GREENWISE CONSULTING

From Data to Decisions:

How IoT Drives ESG Transition and Fuels Business Productivity

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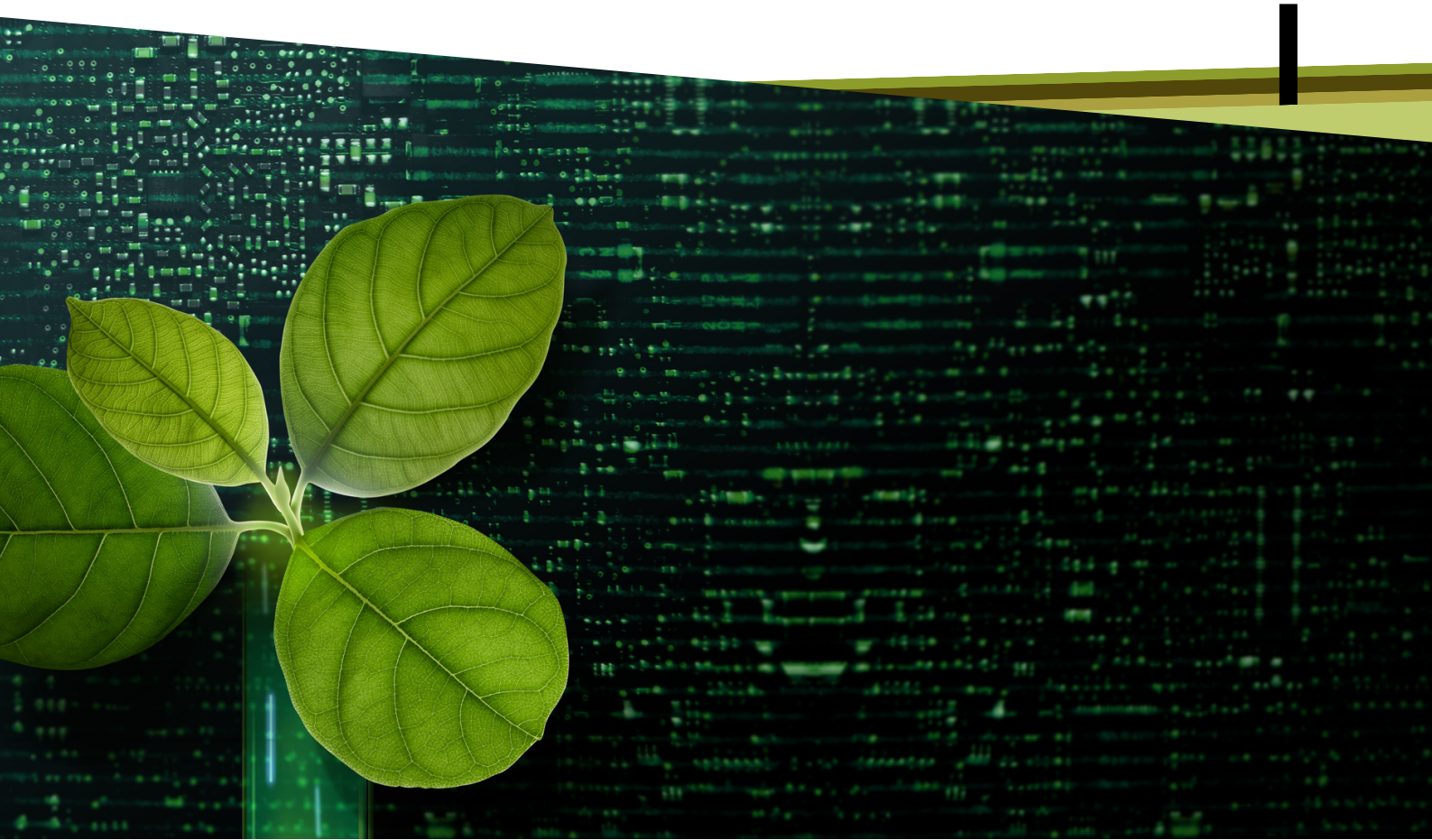

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Foreword

Welcome to the world of business transformation, where innovative technologies continually reshape industries and pave the way for a sustainable future. I am delighted to introduce this insightful whitepaper, "From Data to Decisions: How IoT Drives ESG Transition and Fuels Business Productivity."

In today's fast-paced business environment, staying ahead of the curve is not just a desire; it's a necessity. Embracing sustainability and environmental responsibility, while simultaneously enhancing productivity and efficiency, has become the cornerstone of success for any forward-thinking enterprise. This whitepaper explores the power of data harnessed through the Internet of Things (IoT) and its potential to revolutionize decision-making processes.

Data has assumed unprecedented importance in modern business operations. This paper delves deep into understanding the crucial role data plays in driving informed decisions. In an era where the volume of data is exploding exponentially, the ability to extract meaningful insights becomes a game-changer. By doing so, businesses can unlock unprecedented opportunities to optimize their operations, reduce waste, and foster an eco-friendly and sustainable working environment.

Amidst this data revolution, IoT emerges as a pivotal force in monitoring and tracking Environmental, Social, and Governance (ESG) metrics. The exploration into the Role of IoT in ESG Monitoring and Tracking reveals how smart devices and interconnected systems offer an unprecedented level of transparency, empowering organizations to make sustainable choices with confidence.

The whitepaper demonstrates the tangible and profound impact of Leveraging Data for ESG Transition. Real-world examples showcase how data-driven insights can steer businesses toward a greener path, reducing their carbon footprint, and promoting sustainable practices throughout the supply chain.

IoT-driven strategies not only facilitate ESG transition but also contribute significantly to Enhancing Business Productivity. By optimizing processes, automating routine tasks, and gaining valuable predictive insights, businesses can operate smarter, faster, and more competitively.

Of course, with any technological advancement, challenges are bound to arise. "Overcoming Challenges in Data Management" candidly addresses potential hurdles and provides practical solutions. Armed with this knowledge, businesses can confidently navigate the complexities of data governance, security, and integration, ensuring a seamless and effective IoT implementation.

Throughout this whitepaper, we've drawn upon insights from a range of sources and industry expertise. As we explore "IoT Applications in Different Business Sectors," the versatility of IoT solutions becomes evident. From manufacturing to agriculture, from logistics to healthcare, the possibilities for IoT-driven improvements are limitless.

Real-life "Case Studies: Successful Implementations" offer inspiring stories of companies that have reaped the rewards of IoT-driven ESG initiatives. These case studies provide valuable insights into the transformative potential of IoT, illustrating that sustainability is not just an aspiration but a practical, attainable reality.

I invite you to delve into the pages of this whitepaper and envision the immense potential that lies ahead. The journey from data to decisions is a powerful one, where IoT serves as the driving force behind your business's growth, resilience, and positive impact on the planet.

Embrace the future with curiosity and let this whitepaper inspire you to explore new frontiers in sustainability and business productivity.

Warm regards,

Viriya Paramita
Co-Founder
Greenwise Consulting

INTRODUCTION

The global Sustainable Development Goals (SDGs) were set by the United Nations to be achieved by 2030. To meet this goal, firms and companies are integrating Environment, Social, and Governance (ESG) factors into their business management and investment. Not to mention, the integration of ESG values into business operations also has the potential to increase productivity and longer-term profit growth. Unfortunately, the availability of these ESG data is still regarded as low, which is concerning, to say the least, since the data is critical for the evaluation of the companies' ESG performance. This could be overcome by implementing technologies that enable real-time and transparent data, such as the Internet of Things (IoT). Before delving further into this topic, we must first understand several key terms:

- ## Environment, Social, and Governance (ESG)

Environment: the amount of energy a company uses, the discharged waste, the resources needed, and the impact on living things as a result.

Social: the relationships and reputation that a company cultivates with individuals and institutions in the communities in which it conducts business. Diversity and inclusion are all part of it, as are labor relations.

Governance: the internal set of policies, procedures, and controls that a company uses to govern itself, make good decisions, comply with the law, and satisfy external stakeholders.

- ## Internet of Things (IoT)

IoT refers to a network of things where communication between intelligent devices is carried out through sending and receiving data. In principle, the IoT comprises five layers: perception layer, network layer, and application layer. The data acquisition is available in the perception layer using wireless sensors with a computing unit.

- ## Data-driven decision-making

The use of valid and relevant data to make accurate and effective decisions, which provides credible evidence to stakeholders and management.

From the definitions above, the connection between the three terms is becoming more apparent. The use of IoT can be leveraged by companies to track their ESG data through transparent and real-time monitoring and reporting systems. The data gathered by IoT sensors will be analyzed and turned into ESG reports for the top management, which will act as the basis for decision-making. For example, a company can measure its carbon footprint through wireless sensors that are integrated with computation units. This way, the company is aware of their carbon emission and where it comes from, hence the management could strategically determine how and where to cut their emission. The interconnectedness of these three approaches is critical for the future of a more sustainable business, which will be further explored in the next sections.

THE IMPORTANCE OF DATA IN PROVIDING VALUABLE INSIGHTS INTO ESG PERFORMANCE

In recent years, environmental, social, and governance (ESG) factors have become critical considerations for businesses and investors. ESG performance measures a company's commitment to sustainability, responsible business practices, and its impact on society. As the focus on ESG continues to grow, data plays a pivotal role in providing valuable insights into a company's ESG performance.

Data serves as the foundation for understanding and assessing a company's ESG practices. It encompasses a wide range of information, including environmental and social impact data, labor practices and workforce diversity metrics, governance structures, and more. By analyzing this data, stakeholders can gain a comprehensive understanding of a company's ESG performance and its alignment with sustainability goals.

One of the key reasons data is crucial for ESG analysis is its ability to provide transparency. Accurate and reliable data allows investors, consumers, and other stakeholders to make informed decisions. Companies that prioritize ESG reporting and provide comprehensive data demonstrate their commitment to transparency and accountability. This transparency not only fosters trust but also enables stakeholders to identify areas of improvement and drive positive change.

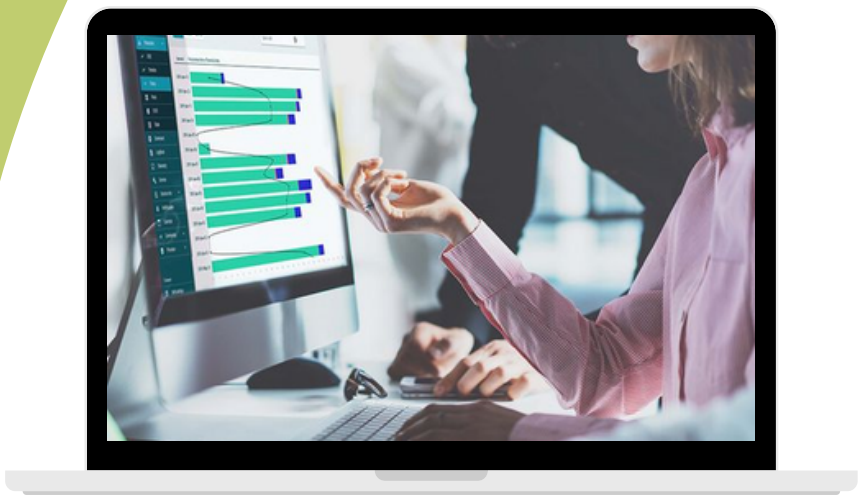
Furthermore, data enables benchmarking and comparisons across industries and companies. Standardized metrics and frameworks, such as the Global Reporting Initiative (GRI) and Sustainability Accounting Standards Board (SASB), help in measuring ESG performance consistently. With access to reliable data, investors can compare companies within the same industry, identify leaders in sustainability, and make more informed investment decisions.

Data-driven insights also allow companies to identify risks and opportunities related to ESG factors. By analyzing ESG data, businesses can uncover operational inefficiencies, potential reputational risks, and areas where they can enhance their positive impact. This information helps companies develop strategies to mitigate risks, reduce their environmental footprint, and improve their overall ESG performance.

Moreover, data analysis provides a basis for performance tracking and progress evaluation. ESG metrics are not static; they evolve as society's expectations change. Regular data collection and analysis allow companies to track their progress over time, set goals, and measure the effectiveness of their sustainability initiatives. It enables companies to communicate their achievements and demonstrate their commitment to long-term sustainable practices.

As ESG considerations become increasingly important, reliable and comprehensive data will continue to be vital in driving sustainability and responsible business practices. By embracing data-driven decision-making, companies can build trust, gain a competitive edge, and contribute to a more sustainable future.

THE ROLE OF IOT IN ESG MONITORING AND TRACKING



Capture data in real-time

The integration of IoT technologies into ESG monitoring and tracking has revolutionized the way organizations manage sustainability. IoT facilitates real-time data collection, analysis, and utilization, enabling seamless monitoring of ESG performance. This transformative capability enhances data collection accuracy, automates processes, and offers numerous real-world applications.

- **Real-Time Monitoring and Alert Systems:**

  One of the key advantages of IoT in ESG monitoring is the ability to capture data in real-time. Organizations can implement IoT devices to monitor and track ESG metrics continuously, providing valuable insights into their environmental and social impact. Real-time data allows for proactive decision-making, enabling organizations to identify issues promptly and take corrective actions. Moreover, IoT-based alert systems can notify stakeholders about deviations from predefined ESG targets, facilitating timely intervention and reducing negative impacts.

- **Advanced Data Analytics and Insights**

  IoT-generated data in ESG monitoring is often vast and complex. However, with the advent of advanced data analytics techniques, organizations can extract valuable insights and patterns from this data. Machine learning algorithms and artificial intelligence can analyze IoT data to identify correlations, trends, and anomalies, providing organizations with actionable information to improve their ESG performance. These insights can drive operational efficiencies, resource optimization, and the implementation of targeted sustainability initiatives.

- **Integration with ESG Reporting and Compliance**

  One of the key advantages of IoT in ESG monitoring is the ability to capture data in real-time. Organizations can implement IoT devices to monitor and track ESG metrics continuously, providing valuable insights into their environmental and social impact. Real-time data allows for proactive decision-making, enabling organizations to identify issues promptly and take corrective actions. Moreover, IoT-based alert systems can notify stakeholders about deviations from predefined ESG targets, facilitating timely intervention and reducing negative impacts.

- **Real-World Applications**

  The role of IoT in ESG monitoring and tracking is exemplified through various real-world applications across industries. For instance, IoT-enabled smart grid systems monitor energy consumption patterns, optimize energy distribution, and reduce carbon emissions. In the transportation sector, IoT sensors in vehicles provide real-time data on fuel efficiency, emissions, and driver behavior. Additionally, IoT devices in agriculture enable precision farming, optimizing water usage and reducing chemical inputs. These examples demonstrate how IoT is revolutionizing ESG monitoring across diverse sectors.

LEVERAGING DATA FOR ESG TRANSITION

- **Demonstrating How IoT Generated Data Can Facilitate ESG Transition Efforts**

The relationship between ESG and IoT is complementary for two primary reasons. Firstly, IoT can greatly enhance the accuracy and efficiency of collecting and organizing ESG metrics. Secondly, there are numerous ways in which IoT can contribute to improving ESG performance. Both ESG and IoT are predicted to undergo significant growth in the future, and it is clear that the partnership between IoT and ESG holds several intriguing prospects.

6 ways to leverage IoT to reach ESG goals:

1.Transition from a mindset of yearly reporting to real-time monitoring and corrective actions

Utilizing IoT enables the shift from a traditional approach of annual ESG reporting to continuous monitoring and proactive management. By collecting and analyzing data in real-time, decision-makers can take prompt actions to address any anomalies or deviations. This also allows auditors to provide near-real-time reporting instead of relying on retrospective assessments.

2. Develop a digital representation of your organization to identify hidden factors that contribute to ESG goals

Creating a digital twin of your organization provides a dynamic and easily understandable snapshot of your current ESG status. This virtual replica enables the C-suite to assess their environmental impact and evaluate the efficacy of different strategies or product configurations in real-time.

By utilizing advanced analytics and geospatial models, you can identify hidden enablers for achieving ESG objectives.

3. Enhance working conditions for employees and reduce overall emissions

IoT systems offer improved monitoring of indoor and outdoor air quality with higher accuracy compared to traditional industrial systems. They can quickly detect and report the presence of contaminants or hazardous gases, such as carbon monoxide, preventing their release into the atmosphere. By identifying anomalies, these systems help safeguard the health and safety of individuals while minimizing emissions.

4. Decrease energy consumption in office or knowledge work environments

Real-time occupancy monitoring through IoT can optimize energy usage in office buildings. By focusing energy consumption on occupied spaces and implementing practices like hotdesking and flexible work arrangements, organizations can effectively reduce energy consumption and improve their ESG performance.

5. Measure ESG impacts throughout the entire procurement network

IoT technology enables real-time monitoring and visibility of carbon emissions not only within your organization but also across the entire supply chain. This data empowers stakeholders such as importers, shippers, dealers, and manufacturers to understand the environmental impact of their supply chain operations at any given moment. IoT tools provide valuable insights into the environmental consequences of supply chain logistics, previously difficult to obtain.

In conclusion, the integration of IoT-generated data plays a pivotal role in facilitating ESG transition efforts for businesses. By leveraging advanced technologies and real-time monitoring, organizations can move beyond traditional reporting and proactively manage their environmental, social, and governance performance. The utilization of fill level sensors, digital waste sorting solutions, and other IoT applications enables businesses to optimize waste management practices, improve resource efficiency, reduce emissions, and ensure regulatory compliance.

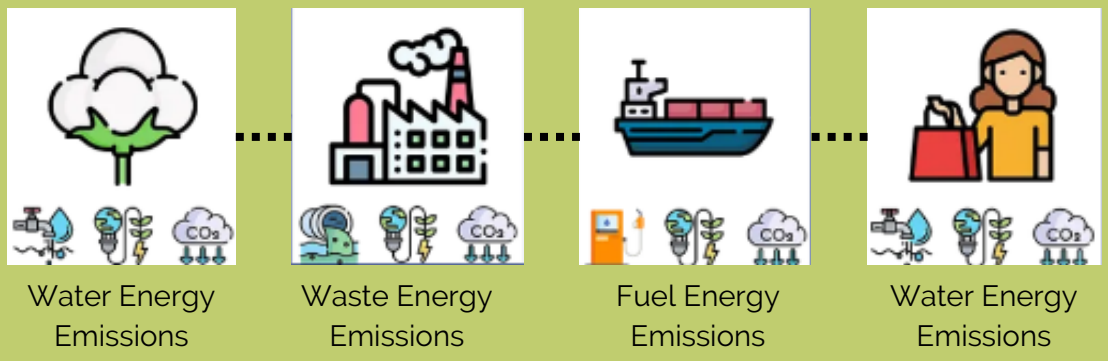
6. Utilize artificial intelligence and IoT in retail settings for improved efficiency

The combination of IoT and artificial intelligence (AI) is revolutionizing sustainability initiatives in the retail sector. From energy consumption reduction to ethical sourcing and waste management, IoT solutions supported by AI are driving positive ESG outcomes throughout the retail value chain. These technologies enable retailers to operate more efficiently and make significant progress towards their ESG goals.

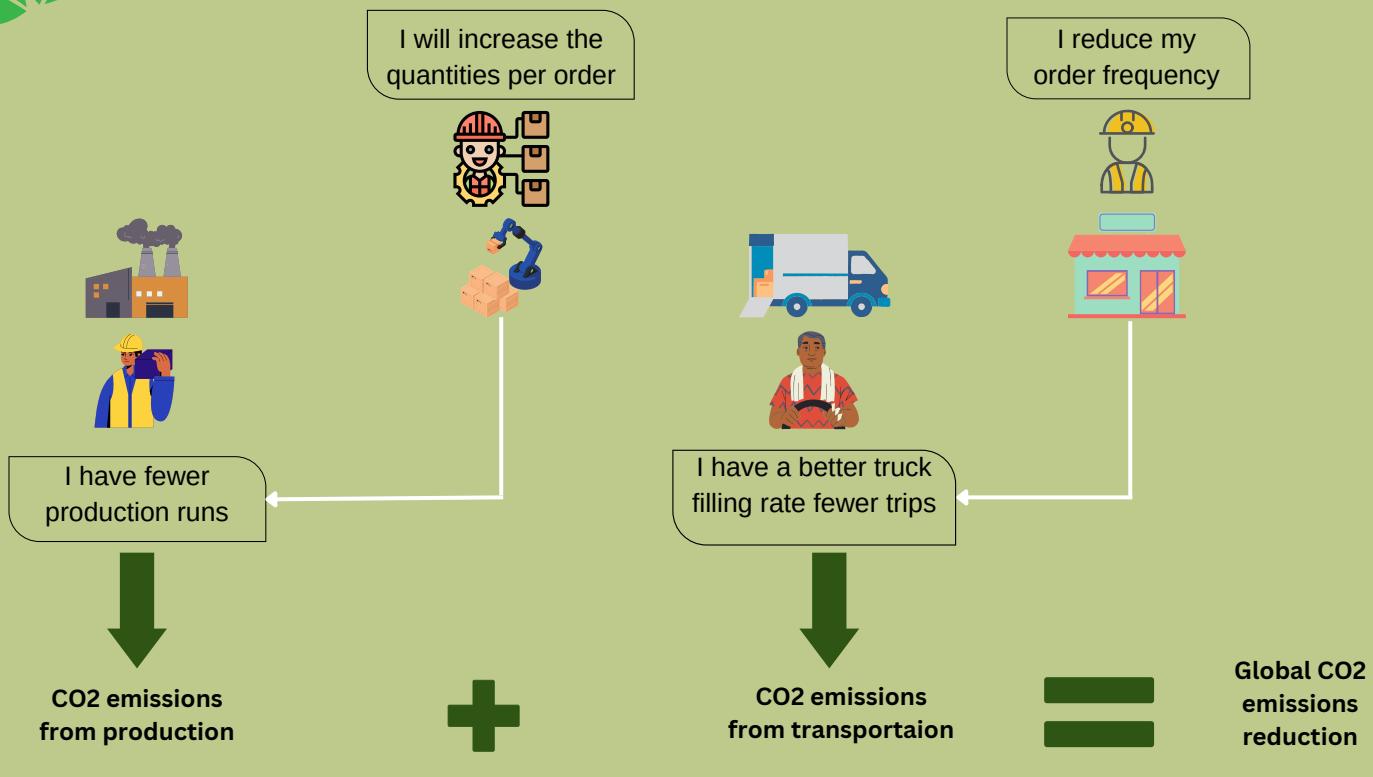
- **Providing Examples How Data-Driven Insights Can Drive Sustainable Practices**

In today's business landscape, embracing sustainable practices has become imperative. With increasing expectations from customers, employees, and investors for organizations to prioritize long-term value creation for all stakeholders, data-driven insights have become essential in building resilient and purpose-led companies that prioritize environmental and social sustainability alongside client interests. The research shows that environmental, social, and governance (ESG) initiatives not only drive competitive advantage, innovation, and financial performance but also contribute to the overall success of organizations. By adopting a data-driven sustainability framework, organizations can leverage insights to make informed decisions that lead to measurable and sustainable business practices, such as reducing greenhouse gas emissions, optimizing supply chains, and minimizing waste, ultimately resulting in positive change and increased profitability. Data-driven sustainability, involves making sustainability-focused decisions based on data collection, analysis, and processing, leading to more responsible and impactful business practices.

A. Minimize Environmental Footprint



To achieve optimal environmental sustainability, a comprehensive and integrated approach is required, ensuring efficiency and striking the right equilibrium that results in a minimal impact on the environment.



Implementing data-driven collaborative actions for sustainable supply chain-transformation

Examples:

1. Our goal is to achieve a 20% reduction in CO2 emissions per unit manufactured.
2. Analysis reveals that 45% of emissions are attributed to transportation and production processes.
3. Store managers will decrease their order frequency by half.
4. Supply planners will increase the replenishment order quantity while reducing the frequency.
5. Transportation teams will ensure the use of appropriately sized trucks.
6. Manufacturing teams will strive to minimize the number of production runs.

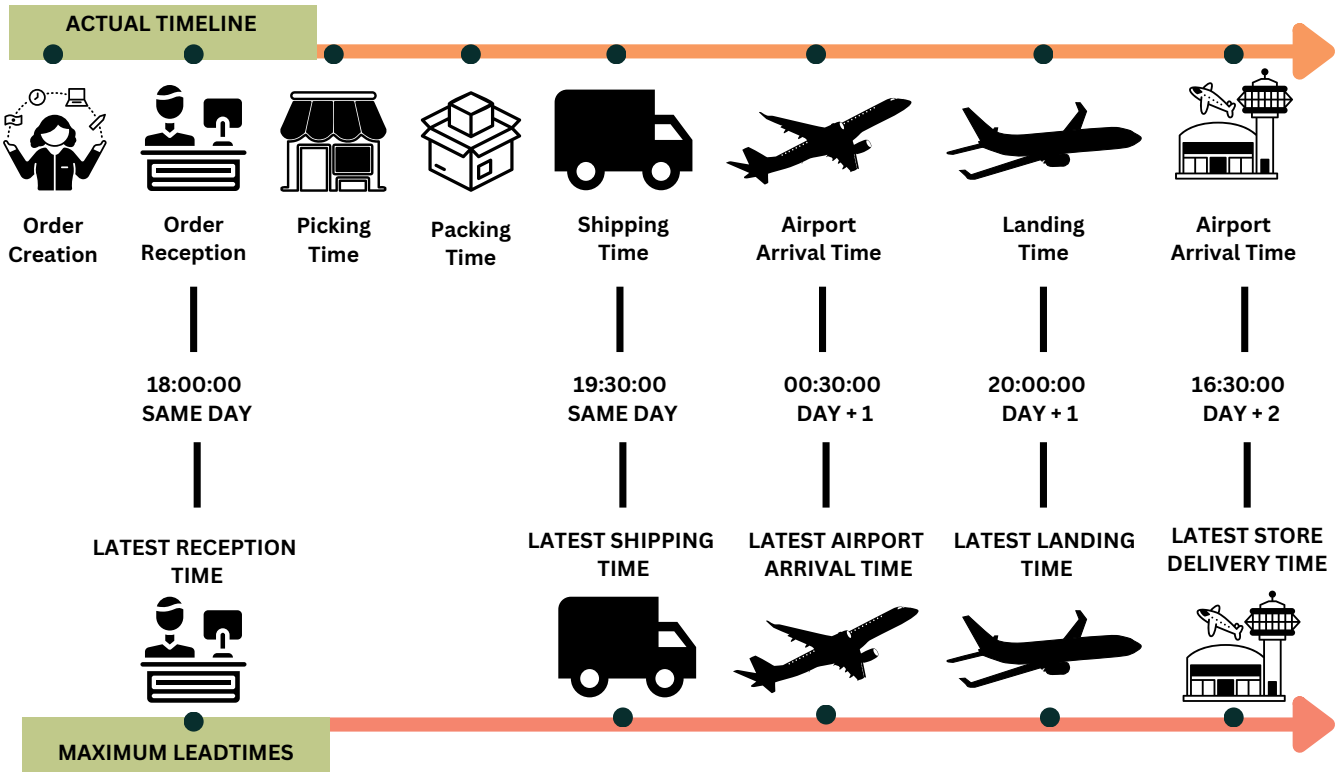
B. Supply chain network optimization

Leveraging data analytics, supply chain optimization aims to identify the most efficient combination of factories and distribution centers to meet customer demand. Through a linear programming approach, the model selects production facilities that both meet demand constraints and minimize overall production and delivery costs. Typically, this involves choosing factories in remote areas with lower production costs, factoring in transportation expenses. This adjustment has a profound impact on the network, particularly in promoting localized production within the European market as part of a low-carbon solution. By adapting the objective function or incorporating cost-related constraints, a balanced approach can be achieved to maintain competitiveness. It is evident that customized optimization models play a crucial role in integrating sustainability into core business processes.

Supply Chain Network Designs for low-cost solutions versus low carbon solution

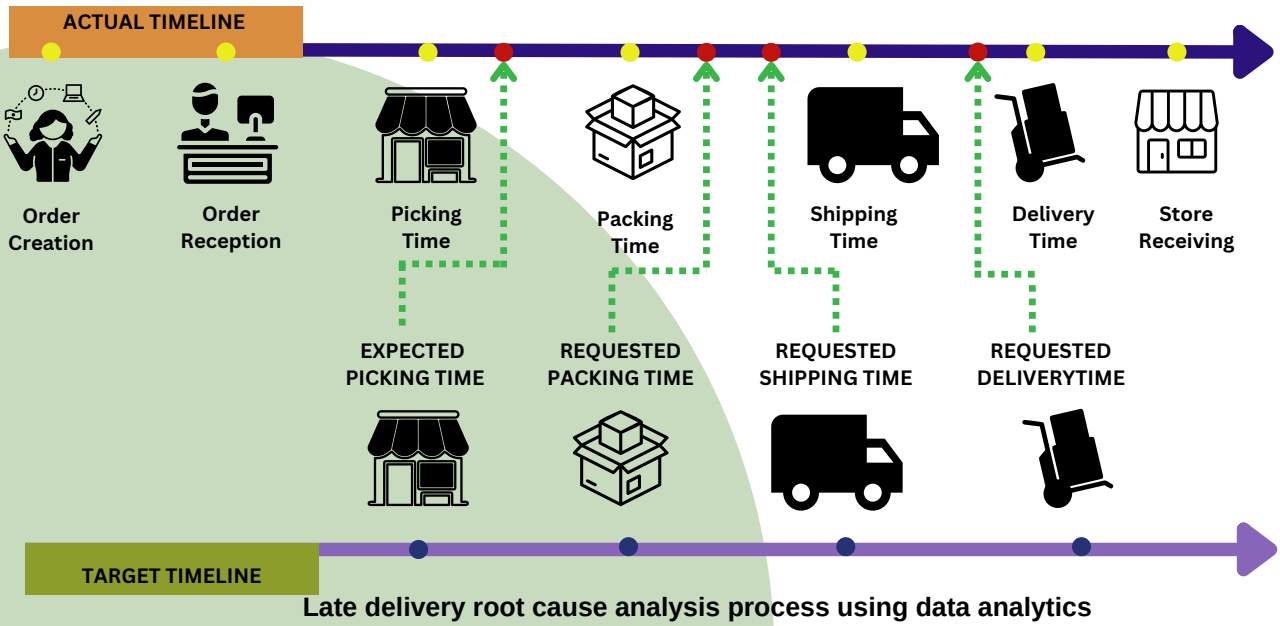
C. Analytics to address cultural barriers

Resistance or indifference can arise when the leadership and operational teams are not in sync with sustainability and green transformation objectives. Outdated mindsets and ingrained habits can serve as substantial obstacles to change. important events across the supply chain.



Utilizing a supply chain control tower for eficient distribution network management

Diagnostic algorithms perform root cause analysis to determine the underlying factors contributing to delays and identify the individuals or entities accountable for them.



Late delivery root cause analysis process using data analytics

This approach can be easily adapted to environmental footprint monitoring:

1. CO_2 emissions
2. Target of emissions to process
3. Compare the actual emissions vs the target using the LCA approach

ENHANCING BUSINESS PRODUCTIVITY WITH DATA

HOW DATA-DRIVEN DECISION-MAKING CAN OPTIMIZE OPERATIONAL EFFICIENCY

Through the Internet of Things (IoT) based system, all data can be recorded and stored in sensors that are directly connected to the internet which is then sent to the server. All the data is then collected as a reference for decision making after the information processing process. Technology support allows IoT to analyze data independently and present information accurately. The process of presenting this information requires analytical methods that support decision making. Some of these methods will form a decision-making model that can be applied to the Internet of Things. The decision making models in IoT include:

A. Intelligent Decision Making

Intelligent Decision Making is a decision-making technique where the system transforms data content into meaningful information which is then classified and applied. This model provides analysis on IoT that can be beneficial to faster and more precise decision making. The application of intelligent decision making is widely applied in IoT because it is oriented towards independent data analysis and can be applied to large-scale data;

B. Fuzzy Decision Making

The advantage of the fuzzy decision making model is that decision making with large data variations that emphasize uncertainty and vagueness of information variables. This method can be applied to the optimization of decision making with variables that have a large enough influence, for example the optimization of the supply chain strategy.

C. Proactive Decision Making

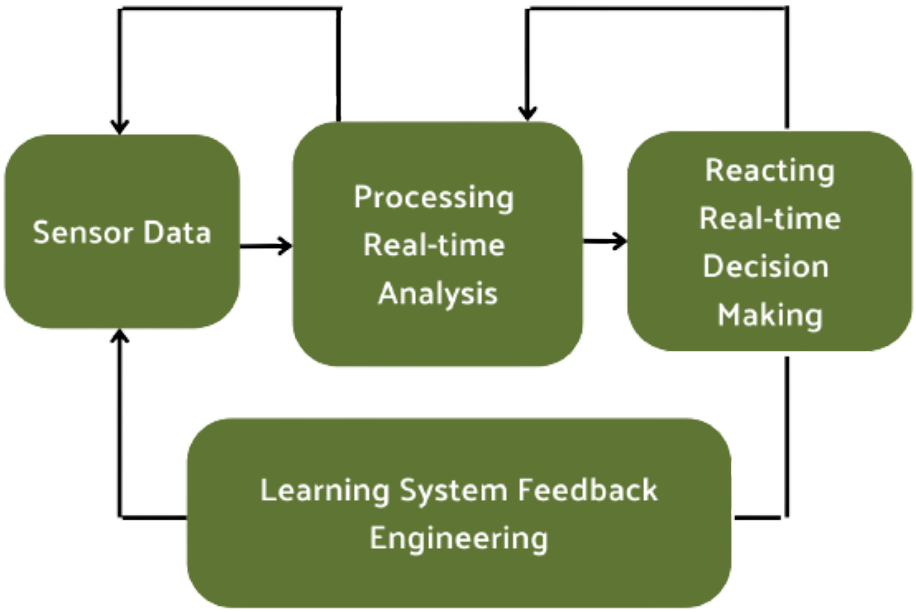
Now, proactive decision making is an advanced development of intelligent decision making. This decision-making model passes through the stage of data analysis and predictions from data analysts which are assembled into a report that helps decision making, all prediction and analysis results can be accessed through the internet network. Proactive decision making uses the principle of "Detect- Predict- Decide-Act". For now, the principle of "Act" or action in the form of notification is very useful and possible with the support of very broad internet access. This model is very suitable for early prevention, or as an early warning system in various fields. Real-time Decision Making has been applied to IoT to obtain the latest information. This model produces visualization output and data management, information, knowledge and decisions.

D. Markov Decision Making

Similar to fuzzy, this model is applied with random and dynamic variables, which have a correlation to the information sought. This model can also be applied to analysis variables that can change but significantly affect the results. 60 IoT sensors can provide flexible data simultaneously. This model is very suitable for IoT applications with a wide environment with many and varied observation objects. One of the applications is the improvement of deep learning resource IoT.

Among the various decision-making models that can be applied to IoT, the data analytics process is an important part. On the other hand, realtime presentation of data and information is a key requirement to improve the quality of IoT services.

Real-time decision informatics



Based on the results of the explanation of the benefits of data-based decision making as an optimization of operational efficiency, of course, it can provide benefits to support business activities, with the automation of data reporting the benefits obtained in business include:

- Effective and informed decisions are based on the analysis of data and information;
- Using valid and relevant data helps place the “problem” in the right context.
- It allows us to identify risks and opportunities.
- Changes that can be expected in statutory and regulatory requirements, emerging technologies, markets or resources which may affect the organization;
- Risks that need to be identified, managed or minimized;
- Various priorities that need to be established and managed, e.g. strategic, operational, resources Other Benefits of Data-driven Decision Making;
- By using data and facts, we can determine the effectiveness of our past decisions. We can do so
- By referencing factual records;
- We also become more able to review, evaluate, challenge and change opinions and decisions.

CHALLENGES IN DATA MANAGEMENT

KEY CHALLENGES

The rapid growth in IoT applications has also spawned problems and challenges that still need to be overcome. There is much work that has been done in this regard, but there is still a need for adequate research to mitigate the challenges faced. Figure 1 shows a diagrammatic representation of the identified challenges. The figure provides a brief overview of the services provided by IoT and the data management-related issues that exist. The details of these challenges are as follows:

Standardization: Industrial IoT applications still lack the global standards that IoT enabled devices needs to follow. These standards are very crucial and will play a fundamental role for interoperability and scalability of IoT on a global scale. Researchers, practitioners and organizations are still working to set standards for IoT. Key organizations working for setting standards include IEEE, ANSI, European Committee for Electro-Technical Standardization, and China Electronics Standardization Institute.

Data storage and management: One of the major research concerns for the next few years could be how to store data produced by objects more than the human population. In order to cater to this challenge in IoT applications, we need to employ mechanisms and frameworks to gather, store and manage data generated in IoT processes.

Confidentiality and privacy: As IoT works on sensing, tracking and connecting everyday life objects used by humans, this adds more concerns regarding privacy and information leakage.

Integrity: One of the significant issues in any data centric environment is data integrity. Sensing devices must gather and share only data essential to perform a required operation and assure that data is not kept or shared indefinitely.

Energy constraints: For smooth and nonstop IoT operations, devices will need an uninterrupted power supply. These devices are not rich enough in terms of memory, processing power and energy. So, these energy constrained devices must be deployed with light weight mechanisms for device discovery, communication and invocation.

Device mobility and heterogeneity: Mobility of smart devices is one of the key factors in the rise of IoT. But managing this tremendous amount of mobile devices becomes an imperative challenge as well.

Device security and backup: Mobile devices of IoT infrastructure must be secured against attacks because these nodes may be easiest victims of the attack and can effortlessly provide a gateway to an adversary to get into the system for malicious activity.

Availability: Availability of IoT services must be ensured due to their critical application nature. Unavailability of these services will not only decrease overall performance, but it can also provide the attackers with the facility to launch different types of attacks against critical applications such as smart city, smart home and smart industries.

Internal adversaries: The significance of internal IoT adversary attack is superior to the external attacker because the internal adversary is part of IoT services and has good knowledge of different IoT components.

PROPOSED DATA MANAGEMENT FRAMEWORK

In this section, our proposed data management framework has been discussed. Data management activity is divided into multiple stages. Breaking down the data management activity into different layers leads to easiness, completeness and scalable functionality. The proposed framework contributes with wider context towards collection, management and analysis requirements of the internet of things. The framework incorporates layers such as data collection layer. Every layer of framework stack contributes to the next layer of data management process.

Data Collection Layer

The First layer in proposed framework is data collection layer. This layer works as a pass-through layer that gathers data coming from different sources and directs it to upper layers for processing.

Fog Computing Layer

Futuristic and time critical applications essentially demand the analysis of data be performed nearby its point of generation rather sending the data to cloud every time for analysis and decision making. Consequently, this calls for shifting data management functionalities closer to data generating devices.

Integrity Management Layer

This layer is responsible for the integrity of whole data management process. Major components of this layer are raw data storage and mobility manger. Moreover, for addressing gaining concerns of device mobility in IoT, mobility manager is mostly attentive towards features associated with device mobility.

Data Aggregation Layer

One of the core intentions of this layer is data size reduction for improved storage, organization and transmission of data. For this reason, data aggregation layer is concentrated towards real time summarization and merging of the data.

Security Layer

Retaining automated security in IoT still remains in the spotlight due to the significance of security needs. In our proposed framework, security layer guarantees security provision to all layers involved in data management process. In this way, the security layer is linked with all layers in the model and intended to meet security requirements at each individual layer.

Data Analysis Layer

This layer augments significance to the data gathered by analysing it to engender smart decisions and analysis. This layer will also fulfill user requirements regarding on demand user analysis and run extraction tools for desired information.

Data Storage Layer

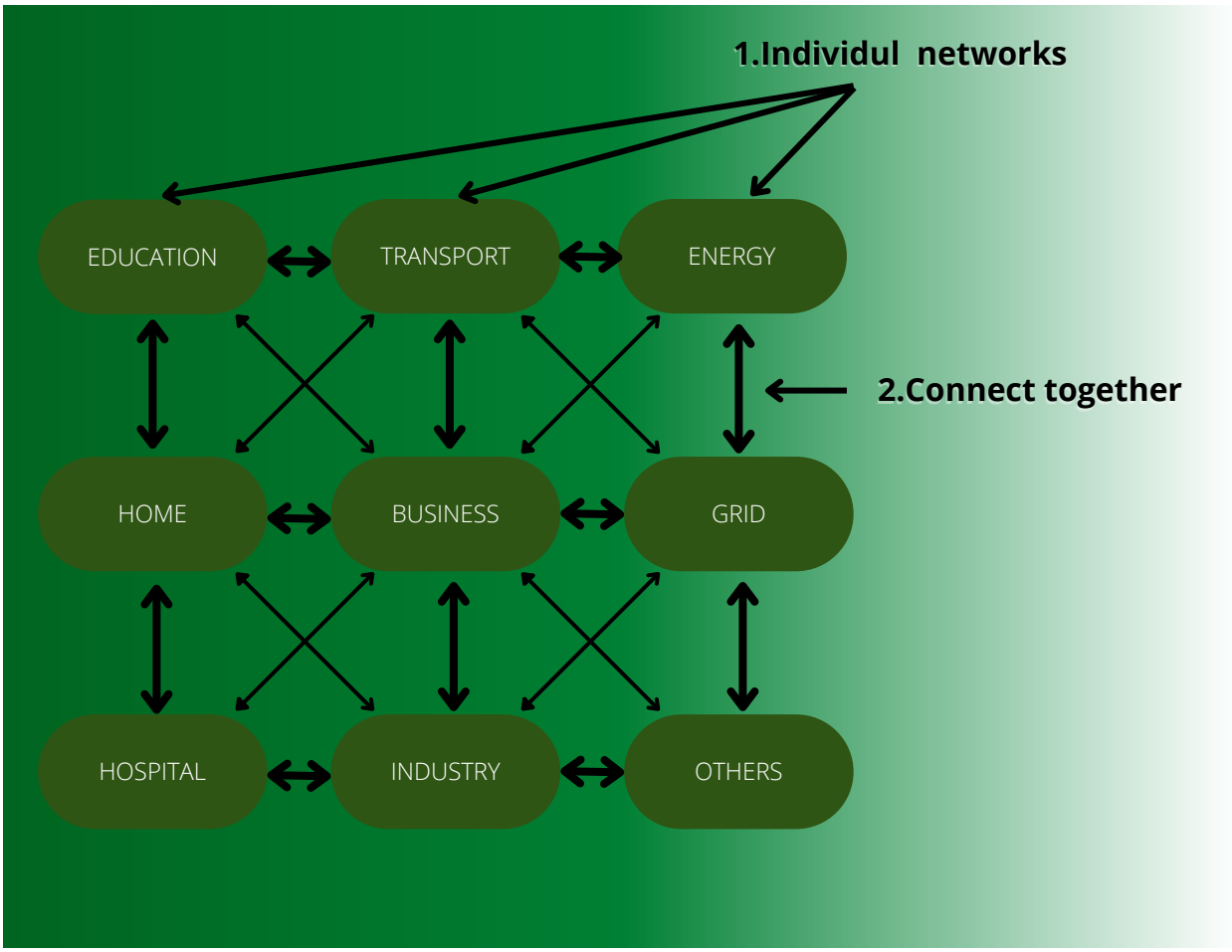
Due to continuous generation of huge amounts of data in different varieties and quantities, the necessity for standardized and efficient mechanisms for data storage is more imperative than ever. Data storage layer is responsible for real time data storage as data is produced .

Application Layer

Application layer will be focused towards providing services to end users and governs data flow. Application layer also performs the duty of load balancing. Further, this layer is responsible for maintaining the quality of service in terms of data for the end user. This layer also looks at the availability of data for application domains.

Archiving Layer

Another important aspect of IoT data management is to archive such huge amount of data generated by the devices. Archiving layer will be responsible for managing growing archiving needs of IoT data with scalable infrastructure.



IOT APPLICATIONS IN DIFFERENT BUSINESS SECTORS

Potential applications of the internet of Things are not only numerous but also quite diverse as they permeate into virtually all aspects of daily life of individuals, institutions, and society. The applications of IoT cover broad areas including manufacturing or the industrial sector, agriculture, smart cities, and smart environment.

Smart Cities

The IoT plays a crucial role in improving the smartness of cities and enhancing general infrastructure. Some of the IoT application areas in creating smart cities include; intelligent transportation systems, smart building, traffic congestion, waste management, smart lighting, smart parking, and urban maps.

Smart Agriculture and Water Management

The IoT has the capacity to strengthen and enhance the agriculture sector through examining soil moisture and in the case of vineyards, monitoring the trunk diameter. IoT would allow to control and preserve the quantity of vitamins found in agricultural products, and regulate microclimate conditions in order to make the most of the production of vegetables and fruits and their quality.

In water management, the role of IoT includes studying water suitability in seas and rivers for both drinking and agriculture use, detecting pressure variations in pipes, and liquid presence outside tanks as well as monitoring levels of water variation in dams, rivers and reservoirs. These IoT applications utilize Wireless sensor networks. Examples of existing IoT applications in this domain include; SiSviA, GBROOS, and SEMAT.

Smart Living

In this domain, IoT can be applied in remote control devices whereby one can remotely switch appliances on and off hence preventing accidents as well as saving energy. Other smart home appliances include refrigerators fitted with LCD (Liquid Crystal Display) screens, enabling one to know what is available inside, what has overstayed and is almost expiring as well as what needs to be restocked. This information can also be linked to a smartphone application enabling one to access it when outside the house and therefore buy what is needed.

Smart Environment

The environment has a vital role within all aspects of life, from people, to animals, birds and also plants, are all affected by an unhealthy environment in one way or another. There have been numerous efforts to create a healthy environment in terms of eliminating pollution and reducing wastage of resources, but the existence of industries, as well as transportations wastes coupled with reckless and harmful human actions are commonplace elements which consistently damage the environment. Consequently, the environment requires smart and innovative ways to help in monitoring and managing waste, which provide a significant amount of data that forces governments to put in place systems that will protect the environment.

CASE STUDIES: INTERVA AS SMART INDUSTRY IOT

Smart Factory is a key component of the Industrial Revolution 4.0 concept. It is a manufacturing solution that is able to solve ESG problems that arise independently, quickly, and automatically to optimize production. By integrating IoT into manufacturing, the process provides real-time response and able to respond to change based on needs or detect malfunctions or other system failures in a timely manner.

Schneider Electric in Batam is one of many examples of companies that have successfully implemented IoT in their business that implements real-time systems. They developed an IoT system platform that is built to share information between components and businesses, in order to track the performance of the production process in real-time. By adopting IoT they have reduced 17% man-hours for maintenance and succeeded in reducing up to 50% of waste material.

Another example comes from the plantation sector in Jambi. They implemented INTERVA, a locally developed integrated IoT system which provides a range of end-to-end IoT-based solutions to obtain on-field data as well as monitor ESG aspects such as energy efficiency, machine productivity, emission monitoring, as well as water and wastewater quality monitoring. The company adopted INTERVA's IoT system to monitor machine productivity and track heavy duty machineries. The data is collected near real-time and can be accessed easily by the management through an online dashboard. By implementing INTERVA, they have increased their efficiency by 30%.

INTERVA is one of Greenwise Consulting's offered solutions. For further inquiries, please contact the listed phone number or email in the back.

Currently, INTERVA has 7 IoT products that can be tailor-made for each company's needs:

- Superstation
  Near real-time monitoring and automation to stations in factories and help enhance control and maintenance of operations within the factory premises.
- Digitank
  Precise measurement on content inside of storages and help reduce the risk of unidentified storage leakage hence boosting more efficiency.
- Aquality
  Provides both direct measurement and analyzer features in water quality monitoring.
- Airmosphere
  Helping organizations develop and fulfill the ESG roadmap through emission monitoring.
- Enervolution
  Developing and executing energy blueprint within organizations and helping reduce energy consumption inefficiencies.
- Pathfinder
  Helps track geolocation -based operations on-field personnel and equipment and prevents fraudulent fuel budget.
- Matrix
  A support system for on-field viewing media. The system will be established on the premise with direct source input from any INTERVA implementations.

Solution

As Indonesia push towards achieving the Sustainable Development Goals (SDGs) set by the United Nations for 2030 the integration of Environment, Social, and Governance (ESG) factors into business management and investment. Embracing ESG values not only contributes to sustainability but also has the potential to enhance long-term profitability and productivity. However, the availability of reliable ESG data remains a challenge. To bridge this gap, the Internet of Things (IoT) emerges as a powerful solution. By leveraging IoT technology, companies can access real-time and transparent data, providing valuable insights into their ESG performance.

Data-driven decision-making forms the backbone of this transformation. Data serves as the foundation for understanding and assessing a company's impact on the environment, its social relationships, and governance structures. Transparent reporting and data analysis build trust among stakeholders, enabling businesses to make informed choices, improve efficiencies, and identify areas for sustainable improvements.

The role of IoT in ESG monitoring and tracking cannot be overstated. The interconnectedness of IoT devices allows for unprecedented transparency in tracking environmental impacts, social engagements, and governance practices. By integrating IoT into ESG monitoring, organizations can strategically measure their carbon footprint, optimize resource consumption, and drive sustainable initiatives.

The proposed data management framework for IoT ensures the efficient handling and analysis of vast amounts of data generated by IoT devices. From data collection to archiving, each layer plays a critical role in ensuring data integrity, security, and accessibility. The implementation of such a framework will address challenges in standardization, data storage, privacy, energy constraints, and device mobility.

IoT applications have far-reaching implications across various sectors. From smart cities and agriculture to smart homes and environmental monitoring, IoT's potential to enhance efficiency and sustainability is boundless. As technology continues to evolve, IoT's role in shaping a sustainable and interconnected world will become even more pronounced.

In conclusion, the Internet of Things stands as a network of networks, a complex adaptive system that will continue to evolve and require innovative forms of engineering and management. Its diverse applications enable individuals, communities, and institutions to harness the power of data for positive change. Embracing IoT in ESG transition is not just a choice; it is an imperative for businesses seeking growth, resilience, and a profound impact on the world we share. By embracing IoT as a powerful tool for increasing productivity, efficiency, and sustainability, we pave the way for a brighter, greener, and more prosperous future.

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