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FROM AMBITION TO ACTION: LEVERAGING DMAIC FOR EMBEDDED SUSTAINABILITY IN SUPPLY CHAIN PROCESSES

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Abstract

In the recent years, corporate have stated ambitious vision related to sustainability and ESG, though translating the vision and goals to implementation has not been easy. Sustainability needs to be embedded and integrated in the core of business operations and sustainability, to have a meaningful impact towards the ESG goals

This paper is an analysis from a practitioner perspective, examining the concept of embedded sustainability and the application of Six Sigma methodology of DMAIC to integrate sustainability in supply chain management practices.

This analysis is intended to guide business managers and supply chain process owners in embedding the ESG focus in business processes more systematically and help towards connecting the strategy to execution. Future scholars could explore more from academic standpoint on how different methodologies from Total Quality Management can be effective in driving improvements in ESG strategies.

Introduction

Across the globe, for many large businesses, sustainability agenda is being steered by ethical considerations, consumer preferences, financial imperatives and regulatory requirements. Many large corporations have declared their very bold vision toward to sustainability and ESG, and the focus on quality of reporting compliance to various frameworks and regulations has also substantially improved in the recent years (Arvidsson & Dumay, 2022) . However, translating the vision and goals to implementation has not been easy. Surveys indicate that only 50% believe that their company performs very effectively against environmental goals (Segal, 2021).

Unless sustainability is embedded and integrated in the core of business operations in terms of sourcing, manufacturing, logistics and supply chain practices, it will be not have a meaningful impact towards the ESG goals. Companies must engage stakeholders, including customers,

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suppliers, employees, and communities, in their sustainability efforts. Embedding sustainability can help build trust, increase brand value, and create shared value for both the company and society.

Organizations would need to look at sustainability as a strategic move within organizations. In this paper we review the existing literature around sustainability as a strategic fitment within the organization landscape and provide a conceptual model to create a roadmap for embedding sustainability within organization strategy. Our research would help academics to build on our model and practitioners to embed sustainability within business strategy.

Concept of Embedded Sustainability

The concept of “Embedded sustainability” is about how sustainability has to be integrated into business strategies and practices. (Laszlo & Zhexembayeva, 2011). Companies that embed sustainability into their core business strategy and operations can create long-term value for both the company and society as a whole. Companies that embrace sustainability must go beyond simply minimizing their environmental impact. They must also consider social and economic factors, such as human rights, labor practices, and community development. Embedded sustainability involves integrating sustainability into all aspects of a company's operations, from product design and sourcing to production and distribution. Companies that embed sustainability into their business strategies also measure and report on their sustainability performance (Spence & Rinaldi, 2014) . It is also fair to argue that sustainability has become a megatrend and a very important business imperative. Companies that fail to take sustainability seriously will fall behind their competitors. Sustainability is no longer a "nice-to-have" but rather a "must-have" for businesses looking to create long-term value and remain competitive (Lubin & Esty, 2010).

Companies must take a comprehensive approach to sustainability, addressing environmental, social, and governance (ESG) factors. This includes reducing their carbon footprint, addressing social and labor issues in their supply chains, and improving governance and transparency.

However, in across many organizations in today’s age, ESG and sustainability is primarily viewed as reporting and regulatory imperative. ESG is becoming is the annual reporting ritual with and a "Tick the box" compliance where companies focus solely on meeting the minimum regulatory requirements for ESG, without making a meaningful commitment to the underlying principle.

Sustainability must go beyond reporting into requiring a new way of thinking about business, with a focus on collaboration, innovation, and long-term value creation. Companies must move beyond short-term thinking and embrace a more holistic approach to business that considers the needs of all stakeholders. Companies can derive significant business value from sustainability initiatives, including cost savings, risk reduction, brand enhancement, and new market opportunities. There is also a strong argument that sustainability can be a source of competitive advantage and a driver of innovation and growth. (Lubin & Esty, 2010)

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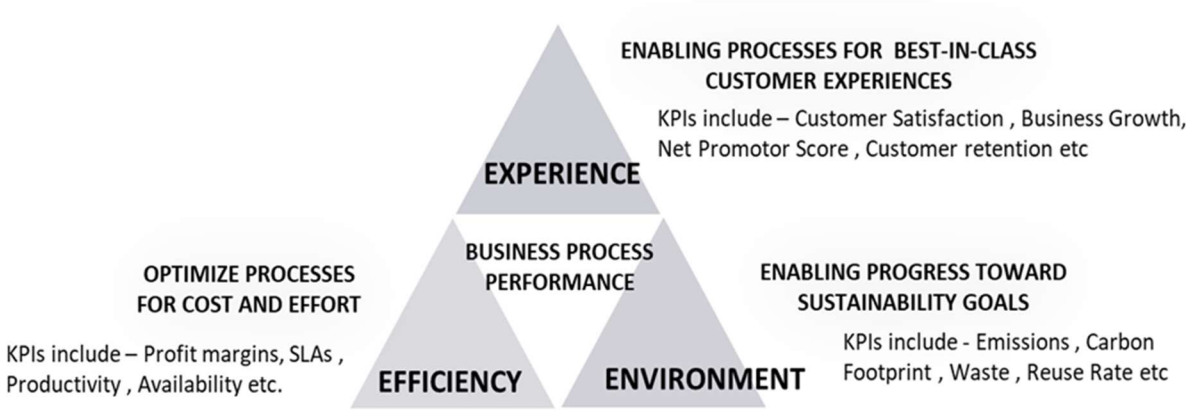
Business Processes and Sustainability

Looking beyond the Reporting and Regulatory compliance, Organizations must integrate sustainability principles into their core operations, customer-service processes, and supply chain processes. They need to aim to measure their performance, improve their decision- making, and drive continuous improvement. The underlying premise is that without altering these foundational business processes and without comprehending the manner in which Environmental, Social, and Governance considerations influence and are implemented efficiency, the attainment of tangible sustainability goals will remain elusive.

Organizations should give precedence to incorporating diverse suppliers in all purchase orders, enhance energy and water efficiency within each production plan, explore more environmentally conscious procedures for each shipment, and implement equitable labor practices throughout their policies. These efforts collectively enable the effective integration of ESG principles. Historically, the emphasis of business process performance has been centered on enhancing customer experiences and achieving cost efficiencies.

Figure 1: Triple EEE business process performance framework.



However, the seamless three-way integration of environmental goals along with enhancing experience and improving efficiency helps in a holistic Business outcome. The objective is be fully incorporate sustainable practices throughout the entire delivery experience and utilize them as a means to yield tangible returns on investment. In this paradigm, sustainability outcomes are viewed as a leading indicator of business excellence (C.S. & Hughes, 2022)

DMAIC Framework for Process Problem solving

Six- Sigma is defined by (Linderman et al., 2003) as ‘an organized and systematic method for strategic process improvement and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in customer defined defect rates.’ Researchers like (Schroeder et al., 2008) indicate that approach and emphasis on quantifiable metrics, the methodical enhancement process of Six Sigma is recognized as a very effective and valuable asset to quality management. This improvement process is commonly referred to by the

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acronym DMAIC. DMAIC stands for Define, Measure, Analyse, Improve, and Control, each phase in the DMAIC methodology represents an important step in the approach towards improving processes, and achieving better outcomes.

Table 1: A generic representation of DMAIC phases

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I.	***Define: this phase is about defining the problem or opportunity for improvement including the problem statement, objectives, and goals***
II.	***Measure: once the problem is defined, the focus is on measuring the current state of the process to identify areas for improvement.***
III.	***Analyse: is about diving deeper into the data to understand the root causes of the problems identified in the previous phase***
IV.	***Improve****: this phase is about generating and selecting potential solutions to address the root causes.*
V.	***Control****: this final phase focuses on supporting the improvements and ensuring that the process remains stable and consistent.*

DMAIC as a Framework for Embedding ESG in Supply Chain and Business operations

The studies and applications on Total Quality Management, Six Sigma and methodologies like DMAIC have largely remained independent from the studies on ESG and sustainability (Jean & Grant, 2022). In order for companies to steer their sustainability strategy and to create longer term impact, it's important to embed sustainability in their operational processes, customer facing processes and supply chain processes. Unless there is change in these frontline processes, and unless ESG impacts are understood and acted up by down-the-line procurement, production, inventory, warehouse processes efficiently, enterprises will not meet the audacious goals needed for practical sustainability. (C.S. & Hughes, 2022)

Using DMAIC as the framework, organizations can identify, manage and continually improve organizational progress in a structured way, towards driving the ESG efforts. This will also be a key for integrating ESGs goals as well the execution in the business and supply chain operations. Following is the elaboration of the DMAIC phases with focus on embedded sustainability -

Define: This phase involves identifying the ESG problem areas, understanding the materiality impact on organization's process and understanding the context of the sustainability opportunity including the processes involved. One of the key requirements for this phase would be to ensure involvement of leadership and required stakeholders.

Measure: This phase involves measuring the current state of the process to identify areas for improvement. This includes Key Performance Indicators (KPIs) like carbon emissions (Scope1, 2, 3), energy consumption, water usage, waste discharges, and supplier's labor practice compliance. Modern Green House Gases (GHG) accounting platforms, Data integration tools, Process Mining Platforms can integrate data from diverse sources including information technology systems,

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ERPs, financial reports, industry databases and more to quantify the current performance of the process. These tools can help integrate structured and unstructured data to provide a holistic view of the ESG landscape. It is also important to understand the data gaps and quality of data as they are critical factors for the right impact. Understanding the variations in the process, drilling down into the possible causes should need a collaborative and multidisciplinary between various teams.

Analyse: This phase is about diving deeper into the data to understand the primary causes of the problems impacting the sustainability performance. The actual causes leading to an inferior sustainability performance could be 'hiding deep down from the surface' (Jayswal et al., 2011). While traditional six sigma techniques and tools such as Pareto charts, Ishikawa diagrams, scatter plots, and statistical analysis can be used to identify potential root causes, modern data analytics platforms and Artificial Intelligence (AI) tools can be leveraged to a significant advantage in this methodology. Techniques like machine learning, natural language processing, and data mining can help to uncover patterns, relationships, and anomalies in the ESG data. Data visualization tools can present ESG data in an easily understandable format, enabling stakeholders to identify trends and anomalies at a glance.

Improve: This phase is about generating and selecting potential solutions to address the root causes. These potential improvement opportunities can span across multiple areas for improving energy efficiency, waste reduction, recycling, water conservation, transportation, logistics and building design. This phase also involves selecting a few promising solutions areas, implementing them on a small scale or in a controlled environment. This pilot testing helps to assess the effectiveness of the solutions and identify any unforeseen challenges. A comprehensive change management plan will also be needed to guide the implementation of the solutions across the organization.

Table 2: **Impact areas for Supply chain and Operations through DMAIC Process Analysis and improvement**

1. ***Green House Gas emissions in Operations****: Looking into practices such as use of energy fuels (coal, oil, and natural gas) for in operations, outdated equipment, lack of energy-saving practices, and poor insulation, resulting in higher emissions per unit of output.*
2. ***Supplier Selection and Sustainable procurement****: Procurement Organizations need to evaluate suppliers based on their environmental practices, and governance. Also, to screen their supplier do not involve unethical practices, such as forced labour, child labour, or human rights abuses.*
3. ***Asset Management and MRO****: Analysing proactive preventive maintenance opportunities to extend the lifespan of equipment and assets, reducing the need for frequent repairs or replacements. Repairing or refurbishing equipment not only extends its lifespan but also reduces landfill waste and conserves resources*
4. ***Logistics****: Looking for ways to optimize transportation routes to reduce mileage, fuel consumption, and emissions. route planning to identify the most efficient and effective routes based on factors such as distance ,cost of transportation, traffic, and delivery schedules helps in consolidating shipments to maximize truckload capacity and reduce the number of trips.*
5. ***Packaging Optimization****: Optimizing packaging design and materials would minimize waste and maximize space utilization. Companies need to think of sustainable packaging materials that are recyclable, reusable, or made from renewable resources and efficient packing techniques to minimize transportation volume and associated emissions*
6. ***Circular Economy:*** *Embrace circular economy principles by designing products and distributing for longevity, reparability, and recyclability. Encourage suppliers to adopt similar practices to reduce waste and resource consumption*

Control: The final phase focuses on supporting the improvements and ensuring that the process area remains stable and consistent. It also includes establishing a feedback loop to continuously monitor and improve the process as needed. The emphasis in on developing a control plan to outline the steps and measures required to maintain the sustainability performance of improved process. A system will need to be setup to monitor and track the key metrics that were set in the measure phase, like the Carbon Emissions (Scope1, 2, 3), Energy consumption, Water Usage, Waste Discharges. The Data Analytics system well-known prior would be critical in establishing adequate process feedback look to continuously monitor and improve the process. A Change Management plan to training and educating the team members with standard operating procedures to guide future mode of operations will be required.

Limitations of Our Study and Way Forward

Our findings based on extant literature suggest embedding sustainability within business strategy is at a relatively nascent stage. We have provided a conceptual model and a point of view which can be empirically validated through ethnographical research methods using interviews with sustainability leadership, change agents and strategic decision makers within organizations. We believe embedding sustainability within the business strategies will become more relevant across industries as regulations across different governments are becoming order of the day.

Conclusion

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The studies on Six Sigma and methodologies like DMAIC have largely remained independent from the studies on ESG and sustainability (Jean & Grant, 2022). This paper is an attempt to leverage DMAIC as a methodology towards logically and seamlessly integrating ESG in Supply chain practices. By adopting the steps of Define, Measure, Analyse, Improve and Control, teams can effectively incorporate and continually improve organizational effectiveness in driving overall ESG efforts.

This analysis is intended to guide Business managers, Process Owners, Supply chain executives in embedding the ESG focus in business processes more systematically and help towards connecting the strategy to execution, Future scholars could explore more from academic stand point on how different methodologies from Total quality Management can be effective in driving improvements in ESG strategies.

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