



EISIC 25

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Title: Process Based System Model (PBSM) to Understand & Define Dynamic Materiality & Value Accounting for Sustainability Reporting: A Quality for Sustainability (Q4S) Case

Purpose of the paper: Explore PBSM as a framework for Stakeholder Capitalism for system boundaries, external resources, drivers, inputs, processes, and outputs. In particular, understand and define two pillars of Stakeholder Capitalism of Dynamic Materiality and Value Accounting using PBSM (and PESTLE as a sensemaking tool for mapping the limits of system boundaries) for an understanding of end-to-end value chain within the context of cradle-to-grave & the emerging cradle-to-cradle (circular) sustainability reporting.

Methodology: Theory building by combining sensemaking and actor-network theories and by integrating a Quality Lens of PBSM for understanding and defining two key pillars of Stakeholder Capitalism of Dynamic Materiality and Value Accounting for companies and sustainability reporting of the future.

Main Findings: Companies are struggling with understanding and defining Dynamic Materiality and Value Accounting. The process focus of Quality Science substantially helps in making both the pillars concrete for companies to start incorporating it in their reporting frameworks in a constructive manner. Using a combination of PBSM and PESTLE allows dynamic materiality and value accounting to be functionally used for a detailed and third party audited sustainability reporting mandated for European companies (more than 500 employees) by FY 2024.

Practical implications: The findings inform stakeholders on how to manage sustainability reporting and evolve the right management frameworks to deal with regulatory and mandatory requirements emerging from Corporate Sustainability Reporting Directive (CSRD) that is replacing the Non-Financial Reporting Directive (NFRD).

Originality/value: Theory building, and quality focused conceptual frameworks proposed and used for sustainability and company sustainability of the future.

Type of paper: Conceptual paper.

Keywords: process-based system model, innovation, sustainability, sustainability reporting, sensemaking, system-of-systems

Potential Panels: Theory & Methodology in Services/Professional Services

1.0 Introduction

Sustainability and sustainable development are often used interchangeably in literature. The lack of a clear boundary line between the two terms directly impacts how companies interpret the key concept of Triple Bottom Line (TBL) (Elkington, 1994) differently. This leads to a narrow focus on Environment, Social and Governance (ESG) material impact and footprint of a company on people and planet. It shows up in the quality of Sustainability Reporting (SR) of companies where the ESG performance of a company is rarely connected to a sustainability or Sustainable Development Goals (SDGs) in a measurable manner. Without measurability there is neither comparability nor benchmarking of key performance indicators of sustainability for a company over time. This lack of benchmarking and comparability leads to two issues that impact leadership and management decisions for sustainability and climate change. The first is that a

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company leadership is not able to get an aggregate view of sustainability performance. The second, flowing from the first, is that the leadership is not able to plug sustainability initiatives of the company as part of a continuous improvement process over time. This is a key gap for companies today. The regulatory standards, disclosure norms and compliance requirements connected to Corporate Sustainability Reporting (CSR) is getting significantly revised across the world. Two illustrative examples will help contextualise the implications of the gap.

The first example relates to Sweden. On April 7, 2022, Sweden became the first country in the world to sign up for adhering to Consumption-based Emissions Accounting (CBA) framework. In simple terms it means that every unit of Green House Gas (GHG) and carbon imported into the country in the form of a raw material, semi-finished product, or a finished product (FP) will have to be accounted for as part of Sweden's carbon footprint [Co2eq calculation framework]. In practical terms, it means that a Swedish retail consumer electronics company importing a phone from China into Sweden, for instance, will have to now account for in its company's carbon accounting the GHG and carbon emissions emitted while producing the phone in China. The Territorial-based Emissions Accounting (TBA) and the Production-based Emissions Accounting (PBA) frameworks being used till date demarcates emissions accounting to emissions occurring within national boundaries. For companies, the implications for their carbon accounting are significant to the extent that the current emissions intensity [EI] calculations² that forms the foundation of all Net Zero targets, sustainability KPIs and investment decisions related to clean technologies will now have to take account all emissions that can be directly and indirectly accrued to a company's production process both within its national boundaries and outside.

The second example is related to the European Union (EU). The Corporate Sustainability Reporting Directive (CSRD) is slated to come into effect in October 2022. It amends the current Non-Financial Reporting Directive (NFRD) to apply to more European and non-European companies listed and operating in the EU regulated markets. Companies start reporting, under the CSRD, from 2024 in line with mandatory EU sustainability reporting standards and alongside an external assurance of sustainability reporting. For companies, there are significant implications in the way environmental, social, governance and sustainability KPIs are going to set, baselined, and measured from 2024 that will have a direct impact on their 'license to operate' in markets and serve customers. The key implication is that all climate action, climate mitigation and sustainability data and information submitted by the company will now be third party assured and audited. In practical terms, this implication means that companies must publicly disclose adequate information about the sustainability, risks, and opportunities they face, as well as the impacts they have on people and the environment. These two specific examples are representative of the new set of challenges are facing companies today in measuring their sustainability initiatives, disclosing it as their ESG compliance and reporting it accurately in their Corporate Sustainability Report (CSR). The key challenges are:

1. Expanding the scope of materiality assessment to accurately account for and measure ESG impacts of a company.
2. Accurately measure, document, and disclose Scope 1 [upstream & downstream] and Scope 3 [downstream] GHG & Carbon emissions in a manner that is directly connected to climate action and climate mitigation.

² E.I is the emission rate, measured on basis its emissions factor, of a given pollutant relative to the intensity of a specific productive activity that creates value within a production process ultimately leading to a finished product [FP].



3. Report a company's sustainability initiatives in a manner that is amenable to year-on-year benchmarking for understanding, defining, and measuring the improvement potential and cross-sectoral comparison
4. A commonly accepted and shared methodology and framework to understand, define and measure value as factor of ecological efficiency, social impact and resource utilization and optimisation.

2.0 A Brief Peek into Dynamic Materiality & Value Accounting

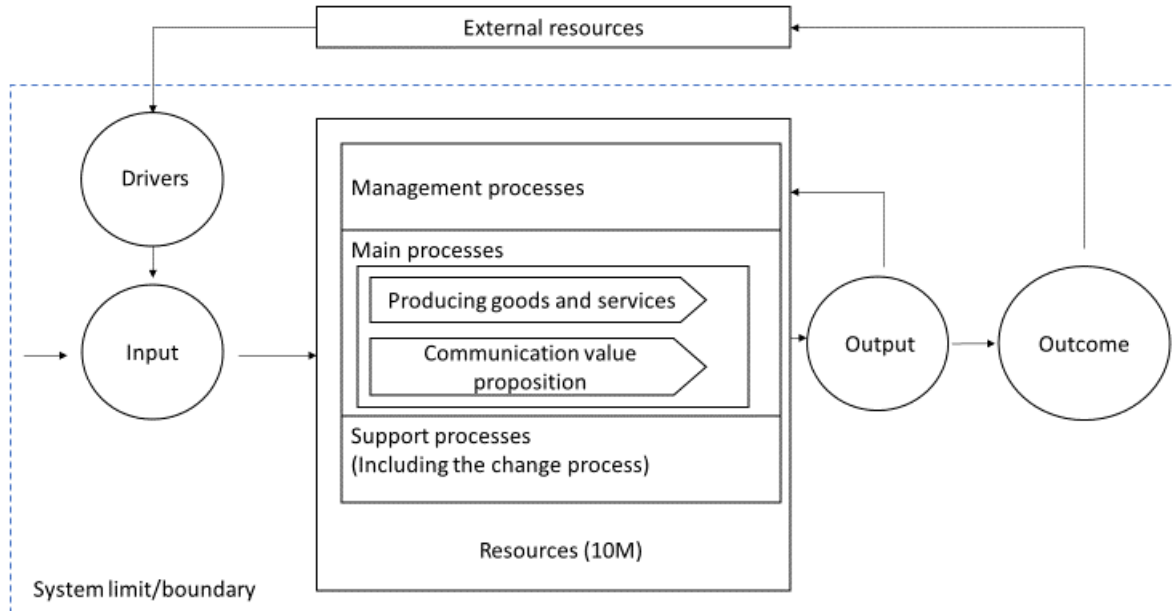
This paper keeps these four key challenges as a starting point. From that starting point, the authors explore and engage with the twin concepts of Dynamic Materiality and Value Accounting through a Process-based System Model (PBSM) [Figure 1.0]. Particularly, this paper explores how the twin concepts are reconfiguring the system limits, introducing new external resources and as consequence new drivers that are directly contributing to the input-processes/throughput-output value chain. Dynamic Materiality and Value Accounting were formally introduced by World Economic Forum-International Business Council (WEF-IBC) as part of its larger project on evolving core and expanded metrics for Stakeholder Capitalism³ (WEF-IBC, 2020). Materiality is a concept that defines why and how certain issues or information are important for a company or a business sector.

At its core, materiality is an accounting principle that defines which information is useful for decision making. Companies commonly use *materiality assessment processes* to identify issues that reflect an organisation's social and environmental impacts, as well as information that supports stakeholder and strategic decision making. Dynamic Materiality acknowledges that what is considered material is and will change *over time*, and therefore takes a forward-looking, adaptive approach to reprioritising ESG topics as part of an organisation's vision, mission and strategy and includes it directly into a company's *continuous process improvement* cycles to allow for more regular action on newly identified risks. Value Accounting seeks to add to and substantially top up the traditional Revenue Accounting where the focus has almost exclusively been on profit and shareholder value. Value Accounting seeks to quantify environmental, social and governance risks and opportunities within an organizational context and in the form of Enterprise Value (EV). In short, Value Accounting wants companies to evolve an equivalent framework for measuring and quantifying value as revenue within the directives of CSRD [which integrates Financial and Non-Financial Reporting metrics] and sustainability reporting standards developed by the European Financial Reporting Advisory Group (EFRAG)⁴.

³ The concept of Stakeholder Capitalism was first expounded by Klaus Schwab in the 1960s as an alternative to a profit focussed shareholder model of capitalism. Within Stakeholder Capitalism, a company is seen as something more than an economic unit generating wealth having the responsibility to fulfill societal and human aspirations, including environmental, social and governance objectives with equity in wealth generation through a cap on executive remuneration as a key pillar. The WEF identifies four key principles as: 1. Companies should pay their fair share of taxes 2. Show zero tolerance for corruption 3. Uphold human rights throughout global supply chains 4. Advocate for competitive level playing field in "platform economy." Stakeholder Capitalism also expands its definition of stakeholder to include employees, suppliers, local community, society and customers.

⁴ EFRAG has published a detailed roadmap for developing new sustainability standards, as well as proposals for mutually reinforcing cooperation between the global and EU standard-setting initiatives. In 2022, EFRAG set the new Sustainability reporting pillar with the creation of the EFRAG Sustainability Reporting Board (SRB) and the EFRAG Sustainability Reporting Technical Expert Group (SR TEG).

Figure 1.0: Generic Process-based System Model (PBSM)



Source: Isaksson, 2019

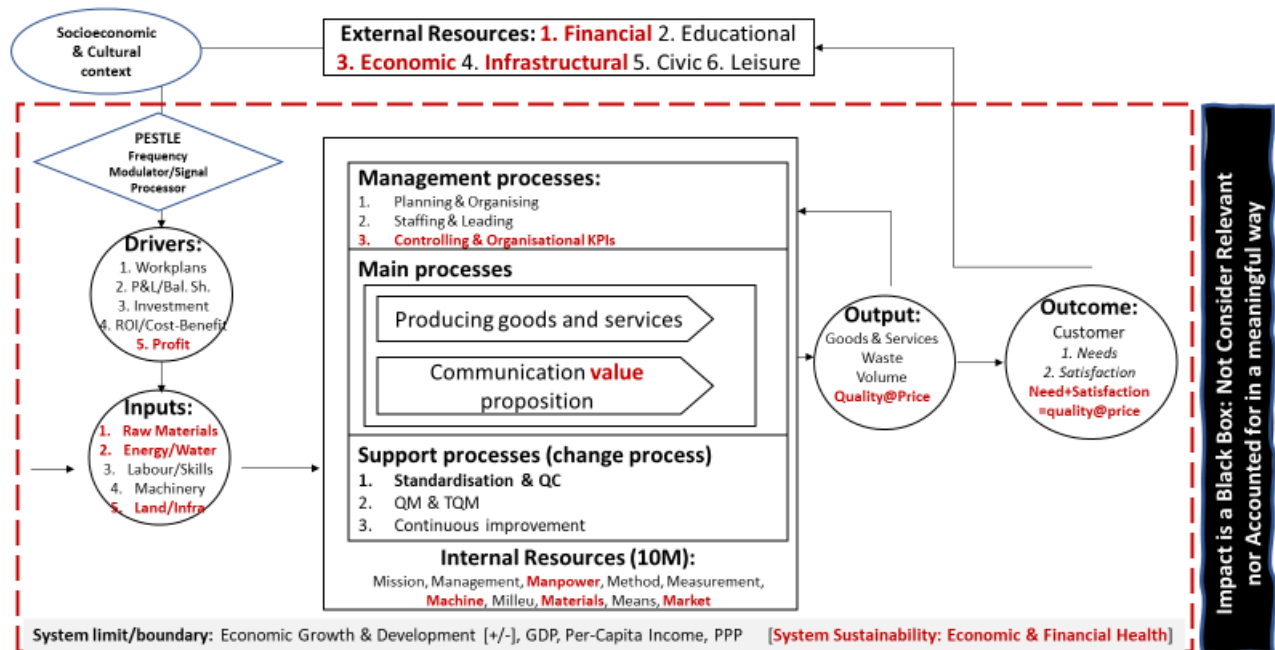
These new challenges and opportunities for corporate sustainability emerging from the rapidly changing regulations, disclosure norms, climate change requires sustainability focused key performance indicators (KPIs) connected to timebound improvement [as +/- metrics] targets that are measured and reported for comparability and benchmarking. The authors propose that for robust and measurable sustainability KPIs that are connected to specific timebound targets that can be peer, sectoral, and industry benchmarked in terms of best practices and continuous improvement requires two new mental models. One that functionally demarcates the definitional boundaries of sustainability and sustainable development as two independent and yet inter-related variables [and levels] and another that evolves a framework that accommodates quality science and sustainability together for a Quality for Sustainability (Q4S)

3.0 Sustainability & Sustainable Development: A PBSM Assessment

The starting point for engaging with Sustainability and Sustainable Development is often the 1987 Brundtland Commission's report that defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' This definition is often then used to directly refer to the 17 Sustainable Development Goals (SDGs) and its 169 targets and indicators thereof. Within this framework, sustainability and sustainable development are not just used interchangeably, but often conflated with each other in such a manner that it has a direct impact on how materiality is assessed, system boundaries [for Upstream Scope 1 & Downstream Scope 3 GHG & carbon emissions] are scoped in a narrow manner. By default, then, there are practically no sustainability driven and ecoefficiency (Glavič et al,

2012) focused and driven KPIs⁵. The authors here use the PBSM to understand how this lack of this clear and functional demarcation between sustainability and sustainable development led to corporate sustainability as an *incremental add on* to the overall organizational process [Figure 2.0].

Figure 2.0: Specific Process-based System Model (PBSM) [Economic Growth (EG)]



Source: Swaminathan, Isaksson, Rosvall, 2022 (derived from Isaksson, 2006, 2019)

As seen in Figure 2.0 the key system limit and boundary condition for system sustainability and [by default] system stability is economic and financial health [depicted as red dotted line]. This default system design requires companies to adhere and contribute to the system balance:

1. At *lower end* in maintaining the system limit [no loss/no profit].
2. At *middle* in enhancing the system limit at a reasonable level [some profit]
3. At *higher end* in strengthening the system limit at a significant level [big profit]

Using Pareto principle as an inspiration, the authors have identified the key elements [*in red*] in each of PBSM-EG components that are prioritized as the key metric/s for determining the main value proposition of an output (product/service). As an illustrative example, within the external resources, education will prioritise those pedagogies, courses, modules, and certifications that contribute in a significant manner to the system health. Within that prioritization itself, for example, courses and certifications that provide train manpower to the *higher end* will have more perceived [societal] and real [financial value. Hence, a degree in financial or a business administration will generally be seen as more desirable than a degree in anthropology. The same prioritizing applies to financial certifications and acumens. Those that provide the potential to increase the return on an investment [shareholder value] will connect to the *higher end*.

⁵ Eco-efficiency is a management strategy of doing more with less and is based on the concept of creating more goods and services while using fewer resources and creating less waste and pollution. It measured as an ratio of positive impact to negative impact expressed as either net positive impact or net negative impact.



The value proposition is a representative integration of the various metrics and indicators in the each of the components within the PBSM-EG where the focus is on cost efficiency and output effectiveness. The *value* in the value proposition, then, is always a balance between quality and price. This converts the *value* into customer satisfaction in the form of fulfilling of his/her needs in an affordable manner [and as an overall *happy* experience]. Within PBSM-EG, the PESTLE [Political-Social-Economic-Technological-Environmental] is positioned and used as a sociocultural frequency modulator and signal processor to ensure that the drivers are modulated and moderated as per the socioeconomic and cultural context. As an illustrative example, trade unions as a downstream signal processor performs the rôle of ensuring the work plans are as per specific skillsets and within appropriate working conditions. A well functioning PESTLE, here, for instance, will be evaluated in terms of how quality of its signal processing [high fidelity and minimal loss]. The maturity and the state of the socioeconomic and cultural context determines the quality and availability of external resources. Within PBSM-EG, sustainability and sustainable development are at best an incremental add on that was brought into the system limits and boundaries as result of some global actions emerging from the 1972 Stockholm Declaration and the 1987 Brundtland Commission report. Since both sustainability and sustainable development do not directly contribute to value generation and value proposition the incentive to functionally define and demarcate the two did not exist. Within this context, the authors of this paper engage with sustainability and sustainable development with the limited purpose to functionally define and demarcate it to ensure that companies are able to deal with new opportunities and challenges [mentioned above] in an appropriate and informed manner.

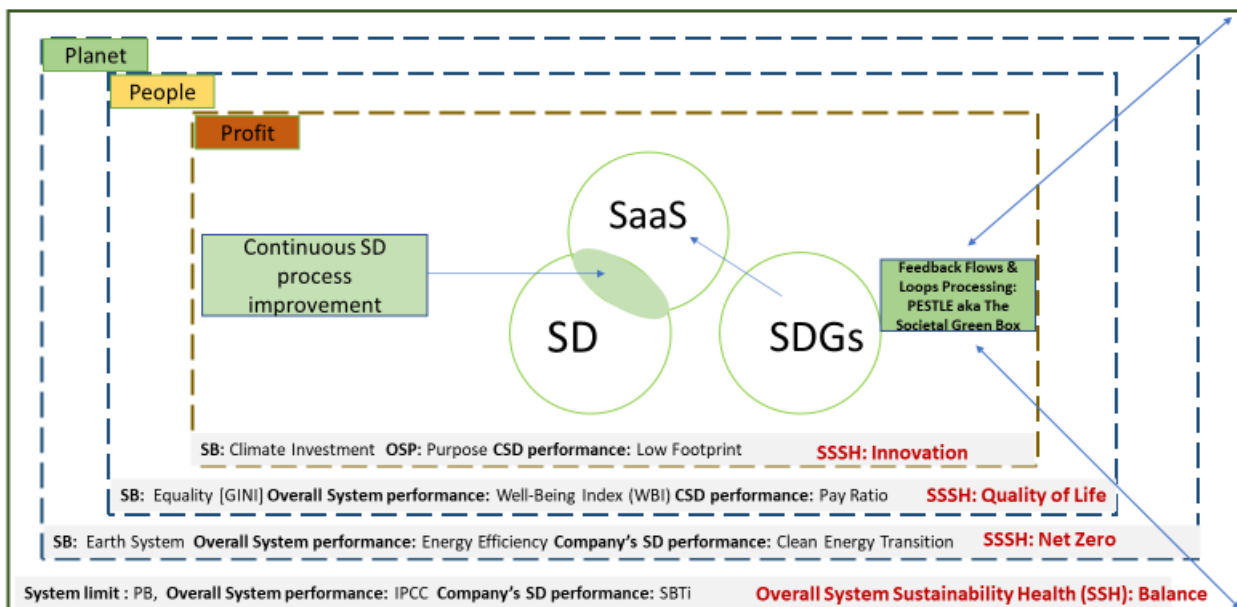
4.0 Differentiating Sustainability & Sustainable Development: A PBSM Approach

Sustainability is an ideal state of balance between planet, people and profit. To that extent, sustainability will always be an imagined state, one derived from a current and continuing assessment of the unsustainability of the company over a period of time. The holy grail of sustainability will always be something that will appear completely out of reach for the current generation and the next. A typical sustainability as a state (SasS) of aspiration' *using the PBSM* would be an absolute fidelity closed-loop connection between inputs-throughput [processes]-output where there is no waste generation, no GHG and carbon emissions so that planet is safe and the people all across the world have an equitable and fair share of profits so that anthropogenic prosperity is created and maintained for the survival of the human species and the planet. The authors propose climate science-based Planetary Boundaries (PB) framework (Steffan, et. al., 2015) to help companies anchor their imagined future state of sustainability to specific targets, mitigation measures and initiatives⁶ to one or more planetary boundaries as per their business model. For a company, an ideal state of sustainability will always be an 'outside-in' imagination where the 'inside-out' approach will be weighted towards its contribution to the balance between planet, people and profit. Sustainable development is a process that creates a concrete pathway, guidance maps, milestones and goals, targets and KPIs to create a '*navigational sense making*' (Weick, et.al., 2015; Latour, 2005) of the state of sustainability. Further, the authors propose that sustainable development within a

⁶ There are nine planetary boundaries : Stratospheric ozone depletion. Loss of biosphere integrity (biodiversity loss and extinctions). Chemical pollution and the release of novel entities. Climate Change. Ocean acidification. Freshwater consumption and the global hydrological cycle. Land system change. Each of these boundaries have science-based safe limits for humanity and other living beings based on the carrying capacity of the Planet. On 18th January 2022, we have crossed the 5th planetary boundary aka the "chemical pollution" & introduction of novel entities into the biosphere".

company context is a continuous process where sustainability opportunities in terms of diagnosing, analysing and solving [DAS] (Isaksson, et. al., 2021) within a company are constantly identified, clearly costed over time in terms of financial investment required and acted upon in the form of clear internal projects and work packages as per the company's core business model and its value chain. Sustainable development for a company, then, becomes a time-bound goal oriented, target-driven, quarter/annual KPI focussed *continuous improvement process* that is quantified in terms of a clear baseline, metrics and incentives. To further drilldown, sustainable development performance of a company will always be benchmarked year-on-year internally to the state of sustainability imagined by the company and the 'outside-in' sustainable development performance of other companies within and outside sectoral boundaries. To that extent, optimising and creating resource eco efficiencies in terms of a cradle-to-grave value chain would be key 'inside out' sustainable development goal of a company. Further, the authors propose that the key 'inside out' sustainable development goals of a company be anchored to the Science-Based Target initiative (SBTi)⁷ which tightly aligns targets to the IPCC reports. Within these two functional definitions, the authors propose that the 17 Sustainable Development Goals (SDGs) and the 169 targets thereof can be considered as 'outside in' global societal and planetary guiding posts that serve as an set of markers to the companies to imagine their state of sustainability. Any goal that is time-bound, like SDGs 2030, is always a milestone that points to the direction of the journey. The journey is expected to continue further even after the milestone is passed or time has elapsed. Making sense of the relationship between sustainability, sustainable development and SDGs 2030 could be supported by using a PBSM which describes the important system elements, and which can be used to identify main KPIs (Figure 3.0).

Figure 3.0: PBSM-based SaaS-SD-SDGs inter-relational feedback flow model



Source: Swaminathan, Isaksson, Rosvall, 2022

Using the key element of system limit in the PBSM, the authors propose a distinction between a *system limit* and a *system boundary*. A system limit is an absolute limit

⁷ The Science Based Targets initiative (SBTi) is a collaboration between CDP, the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF).[1] Since 2015 more than 1,000 companies have joined the initiative to set a science-based climate target.



beyond which the survival of the planet is fundamentally threatened. As seen in Figure 3.0 it is deliberately drawn as a *solid line* to depict its absolute nature. A *system boundary*, depicted as a dotted line, indicates that the overall system is alive to feedback flow and loops emerging from the system limit and each boundary can expand, contract, intersect and even integrate with other boundaries as per the feedback flows coming from the system limit. Additionally, the authors in this model propose that the feedback flows are not just from the system limit [as one-way flow], but also from the three system boundaries back to the limit [as two-way flow]. Additionally, the authors propose that at any given point in time the feedback flow from the *system limit* will *define*, *determine*, and *write* the control laws [system design architecture]. The authors, as can be seen in Figure 3.0, propose three system boundaries. Additionally, each of the system boundaries will have:

1. Internal boundary conditions [SB]
2. Overall system performance
3. Company's Sustainable Development (SD) performance
4. Key system health parameter to be check [SSH]

Further, the authors proposed the scope of these system boundaries as a fundamental design principle. What it means is that the scope of the planet system boundary will always be the outer system boundary within interaction flows with the other system boundaries, names people and profit. Using the same fundamental design principle, the scope of the people system boundary will always be outer system boundary to profit and an inner system boundary to planet. With these design principles and control laws expansion and contraction can (and will) take place.

For the planet system boundary, the authors propose the following:

1. Internal boundary conditions [SB]: Earth Systems [Carrying capacity-ecological costing-ecological assets-to-carbon sequestration-to-global warming reduction]
2. Overall system performance: Low Car [Proportion of clean energy-to-carbon-based energy]
3. Company's Sustainable Development (SD) performance: Clean Energy Transition [Proportion of improvement potential-to-investment-to-clean energy asset generation-to-deployment]
4. Key system health parameter to be checked [SSH]: Net Zero [Proportion of climate action-targets-climate mitigation]

For the people system boundary, the authors propose the following:

1. Internal boundary conditions [SB]: Equity [GiNi Co-efficient as a baseline-to-income equality-to- wealth equality]
2. Overall system performance: Well-Being Index (WBI) [Proportion of total population-to-physical-mental-emotional-psychological health]
3. Company's Sustainable Development (SD) performance: Pay Ratio [Proportion of CXO pay/benefits-to-employee pay/benefits]
4. Key system health parameter to be check [SSH]: Quality of Life (QoL) [Proportion of climate action-to-reasonably secure life]

For the profit system boundary, the authors propose the following:

1. Internal boundary conditions [SB]: Climate Investment [Proportion of overall investment-to-climate investment-climate neutral organizational assets-climate mitigation]
2. Overall system performance: Purpose [Proportion of company production-to-societal benefit-to-planetary health]
3. Company's Sustainable Development (SD) performance: Low Carbon Footprint [Proportion of total company production-to-resource utilisation-to-resource efficiency potential-to-resource efficiency action-GHG/carbon reduction targets]

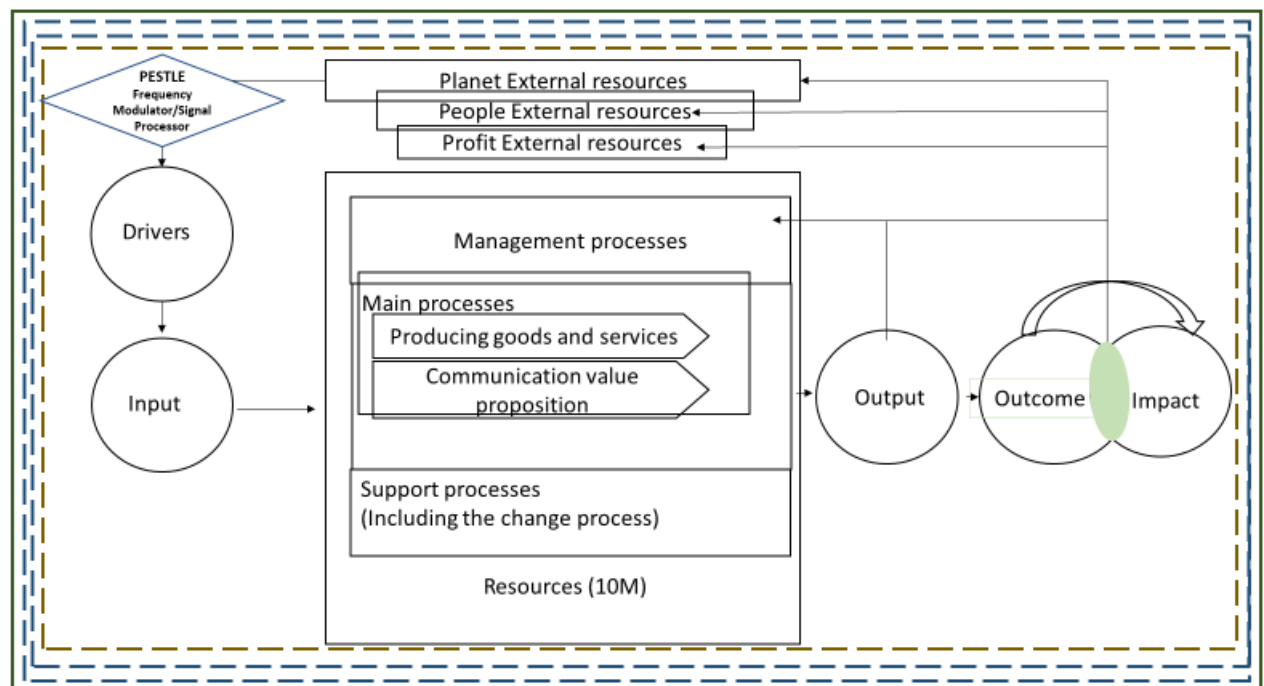
4. Key system health parameter to be check [SSH]: Innovation [Proportion of climate action-based R&D spend-to-new product development]

Additionally, the authors propose that PESTLE will be key '*societal green box*' that captures and processes the different feedback flows into high fidelity actionable sustainability and sustainable development resources for companies to ensure that the system boundaries of Planet-People-Profit interaction are kept in balance. As seen in Figure 3.0, the intersection between SaaS and SD is the operational space for companies to work in terms of continuous organizational improvement [as a process] focused on Sustainability Development goals, targets and KPIs.

5.0 A PBSM for Sustainability and Sustainable Development (SD) for Companies.

The operational space for companies where sustainability opportunities are identified and earmarked as part of continuous improvement requires a *system view* of the upstream and connections to inputs and key processes and downstream connections to outputs, outcomes, and impact. The authors engage with the Generic PBSM (Figure 1.0) and customise it using the PBSM-based SaaS-SD-SDGs inter-relational feedback flow model (Figure 3.0) to propose a Generic PBSM for Sustainability (Figure 4.0).

Figure 4.0: Generic PBSM for Sustainable Development (SD) for Companies



System limit Source: Swaminathan, Isaksson, Rosvall, 2022

Comparing Figure 4.0 with the Generic PBSM (Figure 1.0), the authors have made several changes. To summarise the changes and the key reasons behind it:

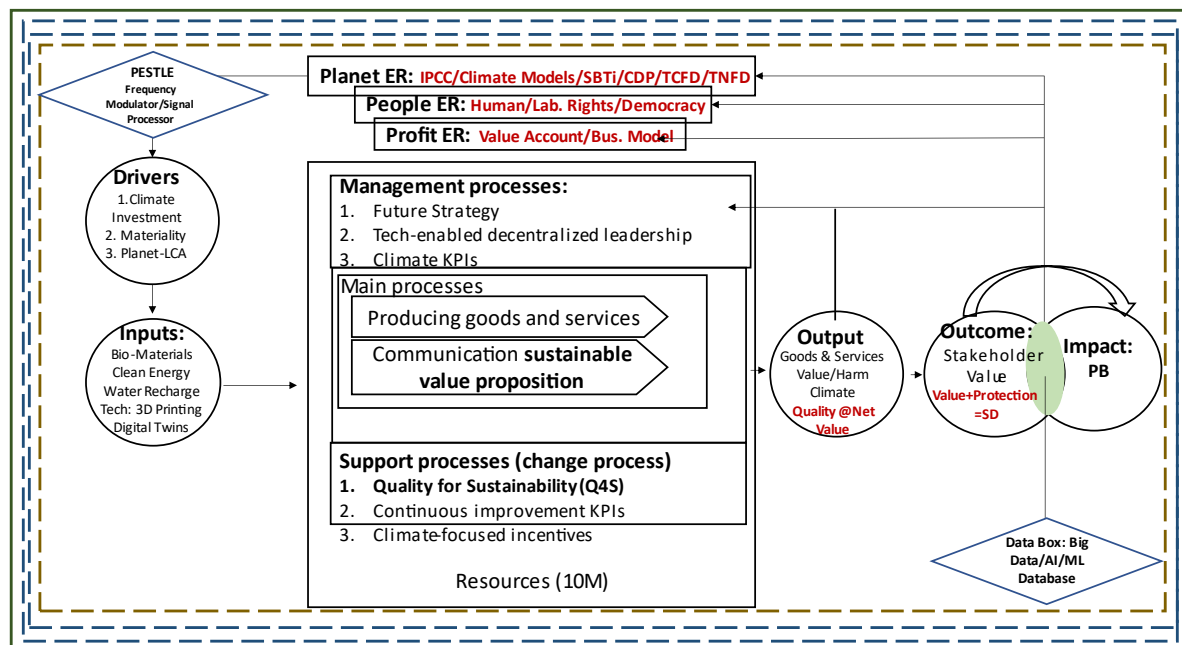
1. The absolute limit is the system limit and there are system boundaries for planet, people, and profit.
2. The external resources are within the system limits and system boundaries. The authors propose that the external resources also need to be within the system limits and system boundaries since the resources required for ensuring that the

absolute limit is not breached, and system boundaries are kept in balance requires innovation, interdisciplinary learning, and new ways of thinking, regulation and financing.

3. The authors further bring in impact as a key element, and within impact identify the intersection (shaded light green) with outcome as an operational arena for continuous organizational process improvement insights, information data and change management as per stakeholder needs.
4. Further, the intersection [operational arena] feeds directly into all the three external resources to align them to the needs of maintaining and securing the system limits, also contributes directly to management processes along with company output measures and indicators.
5. Finally, the authors bring in PESTLE 'societal green box' as a sociocultural, ecological, and economic frequency modulator and processor that contexts to the three external resources and the drivers.

The Generic PBSM for Sustainable Development (SD) for Companies brings in a structured organisational process approach, a continuous process improvement framework and a business model lens to the new challenges and opportunities in front of companies emerging from changing global regulations. Using this Generic PBSM for SD for Companies, the authors have evolved a first level Specific PBSM for SD for Companies (Figure 5.0) that brings in climate science and metrics, subsequent regulatory changes and newer compliance and disclosure requirements and move to evolve integrated metrics for Corporate Sustainability Reporting (CSR)

Figure 5.0: Specific PBSM for SaaS-SD for Companies [PBSM-SD]



Systemlimit Source: Swaminathan, Isaksson, Rosvall, 2022

As you can see in Figure 5.0, the external resources are more specific to the absolute system limit and each system boundary. For example, the Planet External Resource considers IPCC as key diagnostic system for overall planet health, various climate models [both multilateral models like RCP 6.0 and RCP 8.5 and private ones like Aladdin Climate of Blackrock] as various kinds of system tests and SBTi-TCFD (Taskforce on Climate Related Financial Disclosures)-TNFD (Taskforce on Nature Related Financial Disclosures)-



CDP (earlier called Carbon Disclosure Project) as set of goal-targets-KPI setting frameworks and tools. Emerging from the external resources, the authors also position and locate new drivers like climate finance and investment, expanded materiality and planetary scale Lifecycle Analysis (LCA).

The drivers change the nature of focus on inputs with attention on biomaterials and recyclable raw materials, water efficiency and recharge and technology-based inputs like 3D prints and digital twins. In terms of management process, the key process will be climate KPIs that will be directly fed by Quality for Sustainability (Q4S) focused change processes. The Output-to-Outcome connection becomes stronger due to *value accounting* and the outcome-to-impact interaction space will be dominated by big data and AI-focused at source emissions databases like ClimateTrace⁸.

6.0 Materiality, Dynamic Materiality & Value Accounting: A Process Focus

Materiality from a sustainability perspective of companies is largely connected to Global Reporting the Global Reporting Initiative's (GRI) framework for materiality assessment that is used by majority of companies for their sustainability reporting. The concept of materiality comes from the financial domain. For an auditor, materiality is the determination of the significance of a financial transaction or a discrepancy within a financial statement. The aim of a financial audit is for the auditor, as an independent third party vested with fiduciary responsibility, to endorse that a financial statement covers "all material respects in conformity with the reporting framework of Generally Accepted Accounting Principles (GAAP)." (IFRS, 2022; IASB, 2022). A key materiality principle is that an "accounting standard can be ignored if the net impact of doing so has such a small impact on the financial statements that a user of the statements would not be misled." (IFRS, 2022; IASB, 2022). Translated into an accounting rule, it gives the third-party auditor the flexibility to exercise judgement in deciding if a transaction is material or not.

GRI's materiality assessment framework seeks to mimic the audit and accounting framework for sustainability reporting with two critical pieces missing: an integrated set of sustainability standards similar to GAAP, and a policy, legal, regulatory and governance ecosystem tightly aligned to mandatory compliance and benchmarking. The lack of these two critical pieces positions both the principles of Triple Bottom Line (TBL) – Cradle-to-Gate – and the key materiality framework derived from it – GRI's Scope 1, 2 & 3 disclosure standards for GHG emissions accounting – as a terrain of subjective judgement: companies pick and choose standards and what to report. The authors, at the risk of oversimplification, consider this challenge as akin to the financial community making both the key principles of GAAP – revenue accounting for instance – and the key materiality framework derived from it – balance sheets, profit and loss statements, return of investment (ROI) and internal rate of return (IRR) calculations, for example – as a terrain of choice. This leads to the materiality challenge pointed out by WEF, Larry Fink and Chris Hohn that can be articulated thus: *Materiality assessment today is accurately accounting only for Scope 1 emissions with some degree of accuracy for Scope 2 emissions and practically no accounting for Scope 3 emissions*. Now, including the business idea and putting a stakeholder value on it is no simple task since it requires materiality to be envisaged as a filter of inclusion rather than exclusion.

It is this inclusive filter of materiality that underpins WEF's Stakeholder Capitalism and its two pillars of Dynamic Materiality and Value Accounting. The concept of Stakeholder Capitalism has existed in some form or another for close to fifty years. In a simple way,

⁸ Please see: <https://www.climate TRACE.org/>



it can be understood as a bipolar opposite to Milton Friedman's concept of Shareholder Capitalism, where shareholder value (profit) was paramount. Stakeholder Capitalism focuses on creation of long-term stakeholder value, with the shareholders being one of the several stakeholders of customers, employees, suppliers, local community, society, and environment. Klaus Schwab, who proposed the concept of Stakeholder Capitalism, and has been instrumental force behind the WEF's Davos Manifesto 2020 explained Stakeholder Capitalism thus:

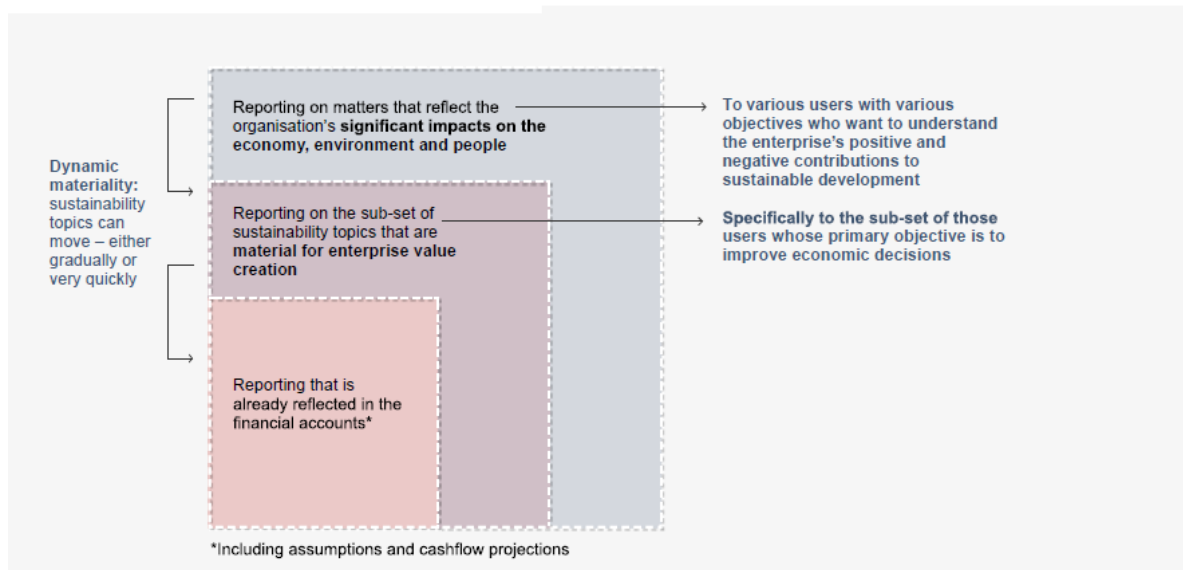
Advocates of shareholder capitalism had neglected the fact that a publicly listed corporation is not just a profit-seeking entity but also a social organism. Together with financial-industry pressures to boost short-term results, the single-minded focus on profits caused shareholder capitalism to become increasingly disconnected from the real economy. Many realize this form of capitalism is no longer sustainable.

Conceptually, such a definition transforms a company from a mere wealth generating unit to one that 'fulfils societal and human aspirations, clearly measures and fulfils its environmental, social and governance obligations and creates a balanced and equitable system by limiting and benchmarking executive remuneration to all its remuneration levels and to that of society' (WEF, 2020). By extension, then, a company is also one among all stakeholders, and *not the first* among all stakeholders, creating a "level playing field for global citizenship" (ibid). The September 2020 World Economic Forum (WEF) consultation paper captures the subtle expansion of materiality thus:

The rate at which issues that are currently immaterial become material is accelerating. In a hyperconnected world the ability to anticipate stakeholder reactions to emerging sustainability issues and how they could affect a business and its performance is therefore critical. Value-creation plans must optimize performance against current and future material ESG issues. The next stage in this evolution will be the introduction of initiatives that aim to improve performance on ESG issues that are likely to be material for a company in the future.

The paper suggests 21 core metrics and disclosures and 34 expanded metrics and disclosures, with the core metrics being a curation and integration of established metrics and disclosures from different standards and reporting initiatives. The core metrics focus on activities within an organisation's own boundaries and come under the bracket of materiality and covered currently by GRI's Scope 2 (gate-to-gate) emissions. The expanded metrics aggregates 34 metrics and disclosures from several standards and frameworks that have traditionally been neglected but have a wider value chain scope [GRI's Upstream Scope 1 emissions and Downstream Scope emissions] In expanding the scope of materiality in this manner (Figure 7.0), the paper has set in motion key stakeholders, in particular institutional funders, large international investment corporations, to make the new version of materiality as one of the key conditions for accessing any ESG related funding and sustainability funds. It also turns materiality from a static entity, as it stands today, to a dynamic state. The framework of dynamic materiality blurs the boundaries between the GRI Upstream Scope 1, Scope 2 & Downstream Scope 3 emissions.

Figure 7.0: Dynamic Materiality

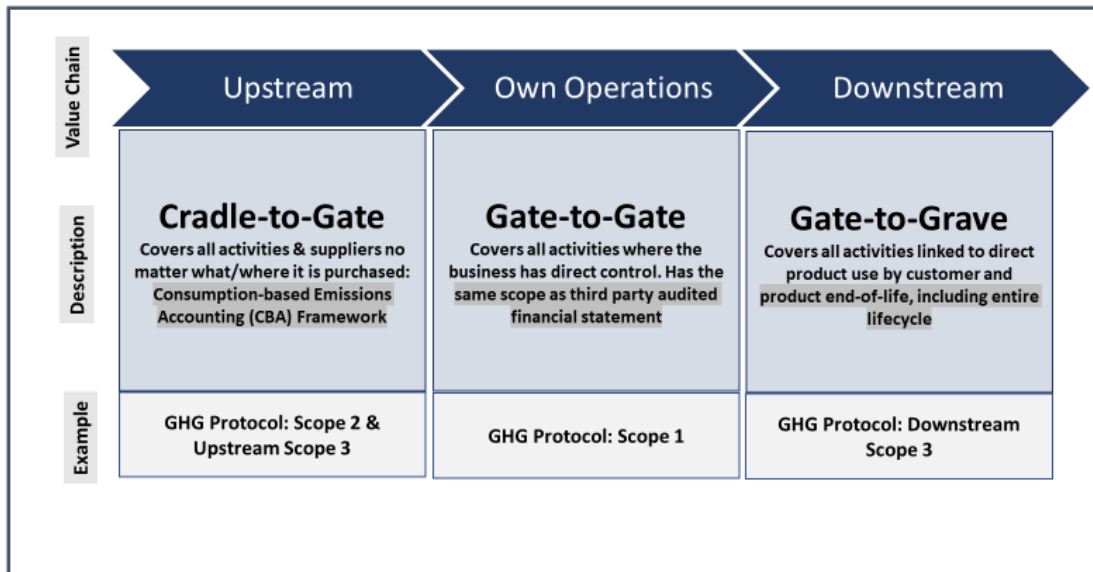


Source: WEF Stakeholder Capitalism & Davos Manifesto, 2020

This framework of expanded materiality turns the current understanding of materiality as a static entity, which is how materiality is interpreted today in form of Scope, 1, 2 & 3 disclosure norms, to a state that is dynamic and open to the possibility of continuous change and adaption. Dynamic materiality, as this expanded materiality is often referred to, means two concrete things. The first is that the concept of cradle-to-grave is now segmented into three parts, with each part interconnected to each other: cradle-to-gate, gate-to-gate and gate-to-grave. Additionally, each of these parts are to be put through a value accounting framework (Figure 2) that quantifies the value that each part generates in relation to climate impacts (VBA, 2022)⁹.

⁹ Please see: <https://www.value-balancing.com/> [Retrieved on 28-01-2022]

Figure 8.0: End-to-End Value Chain Value Accounting



Source: Value Balancing Alliance (VBA), 2022

What this means in practical terms for those directly engaged with sustainability reporting is that they must adopt a value chain approach, at least at the bare minimum as a starting point, to measure carbon footprint and GHG emissions. The same value chain approach must be overlaid on the social and governance dimensions and parameters directly connected to value creation and value addition at each link of the value chain. The second is an explicit acknowledgement that what investors, shareholders, institutions, government, and regulatory bodies consider to be material environmental, social and governance issues will change over time. One specific case in point is the microplastics in oceans and other waterbodies. The second case in point is the increasing amount of antibiotic resistance and endocrine disorders among the general human population as result of its indiscriminate use in meat and poultry industries.

7.0 Dynamic Materiality & Value Accounting : Using the Specific PBSM-SD

Dynamic Materiality and Value Accounting share one common trait. Both are meant to accurately encompass safe limits for planet and people, while moderating and modulating the limits of profit. To the extent of intellectual inspiration, one can trace it to the fundamental thought architecture that emanated from the 1972 Rome Clubs 'Limits of Growth and the Triple Bottom Line (TBL). However, Dynamic Materiality and Value Accounting seeks to transform that broader trait into concrete Enterprise Value that gives energy and focus to Stakeholder Capitalism in lieu of Chareholder Capitalism.

The authors define dynamic materiality for companies as a method that identifies SaaS and SD Strength-Weakness-Opportunities-Threats (SWOT) for the future enterprise value creation for a company. Further, the authors propose that value accounting is the framework by for future Earned Value Management (EVM)¹⁰ that is directly connected to enterprise value creation. Using the Specific PBSM for SaaS-SD for Companies (PBSM-

¹⁰ Earned value management is a technique for measuring performance and progress. It has combine measurements of a project management triangle of scope, time, and costs [in our case an overall value/harm calculation taking our eco-efficiency and other people and planet indicators].

SD), the authors have explored and visualised an initial PBSM-SD for Dynamic Materiality & Value Accounting (Figure 8.0). The figure uses three colour coded legends that indicate :

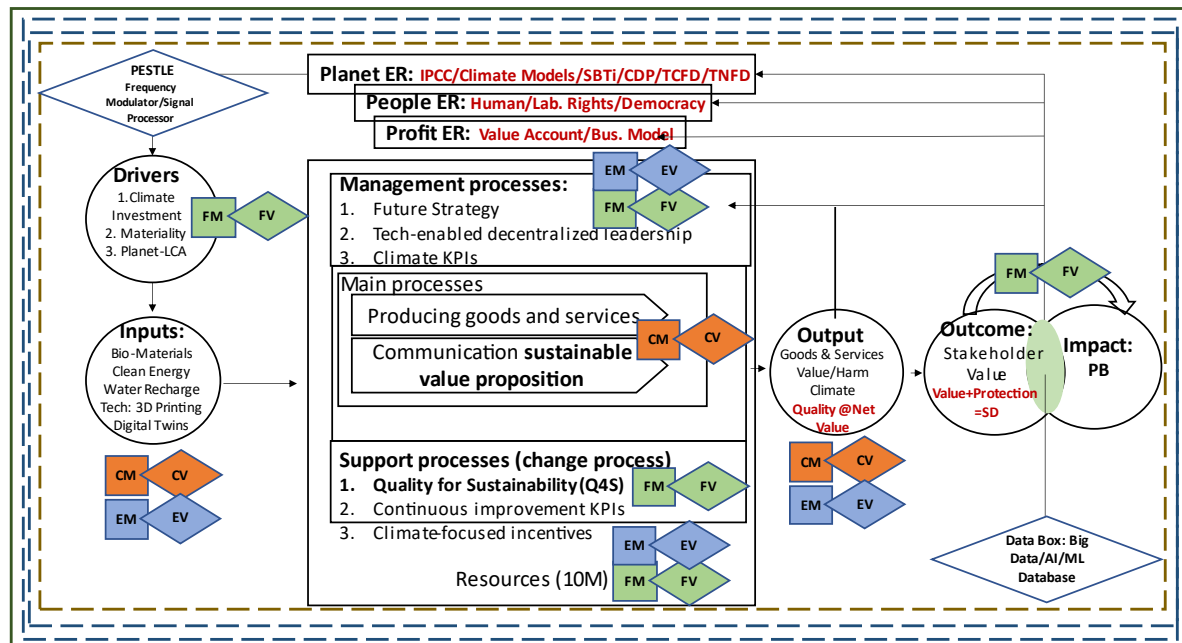
1. Current Materiality [CM]
2. Emerging Materiality [EM]
3. Future Materiality [FM]

Additionally, the figures also uses the same three-colour coded legends [but of a different shape] that indicate the potential for EVM against each materiality

1. Current Value [CV]
2. Emerging Value [EV]
3. Future Value [FV]

This helps expanded materiality assessment [Dynamic Materiality] to be seen as an sustainability and sustainable development opportunity for a company from the perspective of future enterprise value creation and management [Value Accounting]

Figure 9.0: PBSM-SD for Dynamic Materiality & Value Accounting



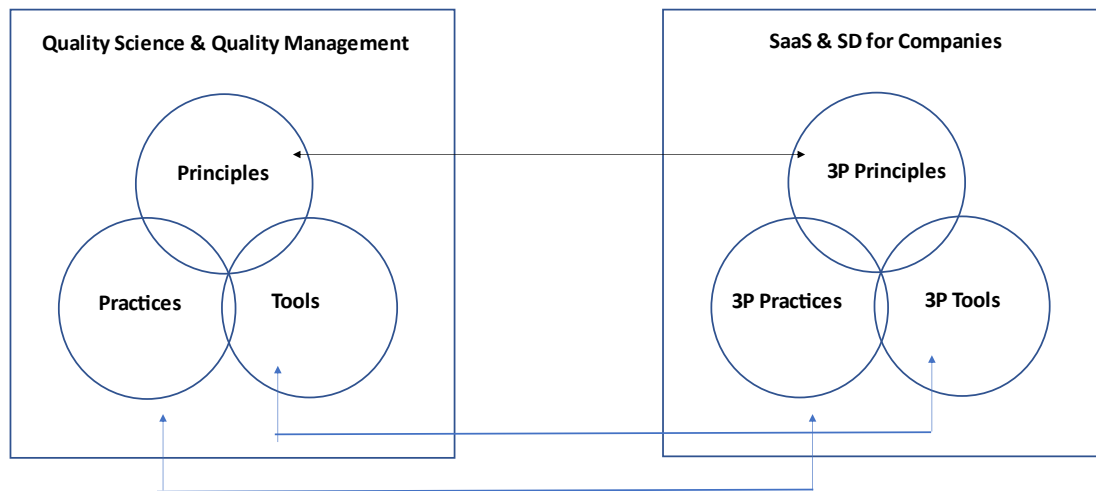
System limit Source: Swaminathan, Isaksson, Rosvall, 2022

To illustrative explain the above through a concrete example, there are two long-term impacts that have emerged from PBSM-EG, in particular the black box of *Impact* (Figure 2.0). Polyfluoroalkyl substances (PFAS) aka 'forever chemicals' and microplastics have become key material issues that emerges as both existential threat to the absolute system limit as well the system boundaries and balance between Planet-People-Profit. For companies, irrespective of which ever sector on industry they are located within, this is a key driver that has become material (expanded and dynamic) which will have a direct impact on the material footprint of their inputs. So a FM/FV materiality issue at the level of Driver as shown in the figure above is EM/EV at the input level for a company. From a Management Process perspective, the key climate investment decisions that need to be taken at the Board/Leadership/CXO level is a both a FM/FV and an EM/EV. To that extent, the authors propose a SWOT framework for a company board that maps Planet-People-Profit system balance imperatives of SD for the company as per the SaaS in the four quadrants of Physical-Transition-Climate-Existential to map actions and the process associated with it.

8.0 Sustainability & Sustainable Development for Companies : A Q4S Approach

The authors are of the view that Sustainability and Sustainable Development today for companies is domain of problem statements that emerge from the complexities of the current model. Further, the authors are also of the view that SaaS and SD for companies is requires a continuous process improvement mindset. Within that limited context, the authors are of the view that the domain of Quality Science and Quality Management provides solution frameworks that are firmly embedded and located in a continuous process improvement worldview and mindset. The author propose an initial level meta mental model that makes Quality Science & Management as a framework and lens of first choice to look at SaaS and SD for a company (Figure 7.0)

Figure 10.0 : Initial Q4S Meta Mental Model



Source: Swaminathan, Isaksson, Rosvall, 2022

9.0 Discussion

Sustainability will become a clear and shared societal value only when the trade-offs and incentives of an overall system-of-systems is aligned towards a value accounting framework that starts treating all stakeholders as defined by WEF, and that includes environment, with an equal invested stake. There is a need to move from an actor-network model to a stakeholder model for an 'outside in' inclusive management model. An actor will act only when there is an incentive to act. For example, to smoke a cigarette is an act or to not smoke one is also an act. A person may decide not to smoke a cigarette because it degrades personal health and those around us. In short, the person's awareness about the ill-effects of cigarette is a strong incentive. It is an incentive that is vested in the person as also those around him. An actor will act for constructive improvement only when there is a stake. In short, an actor becomes a stakeholder only when there is a mechanism for the actor to act: capacity to act backed by a capability to act is what makes a stake. For stakeholder capitalism to succeed, sustainability needs to become a societal value and a cultural fact. A value needs a value accounting framework, which in turn needs a process-based approach to understand



what value is created in which manner so that the harm generated as result of the value creation is both balanced and compensated in an accountable manner. PSBM has the potential, and needs to be explored for understanding, defining, and measuring sustainability as a societal value and cultural fact.

10.0 Conclusions

The paper is an initial attempt to engage with the questions of sustainability, sustainable development materiality and value accounting using a PSBM and Q4S meta model. The paper is also part of larger effort to understand the similarities and the potential synergies between quality science and sustainable development as part of continuing research on Quality for Sustainability (Q4S). A stakeholder needs perspective is necessary for sustainability to be operationalised and the Sustainable Development to be measured as per the definition of the Brundtland Commission report. Stakeholder Capitalism expands the notion of capitalism and brings into the fold of stakeholder framework both environment and ecology as equal and key stakeholders as customers, employees, suppliers, and local communities. Additionally, the change in the approach to materiality, from one accounting focussed exclusion to one of measurement driven continuous inclusion, is a radical change, allowing for factors that are not even considered to be material at present [for example, massive and irreversible coastal flooding due to climate change] to become part of materiality. Additionally, dynamic materiality provides for such factors to move up and down the scopes, with such factors currently outside system boundaries become fundamentally material by having the possibility to define as a Scope 1 materiality factor. There is further work needed on engaging with PSBM within the developments in Stakeholder Capitalism, Dynamic Materiality and Value Accounting. The ultimate aspiration, and expectation, is to evolve a framework that allows for sustainability to become a shared societal value.

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