
# Sustainability Opportunity Study - Diagnosing

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## Abstract

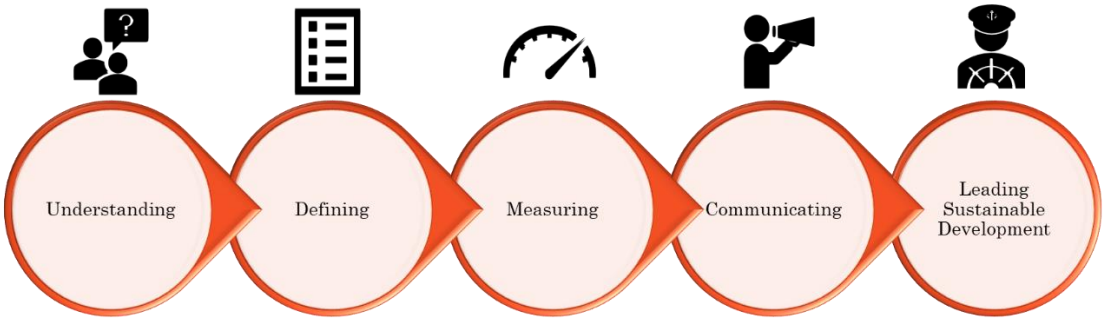
Managing sustainable development is a challenge in all branches. A key challenge is to identify needs and opportunities for change towards sustainability. Previous research has proposed an Opportunity Study for detecting generic improvement opportunities. An Opportunity Study is based on Diagnosing the improvement potential, Analysing the causes, and Solving by proposing feasible solutions (DAS). The prerequisite for doing an Opportunity Study is that we have agreed Key Performance Indicators (KPIs) to use in our Diagnosing. For sustainability performance this could be difficult due to challenges in understanding and defining what constitutes sustainability in the context. Diagnosing requires an agreement of how performance is assessed. Diagnosing needs to be further developed to ensure that what is assessed as a sustainability improvement potential is grounded in a solid understanding of what sustainability is in the studied process. In this paper we look at how Diagnosing can be described more clearly by studying what should be included in Understanding Defining and Measuring (UDM) sustainable development. The work is based on testing a proposed matrix between DAS and UDM with focus on Diagnosing the improvement potential. The proposed D-UDM model is tested for common fields such as building, education, healthcare and tourism.

**Keywords:** Opportunity Study; sustainability; sustainable development; improvement potential; performance; diagnosing.

## 1. Understanding Sustainability and Sustainable Development

Most of us agree that current life on Earth is not sustainable and that change towards a level of sustainability – change that we could call sustainable development – is not happening at the speed needed. Sustainability, like Quality, is a positively charged word that is often overused and inflated. The more important sustainability is the more inflated the meaning of it. Isaksson and Rosvall (2020) study in "Understanding Building Sustainability" how leading Swedish companies have understood and defined the building value chain from cradle to grave. The results indicate that there is no common understanding of neither what the scope should be, nor which the main sustainability impacts are. The study included several large Swedish companies from building, forestry, and mining. Even if only 23 companies were studied the indication is that understanding could be a main hurdle in the progress towards sustainable development. Isaksson and Hallencreutz (2008) suggest a common-sense logic of five steps that goes from understanding to leading change. These steps are visualised in Figure 1.

**Figure 1. The Five Step Logic of Understanding-Defining-Measuring-Communication-Leading Sustainable Development (UDMCL)**



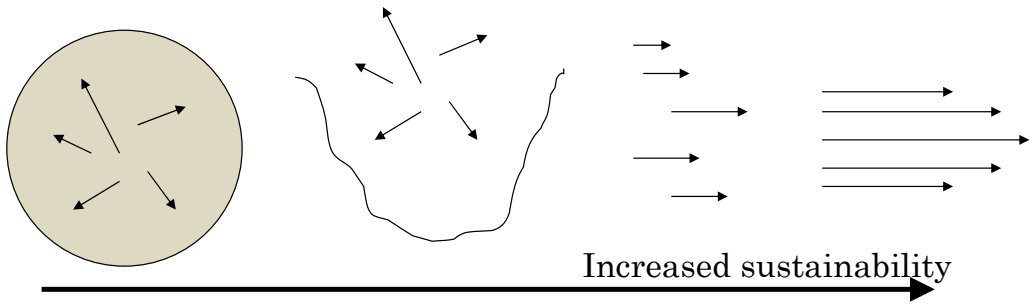

Source: Adapted from Rosvall and Isaksson (2021)

It seems that understanding the contextual interpretation of the commonly cited definition for sustainable development - Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987) – is problematic in many fields. Several studies have reinforced the existence of a critical measurement gap left by the limitations of the current approaches and methods for assessing sustainability information in all its economic, social and environmental dimensions and in an integrated manner (Mayer 2008, O'Rourke D. 2004, Morse et al. 2005, Bell et. al. 1999). Most of these limitations emerge from lack of clearly defined boundaries for data collection, collation and selection (defining information), standardisation and universal set of keys for data interpretation (prioritisation of relevant data) and methodological appropriateness for specific contexts (process definition, outcome focus and stakeholder orientation). The lack of clearly defined boundaries, at a functional and operational level, perforce results in a vague picture, and by extension an incoherent quantification, of sustainability and sustainability performance. This turns decision making by key stakeholders, particularly by companies, for creating sustainability benchmarks into a subjective and ad-hoc process. While this is a first order measurement gap, one that has the most direct implications on quantifiably measuring sustainability, there is also the second order gap connected to data quality, accuracy, adequacy and historicity that is necessary for building data models essential for baselining and measuring sustainability performance as part of process improvement. There is a third order conceptual

gap that, if plugged, would to a large extent take care of the first order and second order measurement gaps. The measurement of sustainability as part of domain of organisational processes and performance, in the form of KPIs, needs systems thinking that is derived from and builds upon the postulates of systems theory (Blowfield et al. 2008:200). Systems thinking of the kind that is embodied in the nine planetary boundaries (Rockström et. al. 2009; Steffen et. al. 2015) provides a set of design principles that allows for sustainability measurement frameworks, and the associated sustainability reporting for companies, to move from specific indicator-level datasets to allow for the observation and measurement of multidimensional systemic performance on a real time basis. The systemic requirement in terms of sufficiency has already been provided by the definition of sustainability as "the level of human consumption and activity, which can continue into the foreseeable future, so that the systems which provide goods and services to humans persist indefinitely." (Mayer 2008:278).

With the increased awareness of climate problems buttressed by climate science, individuals, companies, organisations, and nations are eager to act. However, action without direction might neither be effective nor efficient. In Quality, like in Sustainability, the challenge is to do the right thing in the right way (Cöster et al., 2020). There are many challenges with Change Management even if it is clear what should be changed. Not having understood a challenge means that it cannot be defined which means that measurement is probably not relevant. It could be that areas with recent increase in focus, such as the issue of sustainability, are having more variation in understanding and defining the challenge. In Figure 2 there is a conceptual interpretation of how change could be viewed, where when new things arrive such as focus on quality and customers or focus on sustainability and stakeholders, development goes from a closed system towards effective and efficient change. With sustainability we still could have branches and businesses, at least in the global context, where there is no change willingness. These are lost cases for change management. When awareness breaks in there is a burst of willingness of doing things, but the activities are not coordinated. This could be interpreted as having a sense of urgency of doing something, but not having defined sustainability and consequently not having relevant indicators for sustainability performance.

**Figure 2. A conceptual presentation of organisational change needs awareness**




**No change willingness**
Organization is a closed system and practically no change takes place

**No clear change orientation**
Organization has opened up but does not have an SD-vision

**Insufficient change competency**
Organization has an SD-vision but moves too slowly

**Change willingness with orientation and competency**
Effective and efficient change for SD

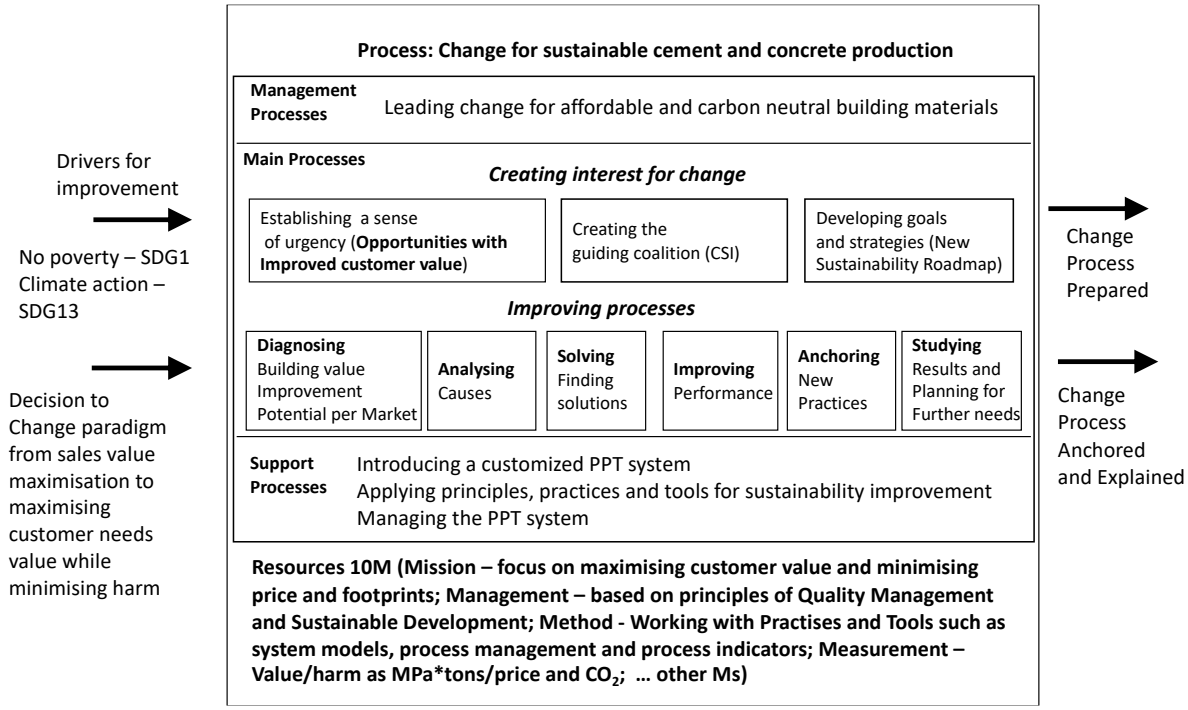
Source: Isaksson 2016

The indication is that many branches and companies still could be in the stage of "No clear change orientation" (see Figure 2). The challenge is to find a logic that permits us to create a

common understanding of the current situation which will lead to a definition and further to relevant measurements: Understanding-Defining-Measuring. The stage of Measuring would be the point where the company works with the right type of change but still with efficiency problems: "Insufficient change competency". At this stage principles, practices and tools from Quality Management could be helpful in speeding up change. The challenge of effective and efficient change is part of larger improvement framework, which is outside of the scope of this paper. We focus on the steps of Diagnosing organisational Understanding, Defining and Measuring of sustainability and sustainable development with the purpose of being able with some level of certainty define indicators for sustainability and sustainable development in the context.

Isaksson (2015) proposes an Opportunity Study as a way of creating a sense of urgency for change. The logic is that clearly presenting an opportunity for management will create interest and a sense of urgency with an agreed and fact-based direction. Kotter (1996) postulates in his book *Leading Change* that the first step in change, is creating the sense of urgency both in management and among most key players in the organisation. Isaksson (2006, 2019) divides change in creating the interest and improving processes. In Figure 3 the role of the Opportunity Study in creating change has been put into an improvement context (Isaksson, 2021). The Opportunity Study is seen as one way of creating a sense of urgency. The Opportunity Study step of Diagnosing the improvement potential presupposes that there is an agreed and correct understanding of the process performance. E.g., in an industrial process such as cement milling, we have a capacity in tons/hour as a KPI. For this case we could have a Best Demonstrated Practice of 100 t/h but an actual average performance of 85 t/h. The theoretical improvement potential is 15 t/h. This value can be converted into either improved sales or in reduced specific energy consumption.

**Figure 3. The Process Based System Model (PBSM) applied for sustainable cement and concrete development.**




Source: Isaksson 2021

If the improvement potential is of substantial value, the Opportunity Study goes to the next stage of Analysing (see Table 1). With sustainability, even when dealing with concrete and measurable performance such as the carbon footprint it could be difficult to establish both current performance in the value chain and the target. An Opportunity Study consists of the steps of Diagnosing, Analysing, Solving (DAS). Diagnosing is based on understanding the context by defining the process that is studied and the process dimensions which are relevant. Diagnosing relates to Understanding-Defining-Measuring and could be presented as matrix (Isaksson, 2021), see Table 1.

**Table 1. Matrix for combining the Opportunity logic DAS with the first three steps of UDMCL**

| | Understanding | Defining | Measuring |
|---|---|---|---|
| Diagnosing | | | |
| Analysing | | | |
| Solving | | | |

Source: Isaksson and Rosvall (2021).

Measuring sustainability in the true sense is about assessing the impact of a stakeholder on three systems encompassing the dimensions of Environment, Social & Governance (ESG), which is also in line with systems theory that "attempts to better understand the behaviour of complex systems that run through cycles of relatively long periods of equilibrium, order, and stability interspersed with relatively short periods of instability and chaos after which new orders emerge", (Rotmans et al. 2009:185). The key characteristic of systems theory is its acknowledgement of complexity while assessing, valuing and examining phenomena that usually cannot be understood as a set of measurements of constituent parts: a quantification that yields indicators and a seeming specificity but doesn't give an understanding of the complete picture. The second key characteristic of systems theory is emergence that postulates "global properties defining higher order systems, structures or 'wholes' can in general not be reduced to the properties of the lower order subsystems or 'parts'" (Heylighen, 2010:1). From the perspective of understanding and measuring sustainability as it exists today, then, a higher level of organisation by default allows the emergence of new properties that can only be understood as "structures and patterns of self-organisation in a complex system." (Goldstein, 1999). Diagnosing the potential for sustainability within an organisation, and as part of set of complex organisational processes, having a potential to self-organise, requires a clear understanding of the studied process interfaces and the KPIs that performance can be measured with. To work efficiently with improvement, we need to be able to identify the vital few indicators that describe process sustainability. Isaksson and Rosvall (2021) present a first proposal for elaborating Diagnosing (see Table 2). The proposal in Table 2 has only been tentatively applied for cement sustainability and without exemplifying all the elements. E.g., the System Principles from the Framework for Strategic Sustainable Development (FSSD) (Broman and Robèrt, 2017) have not been utilised in Isaksson and Rosvall (2021) and neither have the Planetary Boundaries nor the UN SDGs been mentioned. The Table 2 could be seen as a draft proposal that needs to be further studied and tested by different examples.

The purpose of this study is to discuss Diagnosing of Understanding-Defining-Measuring for common value chains to verify relevance of model elements and of the sensemaking that the model can create. More specifically the research questions are:

RQ1: How could the D-UDM matrix in Table 2 be improved?

RQ2: How do applications of Table 2 on some chosen processes look like?

**Table 2. Diagnosing with Understanding-Defining-Measuring**

| | Understanding | Defining | Measuring |
|---|---|---|---|
| D | Setting scope for value chain and parts of it by using the PBSM<br>Identifying main sustainability stakeholders and main impacts on them by referring to the UN SDGs, the Planetary Boundaries Framework and the system principles from the Framework for Strategic Sustainable Development (FSSD)<br>Defining the qualitative improvement potential as the difference between possible and/or required performance and current performance | Based on the Pareto principle define the vital few stakeholders and impacts on them in terms of stakeholder needs that can measured<br>Focus on People and Planet needs and convert this to a proposed definition that can be operationalised | Measure sustainability as a state and sustainable development as change<br>Identify value and harm indicators – the KPIs (y-values) that can be used to describe current sustainability and the sustainability performance over time<br>Value and harm are expressed in terms of impacts on People, Planet and Profit<br>KPIs should be expressed in absolute and relative terms<br>Assess the quantitative improvement potential for chosen y-values in terms of level and rate of change |

Source: Isaksson and Rosvall (2021).

## 2. Method

The D-UDM matrix in Table 2 is used as a starting point for some chosen processes that describe common value chains. The chosen processes are building, education, health care, and tourism. The value chain of building has been chosen due to the familiarity of it that the main author has, but also because the value chain plays an important role in the context of sustainability. The value chain is responsible for some 40% of global carbon emissions and being provided with shelter is a basic human need. Education is important for supporting employability but also for providing the competence needed to work with sustainable development. Health Care is increasingly important, especially in countries with aging populations. The tourism value chain is controversial with both important value generation and important footprints. Globally tourism provides some 10% of the global national product and is responsible for some 8% of global carbon emissions.

Results in the form of Tables that are proposed do not have any indication of source. That is lack of source means that this is a proposed interpretation. The results are presented with a more detailed focus for the building value chain where previously, more work has been done. The results from the building value chain are then used for a first review of Table 2.

## 3. Results

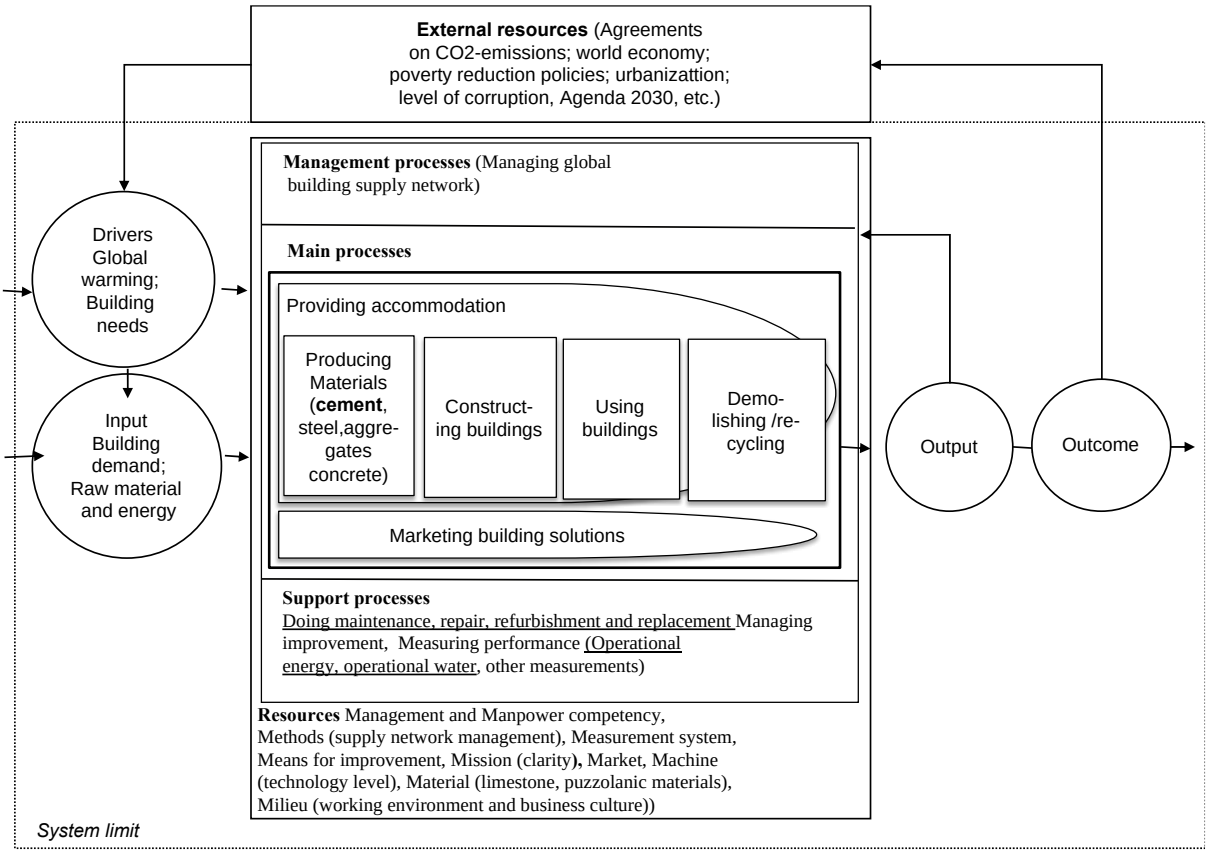
### *3.1. Diagnosing the building value chain*

The work is done by following Table 2 starting with Understanding and then followed by Defining and Measuring.

#### *3.1.1 Understanding the building value chain*

Setting scope for value chain and parts of it by using the PBSM. The main purpose of the Process Based System Model (PBSM) is to create a common picture of the process studied. In Figure 4 the global building value chain from cradle to grave is presented as an adaptation based on the European standard 15978 (2011). The PBSM follows common process notation with management, main and support processes. The PBSM also includes a resources element, which is important to distinguish between the networks of activities and the resources which are there during several process cycles.

**Figure 4. The Process Based System Model (PBSM) applied for the building value chain adapted from EN 15978 (2011).**




Source: Isaksson and Rosvall (2021).

Identifying main sustainability stakeholders and main impacts. The Quality Management logic of focus on customers has in Isaksson (2021) been translated into stakeholder needs focus. The final stakeholders are humanity (People) and nature (Planet). The Pareto principle is used to identify the vital few impacts that can form the content of a first definition. Since climate is one of the two Planetary boundaries which on its own could derail the stable Earth system (Steffen et al. 2015) and Climate Action is SDG goal 13, effects on climate can be seen as an

important impact. The "stakeholder" here is the Atmosphere, and the stakeholder need is stopping the increase of greenhouse gases. The first System Principle is: "In a sustainable society, nature is not subject to systematically increasing concentrations of substances extracted from the Earth's crust" (Broman and Robèrt, 2017). Following this means that there should be no net addition of greenhouse gases. A brief materiality analysis shows that greenhouse gases are significant for the building value chain, where carbon emissions are coming from cement production and from heating and cooling buildings. About 40% of the global carbon emissions are from buildings (Dixit, 2019). Here, we have focused at the important process of providing residential buildings as an example. This enables us to clearly combine value produced with harm caused, as in the more generic version of Eco Efficiency called Value/Harm that compares user value with global harm (Isaksson et al. 2015). Providing shelter is a human need, which means it should be affordable. The two main sustainability stakeholders and impacts to be included in building sustainability are therefore the atmosphere with a need to eliminate carbon emissions and people with focus on poor people to get availability of affordable housing.

Qualitative improvement potential for carbon emissions and for housing affordability. The target for carbon emissions in housing is a net zero carbon footprint latest 2050. In Sweden all operations should be carbon neutral until 2045. This means carbon neutral building materials and carbon neutral heating and cooling. The overall current situation is that about 40% of global carbon emissions or about 16Gt of $CO_2$ per year are generated in the building process. About 20% of this is due to cement production and of the remaining 80% most can be attributed to heating and cooling. The improvement potential is important and can be broken down to different building processes both for building materials and for the use of houses. The improvement potential for reducing carbon emissions is very high. Here, the opportunity is both for Planet but possibly also for Profit, where new technology could help in providing solutions that also create a good market share.

Targets for affordability could be set based on a ratio between what housing costs compared to average earnings. In many countries there is a substantial need for affordable and proper buildings, especially in developing countries with large slum areas. Globally, the improvement potential is presumably very high.

### *3.1.2 Defining building value chain sustainability and sustainable development*

Defining vital few stakeholders and main impacts. Based on the main stakeholders and stakeholder needs we can present the definition of sustainable residential building as affordable and with a zero-carbon footprint for the value chain (Isaksson and Rosvall, 2020). This obviously is a huge simplification, but one that puts focus on the main impacts and the importance of considering the entire value chain. This is in accordance with the recommendations found in the Global Reporting Initiative (GRI) standard 101. Traditional ways of describing housing sustainability include listing a large number of parameters that need to be considered such as ventilation, location, use of materials, etc. On a more detailed level many of these categorisations and certifications are contributing to improvement. However, if the vital few issues of effects on climate and on affordability in the value chain are not included, then proposed housing sustainability definitions are incomplete. More research is needed to establish the current situation of how business and the research society have interpreted housing sustainability. Preliminary results indicate that both builders and researchers globally have not clearly understood what building sustainability is since definitions often seem to be missing or then they are not addressing the full value chain and the main impacts in it.

Can the definition be operationalised? For carbon emissions it is rather simple to measure performance both as absolute and relative values. Absolute value are emissions of $CO_2$ from the building value chain. The housing functionality can be expressed in units of area of

acceptable housing. The absolute value can be expressed as the amount of building area produced. Relative figures are created with the relationship value per harm. The functional value is compared to emissions and price.

*3.1.3 Measuring sustainability and sustainable development in the building value chain*

Measuring housing sustainability and sustainable development. Sustainability is defined as a state which in this case means that 100% of a population can afford housing that is carbon neutral. This splits into the two parts of affordability and climate neutrality. The target for climate sustainability could be expressed as 0 kg $CO_2/m^2$ housing and year. The current performance for climate and affordability are probably only partially recorded but could be done to present the current level and to quantify the improvement potential.

Setting a target for affordability needs to be done. A rule of thumb often used when buying an apartment or house is that it should not cost more than three years income. Another rule of thumb is that housing should not cost you more than 30% of your income. These approximate rules can be used to calculate the level of housing affordability in different contexts. Even in Sweden with a high standard of living, housing is not affordable. The rental market is dysfunctional with queueing times for having a contract for a rented apartment in places like Stockholm being at about 10 years. Property prices for apartments are high in Sweden making the factor of property prices compared to earnings increase thereby reducing the percentage that can afford reasonable housing. Defining the targets in different contexts is a topic for further research. However, it is possible to set targets for housing, which then can be converted to targets for building costs, building material emissions and for housing energy consumption.

Sustainable development is defined as change that takes us from the current level of sustainability to the defines level of sustainability in time. The change must be rapid enough to avoid irreparable damage to system resources. E.g., the Swedish goal of carbon neutrality in 2045 enables to define the rate of change needed for both building construction and building design (change towards passive houses).

Measuring housing sustainability and sustainable development. Performance is expressed in both absolute and relative terms, see Table 3.

**Table 3. Proposed targets and indicators for sustainability and sustainable development.**

| | Sustainability | | Sustainable development | |
|---|---|---|---|---|
| Indicators | "Absolute" | Relative | "Absolute" | Relative |
| Target affordability | A USD/$m^2$ | 100% of population | B USD/$m^2$ reduction per year | % population increase with affordable housing |
| Target climate neutrality | 0 kg $CO_2$ net emissions in value chain | 0 kg $CO_2/m^2$ building and year | C ton $CO_2$ reduction per year from buildings | D% reduction of kg $CO_2/m^2$ per year |
| Performance over time for different indicators | y=f(time) | | | |
| Performance variation – standard deviation of process over year (s) | $s_y$ | | | |

Targets and indicators should be expressed both in absolute and relative terms. In table 3 absolute has been put into brackets since proposed indicators for affordability are relative. Here, presenting the total cost of building would not be relevant, whereas it is relevant for carbon emissions. The A to D in Table 3 indicate specific targets that need to be calculated for the context chosen.

*3.1.4 Summarising Diagnosing-UDM for the building value chain*

We could apply Table 2 without any major problems for the building value chain. Work with Table 3 could have been easier with a specific example where we could have established the factors A to D. This is part of future research. The work here was mostly based on substantial earlier work with the building value chain over the last 10 years. It is therefore not surprising that it was possible to propose targets and indicators for building sustainability. With these indicators and targets it is possible to describe a quantitative improvement potential for the value chain in a chosen context. This could be the global value chain for residential building or a regional value chain. Further research here is planned in studying the value chain of Region Gotland in Sweden. The important question is if this approach for clarifying Diagnosing can be extended to other areas.

*3.2. Diagnosing the processes of education, health care and tourism*

These three areas have been subject to some recent studies with focus on understanding what quality and sustainability could be in these processes.

**Table 4. Purpose and interfaces with processes for education, health care and tourism**

| Processes Providing: | Purpose | Input | Output | Comments |
|---|---|---|---|---|
| Education | Ensuring that every person reaches a defined minimum level of education and additionally that every person can fully exploit their learning capability over their entire lifetime | Person entering pre-school | Person that is finished with education | Sustainable education caters for learning needs over the entire life span |
| Health Care | Providing needed health care during all stages of life | A child that has been conceived | A deceased person | Sustainable health care provides for the needs of everybody from conception to end of life |
| Tourism services | Providing experiences and earning money for the organisers while taking care of tourism resources | A tourist starting planning of trip | A tourist that has come back home | Important that out- and inbound travel are included |

*3.2.1 Understanding education, health care and tourism*

Setting scope. The first thing to do is to agree on the purpose of the chosen processes. This information can then be translated to the process that delivers the value that leads to the purpose. Interfaces of this process are chosen interpreting cradle to grave. Results of the analysis of purpose and interfaces are presented in Table 4.

Main stakeholders and stakeholder needs are identified based on the Pareto principle. There are some differences with the processes. Education and health care are human rights whereas tourism could be seen as an extra, a luxury item. This has some effect on the identification of main stakeholders, especially for tourism processes. In the context of viewing sustainability as a ratio of value per harm this needs to be elaborated to a ratio between the sum of stakeholder value and the sum of stakeholder harm. In all studied processes there are several groups of stakeholders that are here defined as those people or entities that are affected or can be affected by the studied value chain. With entities we highlight the need of going beyond stakeholders as humans only. We see nature and different parts of the planet as stakeholders. Isaksson (2021)

divided Planet as a stakeholder into atmosphere, biosphere, and the lithosphere. All of these are affected by human activities and all of them can affect humans. When we affect the atmosphere with emissions of greenhouse gases, chemicals, and particles the atmosphere and its eco-system services are changed. Greenhouse gases increase the global temperature, a reduced ozone layer leads to problems with more radiation and particles in the atmosphere can change levels of sunshine and cloud formation. Even changes we do in the Earth's crust, have effects in the form of ground water availability.

**Table 5. Proposed stakeholders and stakeholder needs in education.**

| Stakeholders | Pupils, students, adults, employees and parents; | Next process in educational value chain including employers | Public education | Private education |
|---|---|---|---|---|
| People needs | Achieving personal goals; Wellbeing; Affordable education; Liveable salary | Expected entry competence | Educational level; budget in balance; producing tax payers | Revenue; Good reputation |
| People harm | Working hours and efforts; Cost of services | Minimising time with insufficient competency | Operational costs | Operational costs |
| Planet needs – value adding | Sustainability awareness and competence | Sustainability competence | Leaders of sustainable development | Leaders of sustainable development |
| Planet needs – minimising harm | Carbon and environmental footprint | | | |

**Table 6. Proposed stakeholders and stakeholder needs in Health Care**

| Stakeholders | Patients | Employees | Public health care | Private health care |
|---|---|---|---|---|
| People needs | Good health; Good availability and affordability of health care | Reasonable working hours and salary; Wellbeing | Budget in balance. | Revenue; Good reputation |
| People harm | Waiting time, lack of access; Cost of services; Lack of necessary treatment | Working hours and efforts; | Operational costs: population health status | Operational costs |
| Planet needs – minimising harm | Medical waste | Medical waste | Energy and material consumption | Energy and material consumption |

With a defined value chain, we can tentatively identify the main stakeholders and their needs. In Table 5 we have proposed the main stakeholders in a global context for the value chain of education. The review of the educational value chain in Table 5 is repeated for proving Health Care in Table 6 and for providing tourism services in Table 7.

Defining the qualitative improvement potential. In a global context education, health care and tourism are not sustainable. For education and health care the value delivered is insufficient. SDG 3 – Good Health and Wellbeing and SDG 4 Quality Education signal important targets for these two areas that still are to be achieved. Tourism is in some of the SDGs mentioned to achieving other goals and generally as a way towards SDG 1 No Poverty. Tourism can

contribute to SDG 8 Decent Work and Economic Growth. On the other hand, it is a problem due to climate effects from flying. The improvement potential for tourism as for the education and health care is in producing more stakeholder value while reducing the footprints. For education and health care the user needs are in focus whereas for tourism the user tourist is one of several important stakeholders. For all three value chains there is a substantial improvement potential.

### *3.2.2 Defining sustainability and sustainable development in education, health care and tourism*

Defining vital few stakeholders and main impacts in education, health and tourism. The proposed definitions are tentative and based on reasoning starting from identified global People and Planet needs.

The SDG 4 states: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." With some rewording this is a good enough definition for the value created. It identifies people of all ages as learners. The definition also indicates that education should be equitable which can be interpreted as affordable. This means that educational costs constitute an important harm. We suggest educational sustainability as: "Inclusive quality education and lifelong learning opportunities for all".

The SDG 3 states: "Ensure healthy lives and promote well-being for all at all ages". The value is defined whereas harm is not directly mentioned. However, with reference to all it means that health care costs are an important harm. To emphasise affordability we propose sustainable health care as: "Healthy lives and equitable well-being for all at all ages". Both for education and health care we can use the definition from the UN SDGs as a base. For tourism the issue is a little bit different and there we would focus more on the economic effects of tourism.

The SDG 8 states: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all". The target 8.9 focuses on tourism: "By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products". The license to operate for tourism in a resource scarce world lies in the effects it can have in creating employment, reducing poverty, and supporting cultural and natural resource conservation. This could be seen as an example of how there is a shift from customer focus to stakeholder needs focus (Isaksson, 2021). Sustainable tourism needs to focus on several stakeholders. To attract the money, there needs to be focus on customers, but to make tourism sustainable this is not enough. In addition, tourism needs to contribute to satisfying other stakeholder needs while minimising footprints. The two planetary boundaries that are most critical are climate and biodiversity. Tourism affects mostly climate since a large part of tourism includes flying. Tourism could also affect biodiversity both positively and negatively. Travel to national parks in poor countries can help in providing the necessary economy for maintaining natural resources. The third impact mentioned in Isaksson (2021) that always should be checked is the effect on poverty. The text in 8.9 above does not specify what sustainable tourism is but identifies creation of jobs and promoting local culture and products. Possibly the word sustainable is supposed to include effects on climate and biodiversity.

Our proposed definition of sustainable tourism is: Tourism that reduces poverty, respects cultural heritage, and maintains or increases biodiversity with a zero net carbon footprint.

### *3.2.3 Measuring sustainability and sustainable development education, health care and tourism*

In Table 8 we have proposed sustainability indicators for education, health care and tourism based on the proposed definitions.

**Table 7. Proposed stakeholders and stakeholder needs in providing tourism.**

| Stakeholders | Tourists | Employees | Local people and nations | Entrepreneurs |
|---|---|---|---|---|
| People needs | Experiences; Affordability; Contributions to preservation (good conscience) | Reasonable working hours and salary; Wellbeing | Contribution to GNP | Revenue; |
| People harm | Health risks; Quality problems | Working hours and efforts; | Disturbance and effects from tourism; Damage to culture and cultural artefacts | Operational costs |
| Planet value | Individual contributions | Possibility to work with conservation and restauration of nature | Income: Contribution to preserving nature | Company contribution; Branding |
| Planet needs – minimising harm | Carbon emissions; Energy consumption; waste; loss to biodiversity; water consumption | Ecological footprint | Effects on natural heritage | Carbon emissions; Energy and material consumption |

**Table 8. Proposed sustainability indicators.**

| Value chain - providing | Sustainability indicators | Sustainability metrics | Comments |
|---|---|---|---|
| Education- value | Qualification for higher learning<br>Employability and salary<br><br><br>Sustainability competence | % of population;<br><br>% employed after six months with job that corresponds to qualifications<br>Contribution to sustainable development | The perfect learning teaches the right thing in the right way. The right thing should include relevant sustainability competence. |
| Education – harm | Time used;<br>Money spent<br>Carbon footprint | Years<br>US$<br>Tons of $CO_2$ | Harms could possible in specific cases be turned into monetary units |
| Education value/harm | Employability and salary/time and cost | | Employability and salary could be turned into indices as could time and cost. The ratio could then be turned into sustainability metrics |
| Health Care - value | Life expectancy;<br>Good health | Years;<br>Perceived health status and years | |
| Health Care - harm | Cost;<br><br>Availability | US$; % of yearly income;<br>Waiting time in days | |
| Health Care value/harm | Life expectancy/Cots | Years/per capita cost | |
| Tourism - value | Revenue;<br>Money stream that goes to poverty alleviation;<br>Support for maintain nature and culture | US$ total and to poverty alleviation; % of revenue that goes to poverty alleviation;<br>Value of support for nature and culture | |
| Tourism - harm | Carbon footprint | Ton of $CO_2$ | |
| Tourism value/harm | Revenue par carbon footprint | US$/ton of $CO_2$ | |

*3.2.4 Summarising Diagnosing-UDM for education, health care and tourism*

The review of Table 2 for the value chains of education, health care and tourism has been partial. Instead of the PBSM only input and output of the value chain has been indicated. At this overall level deciding upon interfaces is enough to propose definitions and measurements for sustainability. Only the level of sustainability has been indicated. Sustainable development can be defined as the rate of change of the chosen indicator. This requires an agreement of when a level of sustainability should be achieved. Some milestones to provide a rate of change needed can be deducted from SDG targets. This has been left for future research.

The indicators and metrics proposed in Table 8 need to be tested in specific contexts and they probably need to be modified. Still, at an overall level the logic of focusing on main stakeholders and their main needs seem to result in proposed indicators and metrics that can be used in further research. Using these metrics will enable diagnosing the improvement potential in chosen processes for education, health care and tourism.

## 4. Discussion and Conclusions

The purpose of this paper is to develop the step Diagnosing by discussing it in the three stages of Understanding-Defining-Measuring presented in Table 2. The proposed answer for "How could the D-UDM matrix in Table 2 be improved" (RQ1) is presented in Table 9. The proposed answer for: "How do applications of Table 2 on some chosen processes look like?" consists of a summary of the findings in Tables 3-8.

### *4.1 A proposed matrix for Diagnosing of Understanding-Defining-Measuring Sustainability and Sustainable Development*

**Table 9. A proposed matrix for D of UDM**

| | Understanding | Defining | Measuring |
|---|---|---|---|
| D | Scope using value chain from cradle to grave by defining input and output<br>Identifying main sustainability stakeholders, their value needs and the harms they are subjected to by referring to the UN SDGs, the Planetary Boundaries Framework and the system principles from the Framework for Strategic Sustainable Development (FSSD)<br>Defining the qualitative improvement potential as the difference between possible and/or required performance and current performance | Based on the Pareto principle define the vital few stakeholders, value needs and harms caused<br>Focus on People and Planet needs and convert this to a proposed definition that can be operationalised | Measure sustainability as a state and sustainable development as change<br>Identify value and harm indicators – the KPIs (y-values) that can be used to describe current sustainability and the sustainability performance over time<br>Value and harm are expressed in terms of impacts on People, Planet and Profit<br>KPIs should be expressed in absolute and relative terms<br>Assess the quantitative improvement potential for chosen y-values in terms of level and rate of change |

In Table 9 the new proposed Diagnosing of UDM matrix is presented. The PBSM has been omitted. It is more logically part of analysing where it has a role in making sense of analysing. The FSSDs were not used in the exemplified cases, but they still should be retained as the ultimate test of sustainability. Stakeholder value and stakeholder harm have been highlighted more clearly. For other parts the reviewed Table 2 has been confirmed as relevant.

*4.2 Testing D-UDSM in different applications*

The four cases consisting of the value chains of building, providing education, providing health care and providing tourism have been tested using the proposed D-UDSM in Table 10. This is based on Table 9 with some summary added based on findings in Table 3-8.

**Table 10. Visualising Diagnosing for different value chains based on the Diagnosing of Understanding, Defining, Measuring (D-UDM)**

| Value chain of | Understanding | Defining | Measuring (value/harm) | Summary improvement potential |
|---|---|---|---|---|
| Building | Main values are shelter and infrastructure and main harm is climate effect | Affordable with zero-carbon footprint | Living space per price and carbon footprint (Infrastructure per price and carbon footprint) | 16 Gton of CO2/year<br>Huge deficit in appropriate housing |
| Providing education | Main value is the right to learn and main harm the cost of learning | Inclusive quality education and lifelong learning opportunities for all | Realising educational potential and employability | The percentage and number of dropouts<br>Percentage of those that cannot read and write |
| Providing health care | Main value is the right to health and main harm the cost of it | Healthy lives and equitable well-being for all at all ages | Life expectancy at birth compared to yearly costs | Number of people not attaining a target age |
| Providing tourism | Main values are reducing poverty, preserving nature and culture and increasing biodiversity with the main harms being the climate effect and loss of biodiversity | Tourism that reduces poverty, respects cultural heritage, and maintains or increases biodiversity with a zero net carbon footprint | Tourism revenues compared to footprints<br>Revenue going to poverty alleviation. | Current carbon footprint<br>Lost poverty alleviation opportunities. |

The proposed sustainability opportunity study and the initial step Diagnosing aims to redirect and guide organisations and actors engaged in the pursuit of sustainable development. By sorting out the few vital sustainability effects as a first critical step, a common direction for sustainable development can be pursued effectively and efficiently. This first iteration of D-UDM in various value chains highlights the need of understanding for the purpose of the organisation and the context of the value creation. With regards to the affordability challenge as part of the people harm it is inevitable to question the purpose of profit maximization for

organisations. Can an organisation be sustainable while pursuing profit maximization? The declaration of a living purpose for organisations and the positioning as a sustainable organisation will require thorough scrutiny, in which the D-UDM can contribute. Further research could also study the similarities and differences between the stakeholder- and materiality analysis recommended in GRI sustainability reporting and the D-UDM.

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