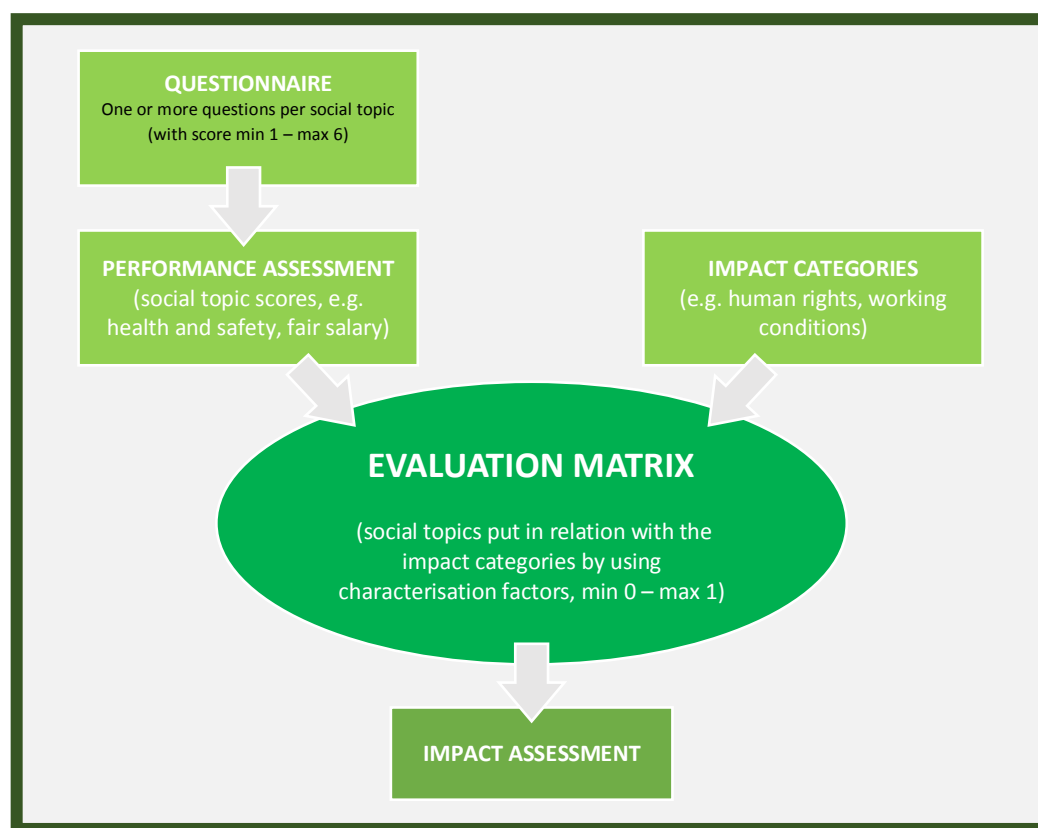
SOCIAL INDICATOR		QUESTION	CONVERSION FACTOR	
Health and Safety			YES	NO
1	Hours of health and safety training per worker	La formazione su salute e sicurezza è stata erogata a ciascun lavoratore almeno una volta nel periodo di riferimento?	1	6
2	Rate of incidents	Sono stati registrati infortuni sul lavoro nel periodo di riferimento?	6	1
3	Rate of incidents due to Sliding	Sono stati registrati infortuni dovuti a scivolamento nel periodo di riferimento?	6	1
4	Cases of Silicosis occurred	Nel periodo di riferimento sono stati registrati casi di silicosi?	6	1
Fair salary			YES	NO
5	Wages meeting minimum legal/industrial standards	Il salario dei lavoratori rispetta gli standard minimi (legali o industriali)?	1	6
Social benefits and social security			YES	NO
6	Social benefits meeting legal/industry minimum standards and provision fully complying with all applicable laws	I sussidi sociali dei lavoratori rispettano gli standard minimi (legali o industriali)?	1	6
Working hours			YES	NO
7	Hours per week worked with exposition to silica	I lavoratori svolgono parte del lavoro in condizioni di esposizione alla Silice?	6	1
8	Preparation steps higher than 30 minutes	Le fasi di preparazione e spreparazione (i.e. doccia) impegnano i lavoratori per un tempo maggiore o uguale a 30 minuti?	6	1
Equal opportunities and discrimination			YES	NO
9	Actions to increase staff diversity and/or promote equal opportunities	Sono state prese iniziative per aumentare la diversità dello staff e/o per promuovere eque opportunità?	1	6
Freedom of association and collective bargain			YES	NO
10	Workers members of associations able to organise themselves and/or bargain collectively	Vi sono lavoratori membri di associazioni in grado di autoorganizzarsi e/o di contrattare collettivamente?	1	6
Employment relationship			YES	NO
11	Workers with documented employment conditions	Tutti i lavoratori hanno un regolare contratto di lavoro?	1	6
Training and formation			YES	NO
12	Numbers of hours of training per employee during the reporting period	è stata fatta formazione (diversa da salute e sicurezza) a ciascun lavoratore?	1	6
Job satisfaction and engagement			YES	NO
13	Workers participating in a job satisfaction and engagement survey	Vi sono lavoratori che hanno partecipato ad almeno un sondaggio sulla soddisfazione ed il coinvolgimento sul lavoro?	1	6



TABLE 6 CONVERSION FACTORS FOR PERFORMANCE INDICATORS OF STAKEHOLDER GROUP LOCAL COMMUNITIES

SOCIAL INDICATOR		QUESTION	CONVERSION FACTOR	
Safe and healthy living conditions			YES	NO
1	Adverse impacts on community health or safety	Sono stati identificati impatti negativi dovuti al processo produttivo in esame su salute e sicurezza della comunità locale nel periodo di riferimento?	6	1
2	Assessment and monitoring of risks and impacts on community health and safety	Tali impatti negativi sono regolarmente valutati e monitorati?	1	6
3	Measures for adverse impacts on community health and safety	Sono state implementate misure appropriate per prevenire o mitigare tali impatti negativi?	1	6
4	Programmes for community health or safety	Sono stati implementati programmi per migliorare la salute e la sicurezza della comunità locale?	1	6
5	Silicosis cases within local community	Si sono verificati casi di Silicosi all'interno della comunità locale?	6	1
Access to tangible resources			YES	NO
6	Assessment and monitoring of risks and impacts on community access to tangible resources	I rischi e gli impatti sull'accesso della comunità locale alle risorse materiali sono regolarmente valutati e monitorati?	1	6
7	Measures for adverse impacts or to restore community access to tangible resources	Sono state implementate misure appropriate per prevenire/mitigare tali impatti?	1	6
8	Proactive action for community access to tangible resources	Sono stati implementati programmi per aumentare l'accesso della comunità locale alle risorse materiali o alle infrastrutture?	1	6
Local capacity building			YES	NO
9	Programmes targeting capacity building in the community	Sono stati implementati programmi rivolti al potenziamento delle capacità delle comunità locali? (iniziative generali e/o programmi formali, per educazione/formazione)	1	6
10	People in the community benefitting from capacity building programmes	Persone della comunità locale hanno beneficiato di tali programmi?	1	6
Community engagement			YES	NO
11	Programmes or events targeting community engagement	Sono stati implementati programmi/eventi per il coinvolgimento della comunità locale? (riunioni, dialogo aperto, etc)	1	6
12	Opportunities and programmes for community support	Sono stati implementati programmi atti al supporto della comunità locale? (economico, sociale, etc)	1	6
Local employment			YES	NO
13	New jobs created	Sono stati creati nuovi posti di lavoro?	1	6

FIGURE 7 SCHEME OF THE APPLICATION OF THE EVALUATION MATRIX,  
WITH RELATIONSHIP AMONG DIFFERENT INVOLVED DATA.



#### 4.8. Evaluation matrix: impact assessment

The evaluation matrix is the method for classification and characterization used for the impact assessment in the S-LCA. It is not possible to find in literature a universally agreed or recommended impact assessment method, so the evaluation matrix shall be created specifically for every single case study. In the case of this project, one single evaluation matrix to be applied to all life cycle stages was created: since most of involved companies are based in Italy, evaluation criteria can be assumed to be the same in every case.

As shown in FIGURE 7, every social topic has been linked with impact categories by means of a characterization factor between 0 and 1, depending on the importance of the linkage (TABLE 7). The same factors have been applied to both stakeholders for all life cycle stages.

The characterization factors have been assigned to each social topic based on the geographical coverage of the study, the involved economic sectors, the reference year and considerations for the specific study.



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After imputing the performance assessment values for the single life cycle stage, the matrix gives the following results (the impact assessment scores, TABLE 9) for every stakeholder group (separately):

- One **impact category score for every impact category** (in yellow), calculated by means of the application of characterization factor of every impact category to all social indicators;
- One **impact assessment score for every social topic** (in orange), calculated by applying all characterization factors to every social indicators and summing results of all impact categories;
- One **final impact assessment score** (in blue), calculated as average of impact assessment scores for social indicators. As previously said, all the social topics related to each stakeholder are assumed to have the same weight.

All impact assessment scores will be presented with a scale of six values (TABLE 8).

TABLE 7 CHARACTERIZATION FACTORS BETWEEN SOCIAL TOPICS AND IMPACT CATEGORIES

RELATION	FACTOR
No relationship	0.0
Weak relationship	0.5
Strong relationship	1.0

TABLE 8 SCALE VALUES USED FOR THE IMPACT ASSESSMENT

IMPACT ASSESSMENT	CODE
Positive effect	1
Lightly positive effect	2
Indifferent effect	3
Lightly negative effect	4
Negative effect	5
Very negative effect	6



TABLE 9 EVALUATION MATRIX  
SANITSER

Stakeholder Group	Social Topics	Performance Assessment	Impact Categories						Impact Assessment
			Human Rights	Working Conditions	Health and Safety	Cultural Heritage	Governance	Socio-Economic Repercussions	
Workers	Health and safety	-	0,5	1,0	1,0	0,0	0,5	1,0	-
	Fair salary	-	1,0	0,5	0,0	0,5	1,0	1,0	-
	Social benefits and social security	-	0,5	0,5	0,5	0,5	1,0	1,0	-
	Working hours	-	1,0	1,0	1,0	0,0	0,5	0,5	-
	Equal opportunities and discrimination	-	1,0	1,0	0,0	0,5	1,0	1,0	-
	Freedom of association and collective bargaining	-	1,0	1,0	0,0	0,5	1,0	1,0	-
	Employment relationship	-	1,0	1,0	0,5	0,0	0,5	1,0	-
	Training and formation	-	0,0	0,5	1,0	0,0	0,0	0,0	-
	Job satisfaction and engagement	-	0,5	1,0	0,5	0,0	0,0	0,5	-
	Total Impact category score		-	-	-	-	-	-	-
Local community	Safe and healthy living conditions	-	1,0	0,5	1,0	0,0	1,0	1,0	
	Access to tangible resources	-	0,5	0,0	0,5	0,5	1,0	1,0	
	Local capacity building	-	0,0	0,5	0,5	0,0	1,0	1,0	
	Community engagement	-	0,0	0,0	0,0	0,5	0,0	1,0	
	Local employment	-	0,5	0,5	0,0	0,0	0,0	1,0	
	Total Impact category score		-	-	-	-	-	-	-



## 5. Final considerations

This S-LCA study was mostly approached by means of using as much as possible the experience of partners, who are experts of the core processes of the production. In this way, it was possible to focus on all aspects that are of real significance to provide a comparison of social impact of the two production processes.

Probably, the most important aspect of the analysis is Silicosis: this is a form of occupational lung disease occurring after inhalation of crystalline silica dust, potentially present in all production processes involving materials containing silica. All over the traditional sanitaryware production process, risk of Silicosis can be found in stages involving quartz or semi-finished products containing it (e.g. slip), since quartz is mainly composed by Silica in its crystalline form. In particular, the quartz extraction stage and the slip production phases of finishing and cooking are the ones with the higher level of risk, releasing silica dust.

The innovative production process allows the complete elimination of the Silicosis issue: the innovative slip formulation completely substitutes quartz with recovered glass, while the glaze formulation contains only small amount of quartz in a liquid form (which minimize inhalation risk).

With the aim of valorising this advantage given by the innovative process, specific indicators were produced and used in the analysis.

Other benefits generated by the innovative technology might be due to a possible lower waste production (ceramic scraps); this could lead to a lower risk of incidents connected to sliding or heavy weights handling. This could result in a lower value of related performance indicators of the social topic Health and Safety.

One last important benefit that can be imagined for SANITSER project is a higher level of positive involvement of both workers and local communities: the introduction of the recycling concept within the ceramic sector is an important innovation that can raise interest and increase a positive view of ceramic companies. Moreover, in the future, the innovation might lead to a higher number of dissemination activities. Probably, it will be difficult to have this kind of results during the short production period of the project, since these are aspects mostly generated by a long period of application.



## 6. References

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ISO 14044:2006, Environmental management -- Life cycle assessment -- Requirements and guidelines





APPENDIX

I

Example: application of the evaluation matrix

The following paragraph provides an example of application of the evaluation matrix. More in detail, the matrix was applied to one of the questionnaires received from the “WORKERS” stakeholder group.

First, the qualitative data received (yes/no) are converted into a quantitative scale (1/6), through the conversion factors in TABLE 5. Then, social topic results are calculated by averaging the values of all its used indicators (TABLE 10).

Social topics scores are the data in input to the evaluation matrix, which calculates impact assessment values as described in PAR. 4.8. the application to this example is reported in FIGURE 8.

Socio-profile - WORKERS	Answer	Score
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TABLE 10 CONVERSION OF QUALITATIVE DATA COLLECTED WITHIN QUANTITATIVE INVENTORY



[illegible]