



Quality for Sustainability (Q4S) - The case of Sweden

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Purpose of the paper: Most countries are struggling with quality and sustainability problems. When studying suggested proposals, (Total) Quality Management is not clearly present. This raises the question: Is (T)QM relevant in solving current quality problems and in supporting

sustainable development? The purpose of this paper is to study how (T)QM could support Sustainable Development and how Swedish sustainability potential could be assessed.

Methodology: Sweden, as a sustainability leader, is used as a case study. (T)QM in this paper is mainly based on ISO 9000 quality principles. The quality principle focus on customers is changed to focus on system needs. The focus on systems enables identifying the system purpose while identifying various stakeholder needs. The Pareto principle is used to deal with conflicting stakeholder wants and needs. We use the Sustainability Opportunity Study (SOS) logic, with an emphasis on its Diagnosing component, in trying to Understand, Define and Measure what national sustainability could be. The approach is conceptual, and the results have been formulated in discussions with quality professionals.

Main Findings: Results suggest that (T)QM could support sustainability through system sensemaking, based on the Pareto guided focus on system purpose. This is used to identify the right thing to focus on, in the studied system. The TQM inspired system-based change theory is called Quality for Sustainability (Q4S) and supports in doing the thing right. Swedish sustainability is defined as: "At least having satisfied citizens with their needs being provided while being carbon neutral and taking global responsibility for sustainability with focus on extreme poverty and peacekeeping." The potential for Swedish carbon reductions has been indicated as an example of how a complex system can be simplified to a measurable potential.

Practical implications: Results provide a roadmap for understanding sustainability on a national level which could promote organisations, such as universities, in facilitating the necessary support with education, research, and societal cooperation.

Originality/value: The novelty is in applying the outside-in perspective based on a needs focus in combination with the Pareto principle of the vital few sustainability impacts at the national level.

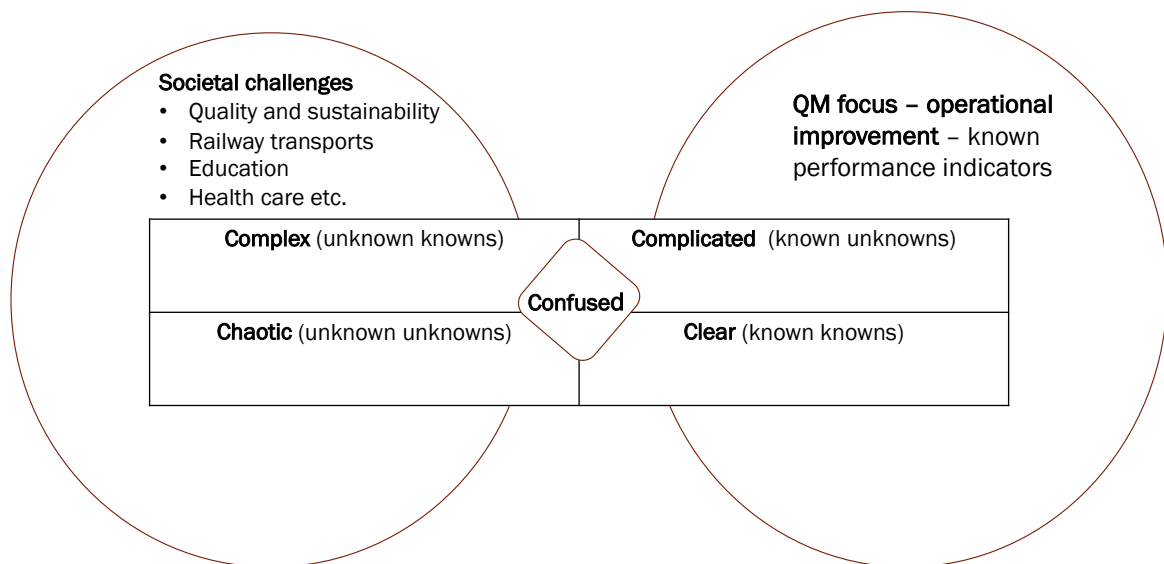
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1. Introduction to quality and sustainability

This research relies on previous work with the Sustainability Opportunity Study (Isaksson, et al., 2023) and practices associated with it, such as the Process Based System Model (Isaksson, 2006, 2019). The original inspiration came from the 26th EISIC conference in Paisley, August 2023, where the keynote speaker, Professor Amanda McKay, at that time research director of the British AWE (Atomic Weapons Establishment), highlighted the problem of a disappearing quality profession. Further discussions were conducted with Professors Jacques Martin and Stan Karapetrovic. The idea of national quality was discussed using Sweden as an example. The notion was raised in the context of the Swedish Quality Management Academy (SQMA), a cooperation forum between Swedish universities teaching and researching quality. The SQMA holds biannual meetings. The spring workshop, April 24-25, 2024, in Visby, Campus Gotland, Uppsala University, focused on the issue of the future of quality with Stan Karapetrovic as a keynote speaker. Another presentation by Max Rosvall and Raine Isaksson presented a working hypothesis of today's complex quality problems, exploring where TQM might support clear and complicated problems, see Figure 1.

Figure 1. An interpretation of the Cynefin framework presented on SQMA in Visby, April 25, 2024.



The important societal challenges described as Complex and Chaotic in Figure 1, could be outside of the current programs and practices in contemporary TQM.

The topic of how to view TQM created general interest in the SQMA-meeting and some of the researchers decided to go forward with the "Grand Challenge" of Swedish national quality as a conference paper for EISIC 27 in Bergamo. The researcher group has grown during the work.

The Quality Movement in Sweden peaked about 1995-2000 with Total Quality Management (TQM) as an umbrella for Process Management and Six Sigma. At this time Lean started taking over as a buzzword. Quality Awards became Excellence Models, showing organisations taking some distance to the word "Quality", because of apparent overuse and because it was seen as adding bureaucracy and stifling innovation. ISO 9001:2000 provided a Quality Management Standard with principles very closely related to TQM.

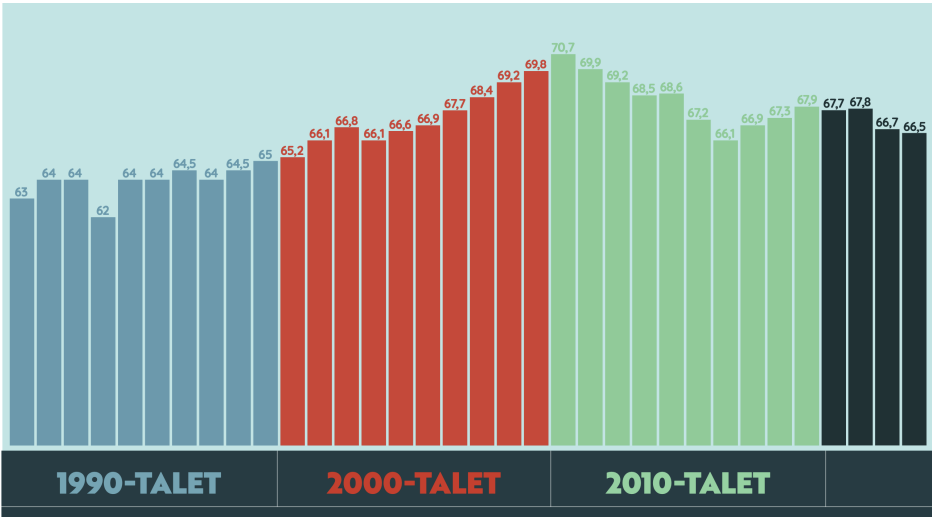
During the last 25 years there has been a slow decline of interest in (T)QM, which is now usually referred to as QM in Sweden. The shift from TQM to QM has been organic and there

seems to be no clear agreement of what the difference is, if any. TQM could possibly be seen as an era of QM. The most frequently used book on Quality Management in Swedish quality education - *Quality from Customer Needs to Customer Satisfaction* – still uses the term TQM (Bergman et al., 2022). We do the same and continue from here on using TQM as an input to what we have decided to call Quality for Sustainability (Q4S).

Both Quality and Sustainability could be seen as levels, meaning that we could speak about low or high levels quality and sustainability (Isaksson, 2013). Quality Management and Sustainable Development could be seen as change processes changing the level of Quality and Sustainability. Both Quality and Sustainability might be hard to interpret requiring sensemaking of the “What” to change. TQM could provide a systematic structure to help both with sensemaking (identifying the right thing – the “What”) and the change process (doing it the right way – the “How”). Sweden forms a good case study for trying to understand national quality and sustainability.

One possibility is that there is a reduced interest in Quality because most quality problems have been solved. The first question is therefore if interest in TQM is disappearing because it is not needed. In Roundtable discussion at the 27th EISIC Conference in Bergamo with Professor Yossi Raanan and Associate Professor Raine Isaksson as chairmen there seemed to be a consensus that quality problems in different fields were pertinent, but that TQM and its likes were not applied as solutions. The picture from Sweden is similar. The country is struggling with a set of quality problems, such as poorly working railroads, problems with low basic school performance, increased gun violence, serious problems with health services and generally perceived poor service quality in frequently used services such as banking, travel, and insurance. Often AI has been introduced in various services more for cost savings and perceived novelty than for improving customer satisfaction. Swedish quality performance today in many fields is probably better than before, but it is not meeting customer expectations. This suggests that there remains a need to focus on quality in Sweden. An indication of the potential decline is presented in Figure 2 based on the Swedish Quality Index (SKI, 2023).

Figure 2. Service quality in Sweden as measured by the Swedish Quality Index integrating chosen areas of services (SKI, 2023); Hallencreutz and Parmler (2019); Hallencreutz et al. (2024).



An interpretation of Figure 2 could be that perceived quality peaks around 2010. Speculatively, the increase between 2000-2010 could be seen as resulting from a quality focus.

The decline could be due to lost attention on customer perceptions and due to quality education losing ground and quality professionals retiring.

This leads to a second question: Is TQM relevant in solving current quality problems? TQM is well defined in literature. The American Society of Quality writes about TQM saying: “A core definition of total quality management (TQM) describes a management approach to long-term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work” (ASQ, 2024). ISO 9000 defines the seven Quality Management principles as:

- QMP 1 – Customer focus
- QMP 2 – Leadership
- QMP 3 – Engagement of people
- QMP 4 – Process approach
- QMP 5 – Improvement
- QMP 6 – Evidence-based decision making
- QMP 7 – Relationship management

The ISO Quality Management principles have their origin in TQM. QMP 1-6 are used in the cornerstone model presented in Figure 4, where TQM is linked to sustainable development. QMP 7 - Relationship management is not part of the model, but could be seen as a practice that supports focus both on suppliers and customers.

Apart from quality problems there is increased focus on sustainability and sustainable development. These expressions are often mixed up at the highest level. An example is from the UN Sustainable Development Goals, which define sustainability by referring to the Brundtland commission definition from 1987. This is a definition of sustainable development, not sustainability. A simple semantical analysis suggests that sustainability could, like quality be seen as a state, while sustainable development indicates a change of that state. We see sustainability as a state and sustainability as the change process towards a state of sustainability (Isaksson et al., 2023).

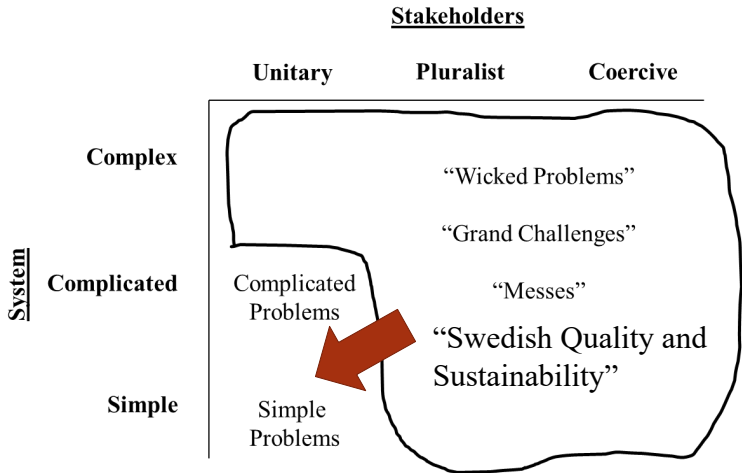
Several authors have argued for synergies between quality and sustainability, which is logical, e.g., Garvare and Isaksson, (2001); Isaksson, (2006); Zink, (2007); Garvare and Johansson, (2010); Asif et al., (2011); Siva et al., (2016); Martin et al., (2020). Systematic improvement work for quality and sustainability should have strong synergies. When studying suggested national improvement proposals for quality and sustainability, TQM does not seem to play any significant role. The answer to this could be that TQM is not relevant for contemporary quality and sustainability challenges, or that the quality movement has failed in promoting TQM as a solution, or both.

It could be that TQM has the power to solve quality and sustainability challenges but that changes are needed for this to happen. There could be a parallel with environmental problems where the high visibility of typical problems in the 1960s and 1970s led to remarkable attention and improvement in the Global North. The environmental problems in rich countries today are more distant in time and place and therefore not immediately visible making them more complex and easier to ignore than problems obvious to the senses. This is highlighted in the Club of Rome report *Limits to Growth*, pointing out that humans tend to focus on here and now (Meadows et al., 1972). We generally have difficulties in getting engaged in topics where cause and effect are distant in time or space. Similarly, quality challenges could have gone from simple to complex where understanding what quality is might not be obvious and where old quality programs might not work. This raises the question, if modifications to TQM are needed to deal with complex challenges?

In a simplistic way we could say that the perfect process does the right thing in the right way over time. The right thing in today's context includes focusing on needs of customers and other stakeholders including nature. A polluting factory with low quality performance can be dealt with traditional systematic improvement using various improvement programs. The output performance - the y-values are known - and causes can be found. TQM is mostly about doing things in the right way and assumes that there is a common understanding of this. Dahlgaard et al. (2019) state that about 88% of QM work is about doing the thing right. A version of TQM could be a Lean Six Sigma program. The practices and tools in these programs are designed to work with known output.

In many cases agreeing on performance measures might not be easy. How will we measure quality and sustainability of a university, an insurance company, of buildings, of tourism? Without clear performance indicators using TQM is not obvious. Some of the mentioned Swedish national problems, like poor railway performance, could in theory be solved using e.g., Lean Six Sigma. In this case we have a clear y-value in the form of train arrival accuracy where arrival in time is defined as less than five minutes late. It is in the analysis of causes where it becomes complex. The overarching problem seems to be under investment in maintenance and lack of investment in new railway capacity. The combination with increased passenger and goods transport needs in a more stressed and less reliable system leads to poor performance. This points at poor management at the national level and the problem of not focusing on things where cause and effect are distant in time. The Swedish national business organisation estimates that the Swedish railway maintenance backlog could be more than US\$ 8 billion. Maybe Swedish governments have and have had an insufficient competence, which has led to lack of management commitment in long range problems, where instead short-sighted savings have enabled using funds for election winning issues? For Lean Six Sigma to work there needs to be management commitment. Improving poor railway services has so far not been an election issue. Railways in Japan still work like they used to do in Sweden.

Figure 3. An interpretation of how complex, pluralist, and coercive problems based on Rosvall (2024) could be related to the solving of "Grand Challenges" such as Swedish Quality and Sustainability.



Could Lean Six Sigma solve the problem of poor healthcare performance or quality and sustainability in universities? Probably not, since here the output is not clear - we do not have agreed y-values. We do not agree on what the right thing is. In this sensemaking, TQM is of limited help. Starting with brainstorming in a system that does not understand itself will probably not lead to finding a common description, the WHAT of quality and sustainability.

If societal challenges with quality and sustainability are complex and chaotic instead of clear and complicated, then contemporary TQM, with a focus on doing the thing right, will probably not be relevant. TQM would need to be complemented with practices and tools for sensemaking to identify the What to improve. Complex problems could be seen as those where we do not agree upon the output, outcome, or the y-values. We could see complex problems as "Wicked Problems", "Grand Challenges" and "Messses" which can be related to a categorisation of different types of problems as described by Rosvall (2024), see Figure 3. Contemporary TQM might only be able to handle unitary simple and complicated problems. When focus goes from customers to stakeholders we end up with pluralist and coercive views which makes it hard to agree on the expected system output or the y-value.

With sensemaking we could move at least parts of the "Grand Challenges", as indicated with the arrow in Figure 3, to areas where TQM programs, principles, practices, and tools can be applied successfully. Doing a Sustainability Opportunity Study (SOS) as suggested by Isaksson et al. (2023) is one possible strategy for sensemaking, see Table 1. The SOS is applied when the studied system has no agreed output relevantly describing performance. The simple Opportunity Study consists of Diagnosing the potential, Analysing the causes for the existing potential and Solving, or proposing workable solutions (Isaksson, 2015).

Table 1. Visualisation of a SOS for Swedish sustainability, based on Isaksson et al. (2023). The ideas of Space of Challenges (SOC) in Rosvall (2024) could potentially be of help.

	Understanding	Defining	Measuring
Diagnosing	Scope Sweden? Which are the vital few Q and S effects - Pareto? SOC?	Defining state and planned change of state as sustainable development	KPI for Sustainability?
Analysing	Which are the vital few causes - Pareto? SOC?	Defining main causes	KPI for main causes?
Solving	Which are the vital few solutions-Pareto? SOC?	Defining main solutions	KPI for proposed solutions and project

In the SOS the Diagnosing-Analysing-Solving (DAS) logic is married with the three first steps of the common-sense logic Diagnosing-Analysing-Measuring-Communicating-Leading (Isaksson and Hallencreutz, 2008). The logic says that to lead we need to be able to communicate, which requires performance indicators, which rely on a definition which is based on common understanding. For the part of Diagnosing in the Sustainability Opportunity Study (SOS) we need agreed performance indicators which are based on a commonly agreed definition. In Table 1 we present the matrix combining Understanding-Defining-Measuring (UDM) with Diagnosing-Analysing-Solving (DAS).

Despite various rankings, typically based on adding different indicators to a summary index there seems to be no agreed way of understanding, defining, or measuring national sustainability or national quality. This presents a "Grand Challenge" where the SOS could be used to understand national sustainability. The SOS has earlier been applied on areas such as buildings, but not on a national level (Isaksson et al., 2023).

The purpose of this paper is to study how (T)QM could support Sustainable Development and how Swedish sustainability potential could be assessed. In chapter 2 the theoretical background relating to TQM and the links to SOS are described. In chapter 3 the method, which

is conceptual, is explained. Chapter 4 presents the results of the work done organised based on the two focus areas described above. Chapter 5 takes up conclusions and discussion.

2. Theoretical background

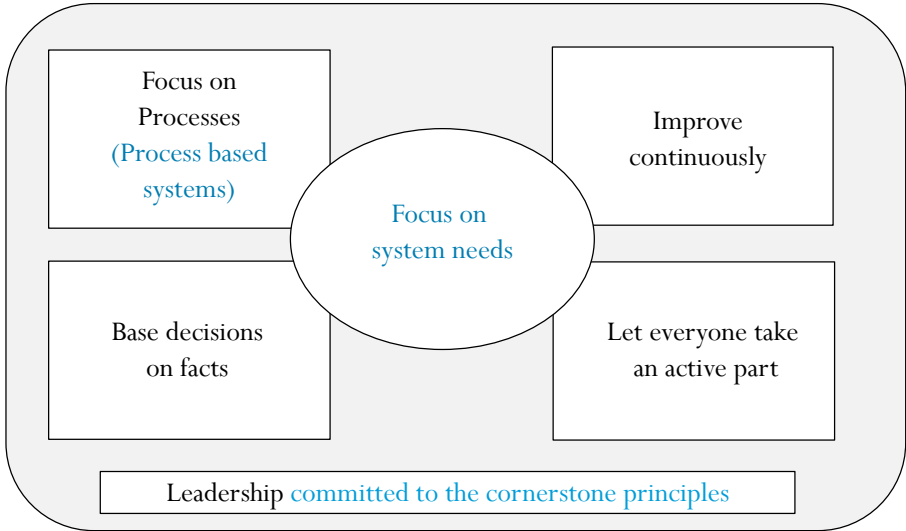
This work originates in ideas presented in an article called "TQM for Sustainable Development - Focus on Processes" by Isaksson (2006). TQM is based on the "Cornerstone Model" in Bergman et al. (2022) with some modifications, see Figure 4. What is presented here could be seen as contemporary TQM. The six "corner stone principles" are like six out of the seven quality management principles in ISO 9000:2015, Quality management systems — Fundamentals and vocabulary. The seventh ISO principle, which is not part of the corner stone model is Relationship management. The principle of customer relationship management could be seen as a practice that supports focus on stakeholders.

2.1 TQM for Sustainable Development

The most important change presented in Figure 4 compared to the original cornerstone is the change from a focus on customers to a focus on system needs. This is where the system becomes a "Grand Challenge", see Figure 3. By enlarging the focus from customers to all stakeholders in a system, TQM becomes sustainable development - change management with focus on the most important customer and stakeholder needs. The challenge is now to understand the WHAT, the right thing, which then leads to systematic improvement, the HOW of doing the thing right with possibly slightly modified programs, principles, practices, and tools.

The process based systems mentioned in Figure 4 is denoting the need of a system focus, which could also be seen as an additional principle. The Process Based System Model (PBSM) is a tool that supports process based system thinking, which means that we can work with system focus via the principle focus on processes (Isaksson, 2019). Focus on stakeholders is like focus on customers dedicated to needs. The leadership commitment in the cornerstone model is interpreted as commitment to the five other principles and not as generic leadership or management commitment.

Figure 4. The cornerstone model which defines TQM principles, based on Bergman et al. (2022). Changes are marked in blue with process based system referring to the use of the Process Based System Model (PBSM).



Deming's System of Profound Knowledge is based on the four parts of system understanding, understanding variation, psychology, and theory of knowledge. It is proposed that system understanding is a core issue. In a previous version of ISO 9000, system approach was one of the principles. We argue that should still be the case. The systems approach is included in the cornerstone model by using processes for system understanding and for setting the boundaries of the system in focus. This can be done with a value chain or more in detail with the PBSM (Isaksson, 2006, 2019), see Figure 5. All value is created in processes, irrespectively if they have been identified or not. This means that we can describe any system at any level with a value chain and with a process model. The PBSM has been compared with and found to comply with the Checkland criteria for a system model (Isaksson, 2006). The PBSM has also been applied in various areas and should work as a support for sensemaking. In the SOS it is used in the part of Understanding Analysing, where the output identified in Diagnosing is linked to the system that produces it. The PBSM includes both networks of activities and the resources needed. There are no processes without resources, which means that they should form part of a PBSM.

2.2 System understanding

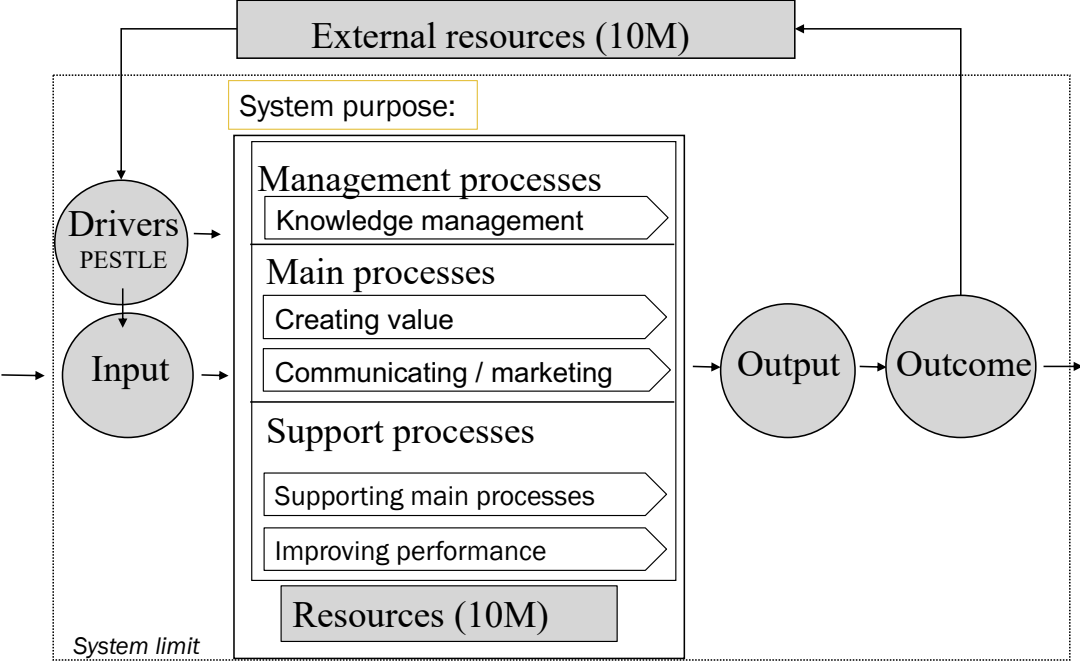
Using the Process Based System Model (PBSM) helps in defining and understanding the system. It includes input, output, and outcome indicators. Understanding variation is part of basing decisions on facts. We need understanding of averages and their variation. Psychology could be interpreted as leadership and relates to leadership of the system and of everybody in the system, making them part of management and improvement. In the PBSM the 10Ms describe a checklist of key resources consisting of Mission, Management, Method, Manpower, Measurement, Machine, Material, Milieu, Market and Means (Isaksson et al., 2024a). Leadership quality can be assessed by personnel surveys (Manpower) and how Management and Method structures look like. The facts-based decisions rely on a good Measurement system measuring the right thing in the right way (Cöster et al., 2020). Finally, the PBSM and its elements could be used to define Knowledge Management as a practical interpretation of the theory of knowledge - what does the system need to know and what can it know.

An important part of system understanding and process management starts by describing the current state, which is a snapshot. This should be an honest picture of the current state of the system. A change process is a different visualisation of a journey for the current state to the visionary state indicated by the sub-process "improving performance" in Figure 5. The PBSM differentiates between output which is the measurable system output and outcome which is the level of stakeholder satisfaction. The outcome generates feedback in different forms, which is then filtered through the external resources. The external resources depend on the system context. For Sweden the context is the developed world, the Global North and outcome needs to be dealt in a way agreed upon in this context. Sweden needs primarily to refer to the European Union rules, regulations, culture, and expectations. Studying national sustainability in e.g., Tanzania would have a different context where the same feedback might not lead to any drivers for change.

In Table 1 Understanding Diagnosing, starts with setting the scope, which can be done using a value chain for the system from cradle to grave. In the system the mission needs to be identified and then the main stakeholders and their needs. A common understanding then leads to a definition and to relevant and measurable performance indicators (Isaksson et al., 2023).

The PBSM plays an important role in Understanding Analysing. This is where the important elements that affect output and outcome are identified.

Figure 5. The Process Based System Model. Based on Isaksson (2006, 2019) describing the steady state and indicating the change process as a support process and knowledge management as a management process.



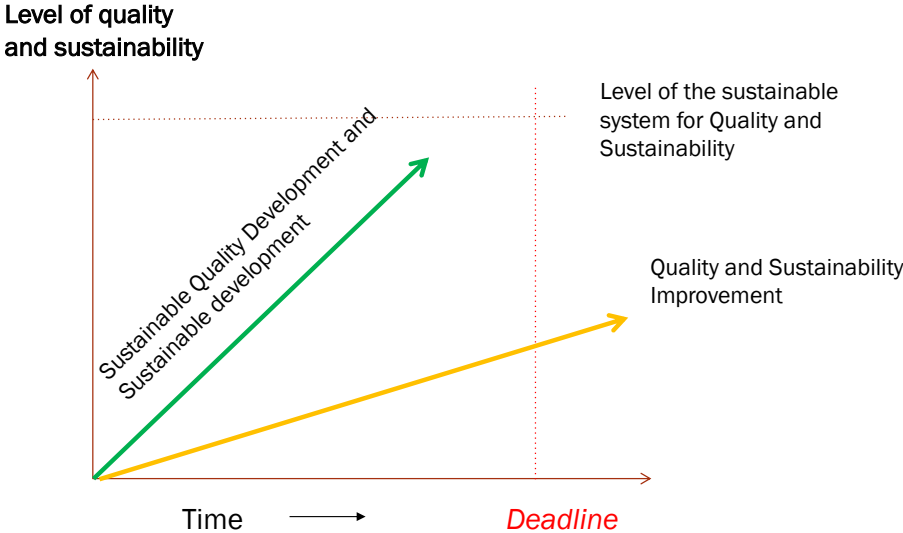
2.3 Relating quality and sustainability

Both Quality and Sustainability are fuzzy expressions with various interpretations. To progress it is necessary to define how expressions like quality, sustainability and sustainable development have been interpreted. Figure 6 presents a simplification based on reasoning which provides us with a good enough definition that enables continued work (Isaksson, 2013). Not all improvement is sustainable development. We can improve sustainability but if the speed is too slow, like with reducing carbon emissions we do not have sustainable development, which we interpret as change management that reaches the level of system sustainability within a required time frame. With carbon emissions we need globally to achieve zero emissions by about 2050. The Swedish national goal is carbon neutrality by 2045. With a sufficient speed of reduction, a country like Sweden could have sustainable climate development. This is only one part of sustainable development, which could be worked with in parallel with other impacts. An important thing is working with the Eco Efficiency or value per harm in a version where value is not only sales value but the total stakeholder value. Harm is the total harm including People and Planet harm which could be such as price and carbon emissions (Isaksson et al., 2015).

The frequently used Triple Bottom Line (TBL) model for understanding sustainability and consisting of the dimensions of Profit, People and Planet could be counterproductive. John Elkington who coined the TBL made a recall of the concept since it has been misused (<https://hbr.org/2018/06/25-years-ago-i-coined-the-phrase-triple-bottom-line-heres-why-im-giving-up-on-it>). The dimensions cannot be added in any sensible way and in practice lead to focus on Profit with some concern provided for People and Planet. Using the Eco Efficiency

which compares Profit in a wider sense as stakeholder value to the People and Planet harm, provides better performance indicators. The value per harm logic is close to the value-based quality perspective of Garvin (1984) where quality is seen in relation to the price. Price could be seen as part of harm which also includes things like working time used and the carbon footprint.

Figure 6. Interpretation of quality, sustainability, quality development and sustainable development. Based on Isaksson (2013).



3. Methodology

In the Sustainable Development Report (SDR, 2024), which tracks performance in complying with UN Sustainable Development Goals, Sweden is nr 2 with Finland as nr 1. Similarly, the Robeco country Environment, Sustainability, Governance (ESG) assessment puts Sweden as nr 2 after Finland (Robeco, 2023). Choosing Sweden and not Finland is partly an issue of convenience, but also related to contemporary Swedish challenges. Sweden is struggling with a set of quality and sustainability problems, such as poorly working railroads, problems with low basic school performance (as based on the Pisa measurements), increased gun violence, and serious problems with health services. This poses an interesting dilemma of visible national quality problems without any particular interest for TQM. The researcher group has had meetings discussing the issue of national quality together and one to one with the plan that this conceptual paper will generate further questions and research proposals.

To create a common understanding a PowerPoint presentation was created proposing basic theory background with continued updates based on the ensuing discussions. The final ppt file was used as an input for Diagnosing Swedish sustainability. Diagnosing is a part of the SOS, and consists of Understanding, Defining and Measuring Diagnosing. Understanding Diagnosing is based on Isaksson et al. (2023) and Isaksson et al. (2024a), see also Table 2. The work starts with defining the scope using a value chain for the entire system process from cradle to grave. This is followed by checking if there are relevant and commonly agreed performance indicators measuring performance and for setting goals. Main stakeholders were identified starting with the recommendation: "... focus on climate, biodiversity and poverty as well as any

other significant harm as identified with the four sustainability principles" (Isaksson et al., 2023). The four sustainability principles are from The Natural Step framework (Robèrt, 2000). Peace was added as a global stakeholder need. People needs have been identified as needs of Swedish and global citizens. The main values and harms for key stakeholders were identified.

Defining Diagnosing was done by using the Pareto principle to produce a proposed definition for Swedish sustainability and sustainable development. Based on the definition, KPIs based on value per harm were proposed.

The steps of doing the SOS are described based on Isaksson et al. (2024a). The roadmap is based on a study of sustainable building in Sweden and is a work in progress. It provides a logic to follow using the SOS matrix in Table 1. The work done here is preliminary and mainly highlighting the challenges.

Table 2. Proposed SOS Roadmap based on Isaksson et al. (2024a).

Activity	Motivation	Comment
Define the overall system to be studied	A system with perceived problems or assumed improvement potential	The scope could be a local process or a global system
Check how sustainability performance is measured	An agreed measurement with targets indicates a mature understanding of sustainability	There will always be some type of understanding. If there are no generally agreed indicators and results are difficult to find without there being any clear targets, then most likely an SOS is needed. Use the Space of Challenges (SOC) logic to define which type of challenge the studied system is (Rosvall, 2024) With relevant KPIs (should be based on value per harm) and data with relevant targets (e.g., Science Based Targets) it will be possible to assess the improvement potential as the difference between current performance and target.
Understanding Diagnosing	Define value chain from cradle to grave Identify main stakeholders and their needs Apply the Pareto principle to identify main value and harm Always check climate, biodiversity, poverty, and effects on peace Use Planetary Boundaries and UN SDGs for further checks	Limit number of sustainability impacts to a vital few knowing that the definition will be: At least ... which leaves room for later changes. The Planetary Boundaries (Rockström et al. 2009) provide a good start for identifying Planet needs. The UN SDGs provide good support covering both People and Planet issues. Profit is a means to an end and is created by providing the best stakeholder needs value for the least harm.
Defining Diagnosing	Propose a definition which relates the value produced to	Value is mostly People value in the form of goods and services but could also be Planet value in e.g., restoration of

Activity	Motivation	Comment
	main harms	wetlands. Harms is both for People and Planet.
Measuring Diagnosing	Define sustainability as a level with chosen indicators and sustainable development as a change process with a specified rate	Sustainability could like quality be viewed as different levels and sustainable development could be seen as a sustainability development which is quick enough to achieve a state of sustainability while the system is still working, like achieving zero net carbon emissions until 2045.
Understanding Analysing	Use PBSM to describe system and use 10Ms as checklist. Use SOC to find out details of Mission, Management and Manpower Use Pareto to single out causes which can be actioned	In a complex system data will mostly be qualitative and implicit. Sensemaking needs to start with understanding the system and its elements including different stakeholders. Further research is needed on providing details for M-criteria and to indicate how SOC can support in identifying power relations and interests (Rosvall, 2024).
Defining Analysing	Suggest main causes to be worked with	Further theory development needed
Measuring Analysing	Propose how to measure the main causes identified	Further theory development needed
Understanding Solving	What competency and agency could be available for solving identified causes? Use SOC to find out relations among key stakeholders.	Further theory development needed
Defining Solving	Suggest a solution which seems feasible for the system studied	Further theory development needed
Measuring Solving	Prepare a business case for the proposed change including time plan	Provided a realistic opportunity can be generated, proposed this to the system management Further theory development needed
From SOS to DASIAS	Provided management interest the proposed opportunity is converted into an improvement project, probably with some modifications	DASIAS (Isaksson, 2015) is a common-sense improvement model where Diagnosing-Analysing-Solving (DAS) describes both an Opportunity Study and the first steps in the improvement process which additionally has Improving-Anchoring-Studying. The SOS can be carried out by consultants whereas the DASIAS should be carried out by stakeholders in the system. This means that a new start including the full DASIAS is needed.

4. Results

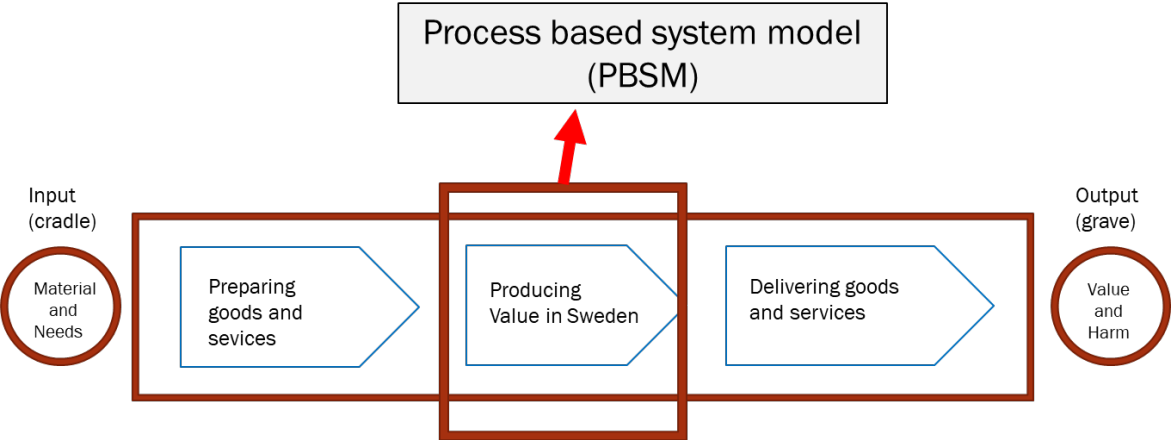
A brief search for national sustainability resulted in several proposed systems, with two of them being the Sustainable Development Report (SDR, 2024) and the Robeco country ESG assessment (Robeco, 2023). These are based on identifying many indicators and adding them up to an index. We could not find any indexes starting with the outside in logic and with focus on the vital few sustainability impacts in a country.

Results are presented based on understanding, defining, and measuring. With the proposed KPIs, a potential for Swedish sustainability is presented.

4.1. Understanding Swedish Sustainability?

The initial discussions on how to view Swedish sustainability and the context were difficult. Nobody had any clear opinion of how to view this. The scope was decided to be the Swedish nation as an organisation among other nations. Scope is defined using the value chain by defining input and output of the studied system. For organisations the business idea is identified. This was not done for Sweden as nation, but this could be an espoused national mission. Following the loci of the SOS in the part of Understanding Diagnosing the first thing is to describe the value chain. In Figure 7 the scope has been set based on the value chain.

Figure 7. Proposed Swedish value chain as part of a global context, based on Isaksson et al. (2024b).



Swedish sustainability is primarily about managing Sweden, but also includes the upstream and downstream processes in the entire value chain. There is joint responsibility in the value chain to see that it changes toward a state of sustainability. Output is the measurable delivery using appropriate y-values and outcome is the stakeholder perception. With the value chain the next step is to identify main stakeholders and the values and harms that are delivered. The main values discussed are citizen value for Swedes and citizen value for the global poor and Sweden's contribution to peace. The main harms looked at are climate impact and impact on biosphere integrity.

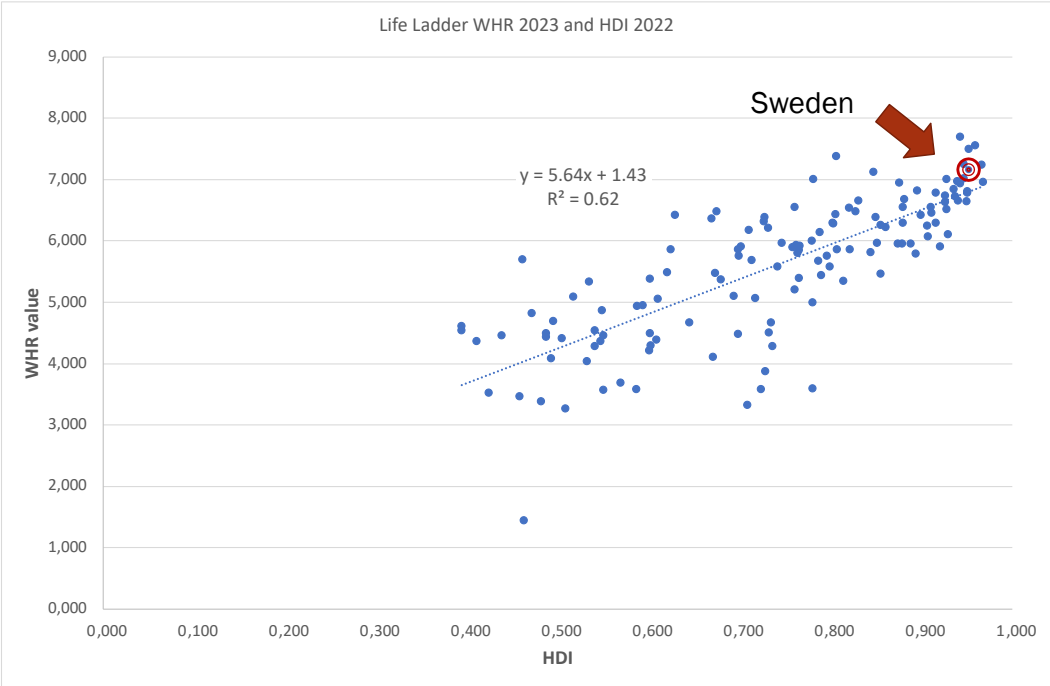
The Swedish national process delivers value for its citizens which are the main People stakeholders. Sweden as a rich nation should also take responsibility for developing nations. Swedish development cooperation provides help to the poorest. This is in line with the UN Sustainable Development Goal (SDG) 1 of No Poverty and further the SDG 1.1 target of

eradicating absolute poverty by 2030. Developed countries are expected to give 0.7% of their Gross National Income to development aid based on UN practice. Sweden had a goal of 1% until 2022, which is now abandoned and in practice reduced to below 1%. There is also a debate on what can be seen as development aid. Swedish governments over the political spectrum have used and use development aid for costs such as receiving migrants, taking funding from projects in the Global South. The current government is using funding for supporting Ukraine in the war with Russia. The question is how much funding is going to combat global extreme poverty and reaching the SDG 1.1 which is a concern for about 800 million people.

What do citizens need to be happy? There are many wants, but which are the vital few needs? Citizen satisfaction as outcome could be measured using the World Happiness Report (WHR) index, which is based on the measurement of subjective well-being. The ranking relies on three main well-being indicators: life evaluations, positive emotions, and negative emotions. The Gallup asks respondents to evaluate their current life using the image of a ladder, with the best possible life for them as a 10 and worst possible as a 0. This scale is referred to as the Cantril ladder (WHR, 2024).

The Human Development Index (HDI, 2024) is based on GNP/capita, life expectancy and education and could also be used as an indicator for citizen value. Both the WHR and HDI have a relatively strong correlation with GNP/capita where higher income results in a higher value and there is a fair correlation between the WHR and the HDI, see Figure 8.

Figure 8. Correlation between World Happiness Report (WHR) ranking and Human Development Index (HDI) based on data from 2023 for WHR and 2022 for HDI. Own elaboration.



At this stage we could use the HDI and WHR as starting points for Swedish citizen value. In addition, we could also use the Gini index which describes how wealth is distributed to improve the performance indicator GNP/capita. The GNP/capita is criticized but seems to be relevant for wellbeing and it also provides a value, which can be related to area of performance in the public and private sectors. Citizen wellbeing should also apply for the global poor, with Sweden having a moral obligation to consider this.

Sweden as a rich, democratic, and peaceful nation should also have a role to play in working for peace by work in different partnerships. Sweden has recently ended its 200 years of non-alliance by joining NATO. To what extent this supports peace can be discussed. However, there is a clear objective of the future as a democratic and peaceful place.

Which are the main harms? Harm for both Planet and People should be considered. The main harms to check first are the impacts Sweden has on climate and biodiversity. Sweden as an industrialised country has a high carbon footprint which based on consumption figures is at about 8 tonnes of CO₂-e/person and year. This needs to come down to zero in about 20 years and presents an important challenge with a defined target. Sweden has large forest areas, which are presented as the green industry. However, there is current criticism of these not really being that green and that the forest plantations are more of monocultures than a natural forest. Despite several challenges with threatened species, Sweden has, at least in the global context, a responsible management of its biodiversity. At this stage biodiversity is excluded from the list of vital few. This is a topic for future research. The effect on absolute poverty is mainly via the publicly financed Swedish development aid, but also via private donations, NGO-work and migrant worker remittances. This output can be measured whereas effects, the outcomes on reduction of extreme poverty could be more difficult to assess.

4.2. Defining Swedish sustainability

A definition is needed both for WHAT of sustainability which can be measured as a level and the HOW the change of sustainability can be defined as a change process for sustainable development. A preliminary definition of Swedish sustainability is presented as: "At least having satisfied citizens with their needs being provided while being carbon neutral and taking global responsibility for sustainability with focus on extreme poverty and peace keeping." The challenge is to set targets for the change - sustainable development - in the different areas.

4.3. Measuring Swedish sustainability

In Table 3 some indicators for the identified values and harms have been discussed. The Swedish citizen value consists of satisfaction of wants and needs. In a globally resource scarce world, focus should be on needs. Since Sweden based on Figure 8 has a high citizen satisfaction the gap here is small and focus should be more on the climate footprint, where the gap is important. In any country, including democracies, there could be more focus on wants than needs. This means that actual legitimate needs for the global poor might have second preference to Global North wants. Irrespectively of this there is an ethically correct goal which could be deducted based on e.g., UN declarations such as the Declaration of Human Rights. For the value, the discussion is how much of total value creation should go to the global poor. Here, the earlier Swedish goal and UN recommendation of 1% of Gross National Income to development aid is suggested as the goal for a sustainable Sweden. What the exact targets should be is up for discussion. For simplified measurements the GNP/capita and the % of GNI to development aid could be used as value indicators. Possibly the GNP could be joined with the GINI-index where a target needs to be discussed. The GINI-index in Sweden has increased over time indicating increasing inequalities. The lowest value recorded was 22.9 in 1981 compared to about 30 for recent years. A value under 40 indicates a reasonably fair distribution of wealth. The target for the GINI-index is an area for future research. The value could also be quality of services measured e.g., with the Swedish Quality Index. This is a second order indicator in that this leads to causes for satisfaction measured in the World Happiness Report. However, this directly relates to Swedish quality performance and further to how universities

should back up quality and sustainability performance, which is planned to be part of future research.

Table 3. Proposed Swedish national sustainability impact indicators as Value and Harm and Value/Harm as output and outcome.

Sustainability effect	Value	Harm	Comment and KPI proposals and goals
Swedish citizen satisfaction	World Happiness Report (WHR) Human Development Index (HDI); GNP/capita; Gini index; Swedish Quality Index (SKI)	Time spent for work; Costs of services relative to income	Value as GNP and GNP/capita; WHR, HDI, Gini Index and SQI. Harm as work satisfaction. <i>Goals to be discussed.</i>
Support to poverty reduction	Poverty reduction	Funds used	Focus on maximising poverty reduction per funding while providing a minimum level of funding KPI Aid% as BNI/capita with goal 1% <i>Outcome measures in terms of poverty reduction to be discussed</i>
Planet satisfaction	Natural restoration	Carbon footprint; Ecological footprint;	KPI: % natural land. Goal: 20% (EU recommendation) Tonnes CO ₂ -eq./person (production). Goal % by 2045 (national goal). Tonnes CO ₂ -eq./person (consumption) (<i>target to be discussed</i>).
Support to peace	Political actions and funding	Time and cost	<i>KPI and targets to be discussed.</i>
Vital few value per harm indicators	The main value chosen for simplicity is national GNP and the main harm is CO ₂ -eq. for production and consumption in Sweden		Harm per value as: CO ₂ -eq. (production and consumption)/GNP Target for CO ₂ -eq./production is 0 in 2045

For the harm we could use the Ecological Footprint of a country measured in how many global ha/capita that are used or how many Earths would be needed if everybody would consume as the country in question. The climate footprint forms an important part of the Ecological Footprint. This means that we could choose carbon emissions as a proxy for harm. The carbon emissions can be calculated based on production or based on consumption. The emissions can be calculated as carbon dioxide (CO₂) or as carbon dioxide equivalents where the different greenhouse gas potentials are translated into CO₂-eq. We use CO₂-eq.

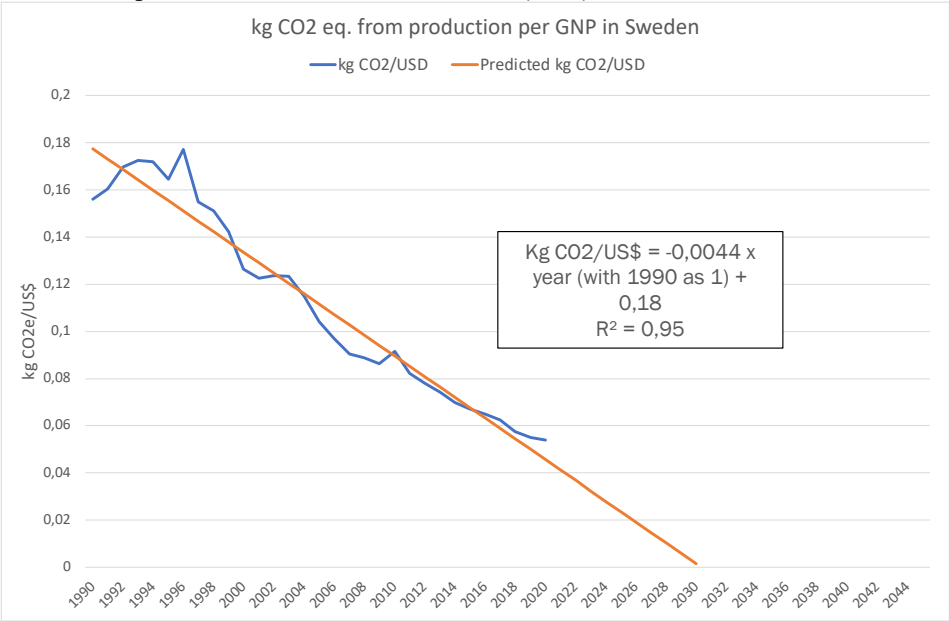
With the proposed indicators it becomes possible to assess current state of sustainability and sustainability development to be compared with targets of sustainable development. This will enable us to do the Diagnosing of Swedish sustainability improvement potential in a simplified way.

4.4. Diagnosing Swedish sustainability potential

As an example of how to present an improvement potential we use GNP as proxy for value and carbon emissions as proxy for harm. The World Bank is already tracking these data. In Figure 9 World Bank (2024) data have been used to present and predict sustainability development for carbon production emissions compared to GNP. The linear regression and the prediction based on it indicates that carbon neutrality will be achieved by 2031 provided that the rate of reduction of 0.0044 kg CO₂eq. per US\$ and year continues. This might be unlikely, but the rate still serves as a target for the rate of change needed. Sweden, as a leading developed

country should logically take its responsibility to be a forerunner towards the Circular Economy (CE).

Figure 9. Carbon emissions from productions compared to GNP of Sweden over time with a linear regression and prediction, based on World Bank (2024).

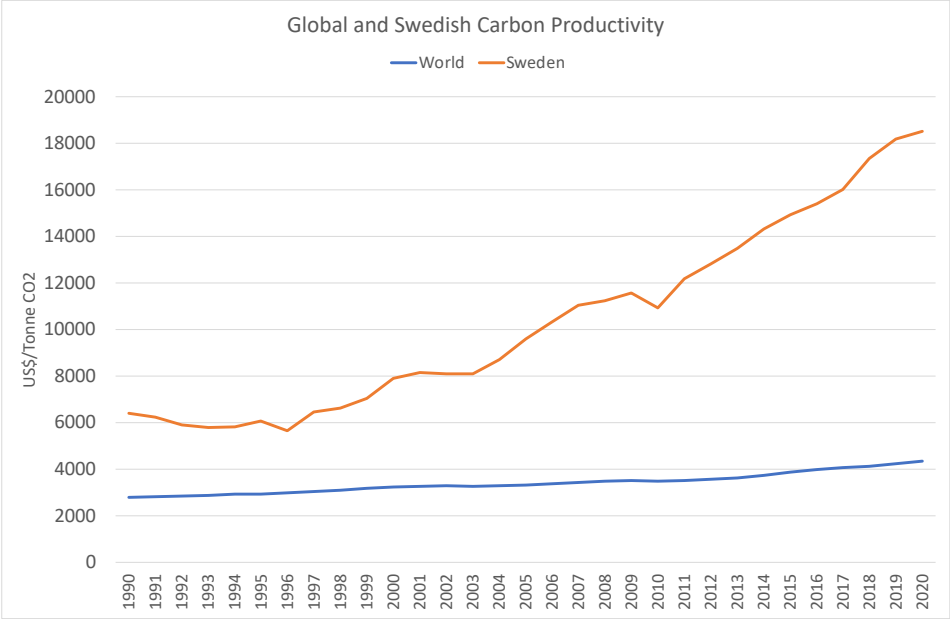


In simple terms CE could be seen as how Earth was before humans but with humans. That means we need to follow the principles of The Natural Step which in their original form are four, where three describe maintaining Nature (Planet) and one maintaining Humanity (People) (Robèrt, 2000). The interpretation of these is presented here with names inspired by Claes Kollberg who has worked closely with Karl-Henrik Robèrt, the founder of The Natural Step and its four system principles. The Bedrock principle states that no material can be removed from the crust of the earth in larger amounts than are being put back. This principle should also include water. The Decay principle states that all materials going back to nature need to disintegrate and become input for new material in a circular loop. This means that we cannot discard any chemicals, plastics or other materials which remain persistent contaminations. The Ecosystem Service principle states that we need to maintain nature and ecosystem services at levels which enable both humanity and nature to be stable. While maintaining the Planet we need to see that People needs are satisfied. The Fairness principle states that all people should have the possibility to be satisfied.

Defining CE as nature was before humans with humans, makes CE equal to sustainable development. The TNS principles provide support in setting goals for the change work. The TNS also contributes with the practice of Backcasting, which means starting from the visionary sustainable state and comparing it with current performance to detect the gap, or the improvement potential as we have called it here. The improvement potential is the difference between current performance and best possible performance. The best possible performance is defined as reaching zero carbon emissions by 2045, which is the national target. This means a complete decoupling of economic value produced and carbon emissions. With about 40 Mtonnes of CO₂-eq generated in Swedish production and with about twenty years left the challenges is to reduce emissions with about 230 000 tonnes CO₂/year while maintaining the same economic activity. Based on Figure 9 this means having a yearly rate of reduction of 0.0044 kg CO₂eq. per US\$ and year. This could be the lead indicators which then needs to be broken into the requirements in different sectors. The calculation is based on a linear reduction.

Reduction of carbon emissions risks of being more difficult the close to zero we come. The latest Swedish values from 2020 indicate a slowdown. We could use carbon productivity as an indicator which is the original Value per Harm expression - how much value do we produce for the carbon footprint. The problem with this indicator is that when carbon emissions go towards zero the value per harm becomes infinite, which explains the World Bank logic to use the inverse. Current global figures for GNP per carbon emissions - carbon productivity - indicate about US\$ 4000 per tonne of CO₂ eq. and about US\$ 18 000 for Sweden, see Figure 10.

Figure 10. Global and Swedish carbon productivity over time, based on data from World Bank (2024).



The performance levels in Figure 10 are extremely high both in comparison with what typical businesses generate and in comparison, with the prices for European carbon emissions rights, where these in 2024 are below US\$ 100 per tonne of CO₂. New businesses should aim at being carbon neutral or to at least produce >20 000 USD per tonne of CO₂-eq.

Using the data in Figure 9 with a regression using an exponential equation presents the challenge more clearly, see Figure 11. The improvement potential is in decarbonating the Swedish economy in 20 years. The improvement potential is the difference between the current predicted development and the one that is needed. This could be seen as the difference between a linear reduction and the anticipated exponential reduction.

To simplify further we can focus on the problems which is mainly the footprint, not the value where Swedish citizens already are among the happiest in the world. In Figure 12 the Swedish carbon emissions have been described with two different predictions and the target of reaching carbon neutrality in 2045.

Figure 11 indicates how the challenge of using less carbon emissions for the same value will become more and more difficult. There is a growing group of people that believe in Degrowth which would indicate that we try to solve the equation by reducing the GNP. This is an area for further research.

The improvement potential is the difference between the target and the current performance. More detailed predictions can be used to better quantify the additional decarbonisation needed in Mtonnes per year.

Figure 11. Carbon emissions from productions compared to GNP of Sweden over time with an exponential regression and prediction, based on World Bank (2024).

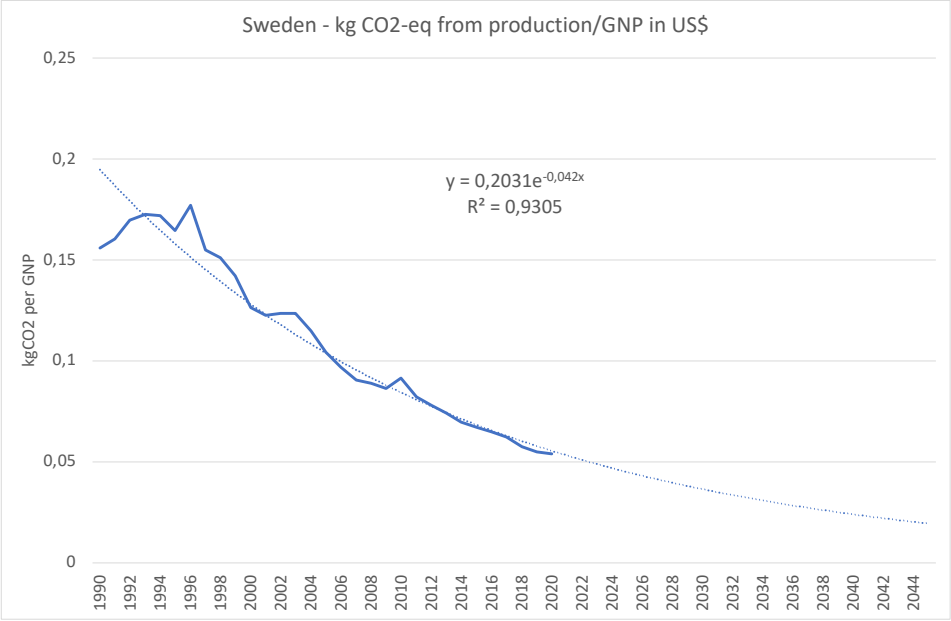
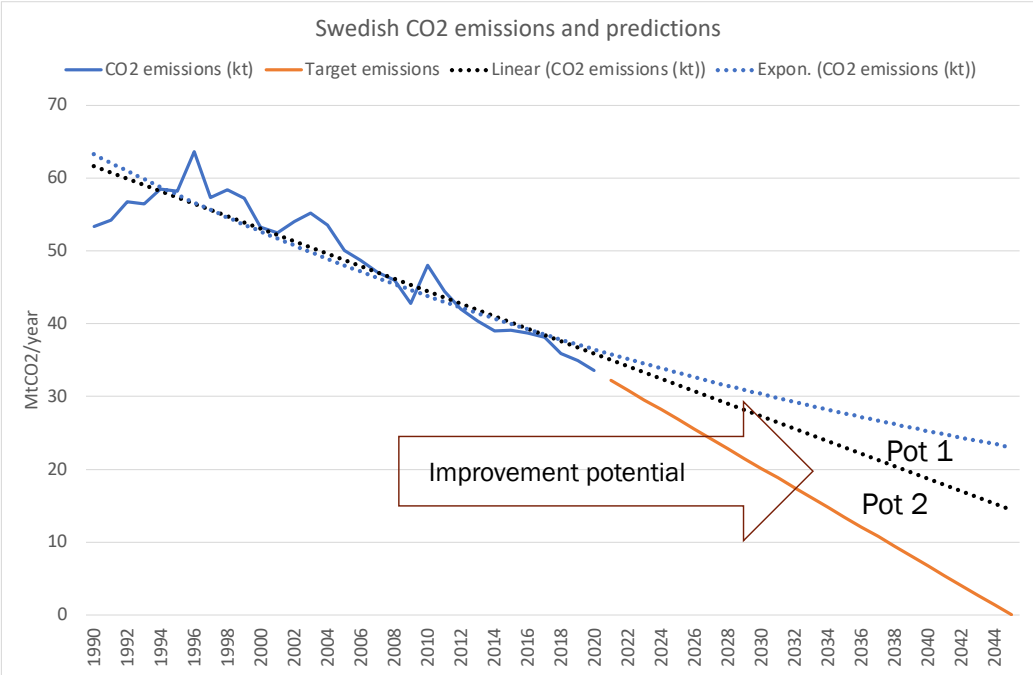
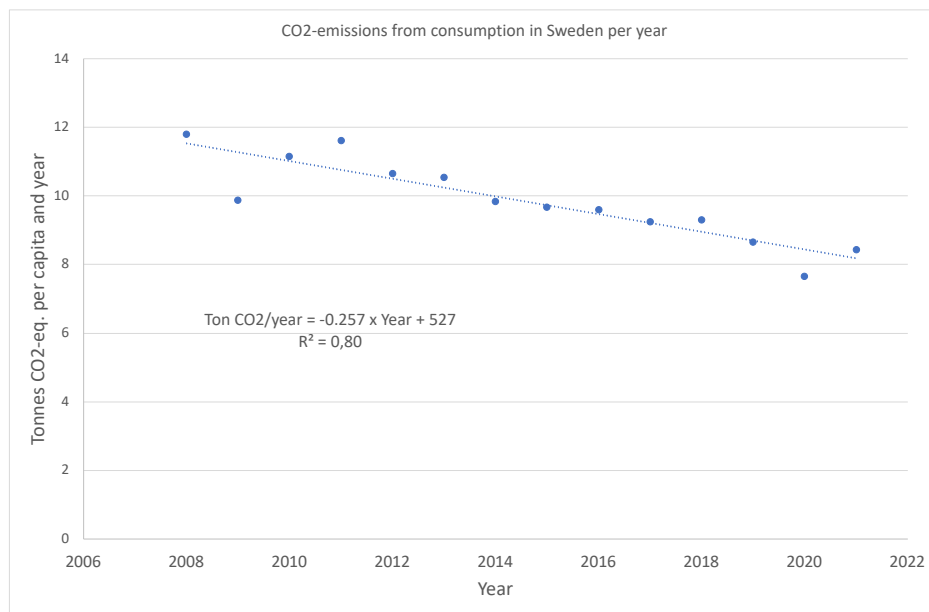


Figure 12. Swedish carbon emissions from production and indicated improvement potential compared to business as usual based on a linear prediction (POT1) and the additional potential (POT2) based on an exponential prediction, based on World Bank data (2024).



The Consumption figures in Sweden are higher indicating more problems with overconsumption. Consumption figures are also dropping but more slowly and will reach carbon neutrality by 2050 based on prediction based on a liner regression (Naturvardsverket, 2024), see Figure 13. To achieve carbon neutrality for consumption figures the rate should increase with some 20% compared to the current rate indicated by the slope in Figure 13.

Figure 13. Swedish carbon emissions from consumption based on World Bank figures (2024).



Consumption figures have more to do with individual habits where our choices as customers have an effect. The main consumption effects could roughly be split in four, these being housing, transporting, consumption of food and shopping. We as individuals also need to set targets to reach net zero. The improvement potential can be calculated by assessing current consumption based on e.g., the World Wildlife Fund ecological footprint calculator or a similar from Global Footprint Network Ecological Footprint Calculator. These will provide the current level, national average and indicate the target. In Sweden the rate of change can be calculated to a reduction of about 8 tonnes per 20 years or in linear terms 400 kg CO₂/year

The Pot 1 and Pot 2 in Figure 13 could be estimated using the exponential regression curve as the business-as-usual reference. A rough estimate of the area for Pot 1 is 80 Mt CO₂. The Pot 2 indicates additional 150 Mt of CO₂ with the total "worst case" improvement need being 230 Mt of CO₂ over a period of 20 years. This presents a considerable challenge. The consumption reduction challenge presented in Figure 13 might be even harder.

5. Discussions and conclusions

The purpose of this paper was to discuss the role of TQM in contemporary society and to present a first preliminary assessment of a sustainability improvement potential for Sweden. This was done based on a series of assumptions based on various quality principles starting with the logic of the perfect process doing the right thing in the right way over time. The right thing was defined using the outside in view and identifying the main stakeholders as humanity (People) and nature (Planet). For People in Sweden citizen satisfaction, eliminating absolute poverty globally and maintaining global peace were identified as main needs. For the Planet carbon emissions were identified as the main sustainability impact.

Diagnosing of the potential in the SOS (Isaksson et al., 2023) was applied to define a Swedish sustainability potential as an example of how TQM based theory could use for sensemaking and for preparing change projects that can be dealt with TQM. The assumptions and limitations are discussed followed by the conclusions.

5.1 Discussion

This study makes several assumptions with the purpose of being able to further the logical thinking following the logic of the Opportunity Study. The findings are therefore only indicative and preliminary. The approach enables us to continue further in the logic of understanding national sustainability and the role of quality in it. TQM has been defined based on general quality principles. But, as with many popular practices, philosophies, and programs there are no universally accepted definitions. We have tried to justify our interpretations and welcome criticism.

We believe that Deming's profound system of knowledge could form a logical basis for TQM as a system-based improvement program. All parts of the system are claimed by different academic principles. Variation is claimed by statisticians, leadership by behavioural sciences and knowledge management is probably seen as epistemology and part of every area. There are also specific disciplines for system theory. But nobody seems to put all these areas together in a cross functional theory with focus on stakeholder satisfaction. TQM can be used to manage and improve system performance.

We have discussed Circular Economy (CE) and view it as life on earth before humans with humans and use the four system principles from TNS to support this (Robèrt, 2000). This is still a work in progress and the ideas have not been explicitly integrated in the proposed definition for Swedish sustainability. For Planet future work means including more than the climate footprint and studying such areas as the ecological footprint and effects on all system principles. In the forthcoming work with Analysing, we will revert to the CE.

We have discussed citizen satisfaction as the WHR and HDI. The WHR has verified correlations with measurable parameters such as GNP. Probably the variation of the GNP has an effect. How to relate the GINI index to GNP and further to citizen satisfaction is part of future research.

The principle focus on processes can be used to understand systems. In practical terms we can do it with the PBSM which is based on basic TQM (Isaksson, 2006). The PBSM could play a role in Understanding Analysing where it can be used to identify important system elements that are needed to understand the system and how it links to the performance described under Measuring Diagnosing, see Table 1. The PBSM could act as a system model that includes the areas of Knowledge Management, Variation and Psychology (leadership). Knowledge Management is defined as a management process. The resource of Measurement provides the system for tracking facts including variation. The resources Management, Method and Manpower include elements of psychology. This is a work in progress where the next stage is doing work with Analysing and preparing a PBSM for Sweden, see Figure 5.

The main processes are defined as producing value and communicating. Value production includes both public and private. Communicating, which also includes marketing, is a default main process with external customers. Support processes are such as taking care of people's needs (health, elderly, and social care) and educating in a lifelong learning process. These are assumed to be the processes delivering the output, which Swedish citizen satisfaction is based on. Part of the value creating should support citizens in the Global South. There are also needs of support processes for providing private and public companies with infrastructure improvement. An important subprocess is "Improving Sweden as a System", which could be a task for university TQM. This includes both sensemaking of the system and improving it. Related to this is the process of measuring performance which is important. The measurement system provides the facts needed for making good decisions and for assessing the improvement potential.

In Analysing future work will be reviewing the 10M checklists for external and internal resources (Isaksson et al., 2024a and b). Internal resources on the country level are country

legislation, culture, citizen competence etc. Questions that need to be answered are such as Mission for Sweden which focuses on satisfying its citizens but also includes the commitment of eradicating poverty based on SDG 1.1 and the commitment to development aid. Another part of the Mission is the commitment to Peace where it needs to be discussed how this can be understood. Method could be the system of governance of the public and private sector - the espoused policies. Here, an important question is how different standards can support national sustainability. Standards probably need to be integrated and possibly simplified to become acceptable and usable resources for national sustainability management. Standard development might also have to start from the main risks to be managed and adapted to needs in the studied system. Standards could possibly be system and process based more than functionally oriented. Management systems could possibly be used to delimit the areas of knowledge that need to be managed. Management could be how Method is enacted, the quality of management, which relates to TQM competence. Measurement is an important area where TQM can contribute by sensemaking of the WHAT to measure and then the HOW of improvement measurements including the understanding of variation. An important part of the Measurement challenge is assessing outcome of development aid in the form of poverty reduction. Currently, it is common that citizens "know" that development aid is not working, which means that it can be reduced. Populistic parties and populistic opinions use this to justify a "me first" way of thinking.

The potential of the Spaces of Challenges (SOC) support to sensemaking has only been dealt with marginally and forms part of future research.

The issue of communication, which is a main process parallel to value creation, has not been discussed. If TQM can support sustainable development, then there probably is a problem with communication. How well are universities communicating the support that TQM can provide to sustainable development? Is there an understanding of how quality could support at the national and at the university level? Could any of the leading academic quality professionals make an elevator speech on why we should work with (T)QM? If not, (T)QM might have lost its focus on customer and other stakeholder needs.

5.2 Conclusions

The conclusion is that TQM can support sustainable development with sensemaking by identifying the WHAT, the right thing to work with. With an identified WHAT, TQM can support the HOW with relevant change programs. We call TQM for Sustainable Development, Quality for Sustainability (Q4S).

Using the outside in approach with focus on main stakeholder needs in the system the vital few sustainability impacts can be identified in terms of value and harm. This will help in creating a common understanding which will enable agreeing upon a definition for system sustainability.

Swedish sustainability is defined as "At least having satisfied citizens with their needs being provided while being carbon neutral by 2045 and taking global responsibility for sustainability with focus on extreme poverty and peacekeeping."

System performance can be measured using Value, Harm and Value/Harm. Swedish sustainability could in a simplified way be measured with focus on the values of GNP, development aid and contribution to peace and with the harms of carbon footprint from production and consumption. The GNP forms an important part of both the World Happiness Report (WHR) index and the Human Development Index (HDI) indicating that GNP is a vital few indicator. The value per harm indicator would logically be carbon productivity or GNP/carbon emissions from production and from consumption. But since this value in the

circular economy goes towards infinity the Carbon emissions/GNP is chosen with the target being zero while having a targeted GNP.

Sweden is performing well with WHR and HDI, see Figure 8, and the gap is small compared to the gap with the harm part - the carbon footprint. Focus should therefore be on reducing this. Public and private business have the responsibility for production reductions and citizens have a responsibility for consumption reductions. Typical citizen consumption areas are housing, food, transports and consumption of goods and services. Here individual targets are needed with the view of achieving net zero by 2045. This should be done with retained citizen satisfaction.

Main indicators exemplifying concrete measurements that have been exemplified are carbon emissions per GNP (kg CO₂/US\$) and carbon emissions (Mt CO₂/year) with the target being zero by 2045. The improvement potential has only been assessed for the harm indicator carbon emissions from production, see Figure 12. For Sweden the challenge is decarbonising while maintaining citizen satisfaction. The challenge is in additional reductions based compared to predictions of emissions of 80 to 230 Mt of CO₂ in the next 20 years. The quantified potential is more of an example of how this can be done than a correct assessment of the challenge.

With agreed KPIs and targets this part of the studied system can be moved from complex to complicated meaning that we have agreed output indicators or y-values. The next challenge is understanding the x-es which will be done in Analysing, followed by Solving. This enables moving parts from complex to complicated problems. We can then work with the parts transferred using TQM inspired process improvement programs like the SOS and DASIAS (Isaksson, 2019) and Lean Six Sigma.

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