Make Agriculture and Energy Green Again

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Abstract

Following the initial decade of the 21st century and the onset of the financial crisis that evolved into a debt crisis, the global population is confronting another challenge, the food crisis; nevertheless, certain remedies may be anticipated as preemptive measures. This paper aims to elucidate various scenarios that could mitigate instances of exceeding limits, such as enhancing agribusiness through timely delivery solutions and reducing the carbon footprint of existing electric power-consuming units in factories, industrial sites, and food production or preparation processes, while promoting the intelligent generation of green energy. The shared factor of the innovative and sophisticated solutions arises from the engagement of the IT&C sector and its computational capabilities.

Keywords

agriculture, innovation, big data analysis, interconnectivity

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Introduction

Interdisciplinary innovation propels the future of sustainable and highly productive agriculture (Buzoianu, et al., 2024). We must incorporate the concept of interconnection propelled by the Internet of Things and acknowledge that Gordon Moore's law remains applicable and evolving as we speak. Moore observed in the early 1960s that the processing power unit's price diminishes by half every 18 months, a phenomenon that suggests that, in a few years, the costs associated with IT-driven industries will approach $0. The sole alteration in Moore's Law from the 1960s to the present is the reduction of the halving time from 18 months to 9 months. The concept of commercial tradeoff occurs among merchants, agricultural producers, and clients, centered on maximizing profits, minimizing the business turnover process for traded items (particularly perishable agricultural products), and expanding the geographical market region.

The increasing global emphasis on sustainability has exacerbated the necessity for innovative solutions in energy management and agriculture, underscoring the vital role of interconnected systems, data analytics, and technology. Big data has emerged as a transformative force, revolutionizing sustainable agriculture by improving efficiency, reducing waste, and ensuring resource optimization. For example, a systematic review of big data applications in agri-food supply chains emphasizes the substantial influence of data-driven strategies on soil management, crop monitoring, and supply chain traceability (Rejeb et al., 2021). This is consistent with the tenets of smart agriculture, which involve the utilization of digital tools and data analytics to meet the increasing demand for environmentally friendly products, minimize losses, and optimize production.

In the same way, the potential to optimize energy production has been demonstrated by the integration of big data and analytics in renewable energy, particularly in solar energy systems (Briones et al., 2017). Advanced data-driven solutions have the potential to improve the efficiency of energy grids, optimize power generation, and facilitate the transition to sustainable energy sources. Additionally, the utilization of big data has been instrumental in the enhancement of food supply chain management by guaranteeing product traceability, reducing waste, and increasing transparency (Margaritis et al., 2022). Collectively, these studies demonstrate the potential of data-driven innovation to revolutionize the agricultural and energy sectors, thereby establishing a basis for the creation of sustainable, interconnected systems that are consistent with environmental objectives.

1. Methodological Approach on Agriculture as a Sustainable Business and Process

To build on this actual research paper we developed a 50/50 approach on what it takes to be green again, and we followed the process behind waste as one of the main issues of the agricultural supply chain and how it can be reduced through geographical targeting.

1.1. Lower Waste in the Agricultural Supply Chain

The agricultural sector, which operates on a business-to-business and business-to-consumer model, relies on economic scale processes over time (Burlacu et al., 2018). This framework encompasses three evolutionary factors: establishing work standards, large-scale implementation, and minimizing downtime (Bran, Bodislav, 2012). The harvesting process architecture must also optimize consumer engagement through a timely distribution method. To achieve a comprehensive understanding, it is essential to acknowledge the environmental and health standards that must be adhered to regarding crops, whether they are organic, ecological, or genetically modified organisms (GMOs). These standards are increasingly significant to consumers as well as regulatory agencies (Low, Vogel, 2011). When evaluating large retailers, specifically Wal-Mart, Tesco, and Carrefour in 2014, it is evident that they prioritize offering environmentally friendly products by creating customer-oriented spaces tailored to individual preferences and the geographic origin of the products. To enhance distribution efficiency to retailers and final consumers, the operational and developmental strategy was delegated to the carrier, as they can optimize downtime by calculating the intervals for production, harvesting, processing, and transportation to retailers. This enables them to provide a product life cycle sufficient to prevent losses due to expiration dates (commonly referred to as shelf life - Profiroiu et al., 2019).

The production process can also be regarded as a horizontal development component within the agriculture sector, which is integral to the vertical distribution chain leading to the end consumer, whose payments support other complimentary businesses (Prăvalie et al., 2013). Local production serves as the initial phase of agricultural recovery; however, it faces competition from global output that is excessively industrialized or chemically treated.

It may be regarded as one of the few sustainable types of outsourcing in the long term (Radulescu, Bran, and Burlacu, 2019). Outsourcing can ultimately undermine organizational culture and impede a company's progress, fostering detrimental dependency and the potential emergence of a competitor from the subcontracted entity (Bran, Bodislav, 2012). The equilibrium established through the agricultural conglomerate's production outsourcing method is distinctive as it signifies a mutually beneficial scenario in the long term (Ata et al., 2012). To outsource a local process of a global conglomerate, it must be aligned with the retailer's distribution system by restructuring the distribution network. This can be achieved by optimizing the relationship between agricultural producers/processors and the retailer's store chain or by establishing continuous flow depots to supply the retailer's stores. This approach incurs additional storage and new distribution costs between the depot and the stores, while the intense competition precludes the establishment of price disparities.

1.2. Geo-targeting for Reducing Waste

The perishability of agricultural products will restrict the feasibility of delivering to far stores, which is why producers cannot produce vast quantities, as demand is limited. If transportation costs are substantial, the retailer utilizes the deposit unit for store deliveries. Moreover, this issue is compounded by population growth, as the global development strategies of major consumer retail corporations (such as Wal-Mart, Tesco, Carrefour, etc.) are predicated on population density. In areas of population growth, there is a corresponding increase in the number and size of stores, leading to heightened consumption (Bran, Bodislav, 2012). The increase in population density enhances the economies of scale for agricultural producers, whether through extensive development (which is challenging due to the unavailability of arable land in urban areas) or through intensive development (provided that environmental and healthcare standards are maintained – Ata et al., 2012).

The solution that favors the local production model lies not in specialization but in distribution; the cost of distribution is crucial for success, provided it is managed by either the producer or the retailer, while maintaining a total cost that remains lower than that of competitors and allows for an optimal profit margin (Bran, Bodislav, 2012). Prioritizing profits entails assessing vertical differentiation, thereby enhancing the local agricultural producer by establishing new brands based on their attributes, such as organic or ecological crops in contrast to conventional agricultural products.

The innovation introduced by Big Data analysis and the Internet of Things (IT&C's physical synergy) in the merchandising sector facilitates an advanced distribution system for fresh products, adhering to stringent healthcare standards and aligning products within the bio or eco niches. A pertinent example is FarmPlate (USA), which leverages internet connectivity to engage consumers who advocate for locally sourced products from producers categorized by product type (bio, eco, or mainstream).

The clients embrace bio and eco-friendly products as primary attributes at a certain degree of professional knowledge and above-average earnings. FarmPlate leveraged their client's attributes to establish "a community for consumers of sustainable agricultural products" (with sustainability encompassing organic and ecological products), which embodies YELP, an online platform (informational marketplace) connecting those seeking sustainable agricultural products with providers, as well as facilitating reviews for each product (Bran, Bodislav, 2012). Client data constitutes a database or Big Data that embodies a model of expectations for future consumption, so transforming into an asset provided to agricultural farmers, restaurant proprietors, and health-conscious culinary enthusiasts. The legitimacy of these platforms is derived from their complete openness, which conveys professionalism to participants and demonstrates their endorsement of sustainable products and foods. In the United States, bio, eco, organic, and natural fashion has become nearly ubiquitous, trending towards mainstream acceptance. This shift validates theories related to group membership, as consumers increasingly opt for local products. Furthermore, this alternative presents a long-term business opportunity by aligning demand with supply, potentially eliminating retailers from the merchandising equation.

2. Big Data Analysis and Intelligent Interconnectivity - Reducing the Cost Disparity for Achieving Comparability Between Conventional and Renewable Energy

In the renewable energy sector, the solar energy niche achieves a yield of 75%, attributed to the physical efficiency of the silicon utilized in solar panels and the reconfiguration of the solar energy absorption system, resulting in a yield of 92% (Bodislav, 2011). The yield of 92% represents the utmost attainable efficiency after all physical components, including silicon, have attained their optimal performance, and the construction and development methodologies of the technical and managerial systems have achieved their peak efficiency (Rădulescu et al., 2023). How can we achieve a 100% yield? An integrated efficiency management system establishes a connection between Information Technology and Communication (IT&C), Gordon Moore's law of system efficiency, and the optimal yield for solar energy acquisition, which currently reaches a maximum of 98%, significantly surpassing the conventional yield of 75% achieved through traditional methods (Bodislav et al., 2025a).

A comprehensive project validating this solution has previously been executed by Silicon Valley entrepreneur Bill Gross, an expert in fossil fuels. His fervor in pursuing the concept of "green" technology has yielded results today by establishing a pioneering presence in the field. He is the principal stakeholder of eSolar, a firm that constructs solar energy facilities; Aptera, which manufactures electric vehicles; and Energy Innovations, a developer of advanced photovoltaic technology (Bodislav, 2011). The "laboratory" for this initiative is exemplified by the largest contract awarded to an independent green energy producer: providing the technology to construct a solar "farm" in China capable of generating 2000 megawatts, comparable to two high-capacity nuclear power reactors (Liu et al., 2014).

The operational and construction principles of a solar energy power plant involve positioning thousands of mirrors, known as heliostats, to concentrate sunlight onto water-filled boilers situated atop towers, which then heat the water. The heat produces steam that activates a turbine, which generates power. The prototype plant, designated Sierra, was established in 2009 in the desert outside Los Angeles and generates 5 megawatts of energy.

This innovative technique represents a technical and economic reconfiguration of power towers, utilizing advanced management and imaging software to handle 176,000 mirrors that produce 46 megawatts. Computational processing power accurately positions the focal point of each mirror that constitutes a huge parabolic mirror directed at the sun (Wood, 2010). The economic performance is characterized by: - a parabolic mirror constructed from numerous smaller mirrors, which are less expensive than a single large mirror (the cost of mirrors increases exponentially with size); - reducing the surface area of each mirror diminishes the land requirement for construction on a level surface (the land acquisition cost is lower); - installation and manufacturing costs decrease due to simplified deployment.

Moore's Law is referenced more frequently than the rules of physics or the steel utilized in manufacturing (Anderson, 2008). New efficiency models for generating electricity using sustainable ways can be developed by forming innovative partnerships, such as one between a green energy firm and technology and innovation organizations like Google (Major and Kiss, 2013). A crucial lesson is to adopt a philosophical perspective on computer-generated green energy. According to Moore's Law, a processor that cost $5,000 a decade ago is now priced at $5, allowing for the installation of a microprocessor in each mirror. These microprocessors compute real-time statistics on their status, position, confidence coefficient of the received data, and data accuracy, with each mirror obtaining this information individually. The organizational framework of a green-tech enterprise parallels that of online-centric businesses, as both necessitate the generation of logs for each data entry, including complete rotation cycles of turbines, measurements from control towers, and video observations of the energy production grid. This establishes a comparable system of "data mining" and "data analysis" (Branson et al., 2010).

A classic software corporation is established following a transformation process that transitions from technology and management practices to system programming, enhancing all power plants that generate "green" energy (Gaillard, 2013). This is a significant distinction between old technology and future technology from a solar perspective. If a substantial area of solar panels is established, they are designed to endure 25 years of continuous operation. They exhibit same performance without any potential enhancements.

A software upgrade can be implemented at each plant, augmenting the initial yield by 3%. However, to generate renewable energy for the entire planet, there exists a significant capital deficit. Efficiency improves every six months through software upgrades designed to enhance system performance in power plants (Wood, 2010). Enhancements can be implemented in the hardware components of power plants; nevertheless, even in the absence of hardware upgrades, software modifications can generate increased power output.

A significant issue lies in the substantial capital expenditure required for the implementation and advancement of innovative methodologies in renewable energy, particularly solar energy (Angheluta et al., 2019). However, a notable distinction is that, despite renewable energy being analogous to energy derived from traditional methods, such as thermal (coal), all capital must be presented upfront to cover fixed costs and expenses for a 20-year period of utilization (Bodislav et al., 2020).

In a thermal power plant, the requisite capital constitutes 20% of the overall operational costs, whereas 80% pertains to coal consumption during a 20-year period. In renewable energy, around 80-90% of the initial expenditure is allocated to plant construction, while fuel expenses are nonexistent; the sole ongoing expense is to maintenance and operations, which remains minimal. The primary restraint is the elevated costs, which restrict the expansion and final energy output capacity of the plant (Wood, 2010).

A technique involves establishing an energetic hedge fund, compelling the client to accumulate the requisite capital for constructing the plant (Stanislaw, 2010). The transition to green energy requires substantial resources, yet the primary challenge is that this capital must be provided upfront (Diaconu et al., 2019).

In 2011, Germany is developing and executing one of these innovative energy mega-structures. Facilitated access to funding enhances the direct execution of the project in the market while simultaneously increasing its visibility and viability. Virtually Ferrostaal, a German plant developer, possesses the expertise to create traditional thermal plants enhanced by the technology created by eSolar.

This efficiency strategy for harnessing renewable energy, specifically solar energy, was deployed on a big scale in China at a power plant with an installed capacity of 2000 megawatts. The Chinese facility marked a significant achievement in worldwide business, with development progressing seamlessly due to an effective methodology and requisite capital, without the complications of securing challenging bank contracts (Pauna et al., 2022). Another advantage for China is the extensive territory available for the establishment of power plants. China is an advantageous location for the advancement of such systems. Alongside accessible capital and a substantial growth rate, there exists a significant demand for energy. These implementations are not driven by global benevolence; rather, they are motivated by necessity to ensure that the globe benefits from the innovations developed. The towns in China are recognized as filthy, and the current generation of electric energy serves as a significant and ongoing source of pollution for the country (Li-qun et al., 2014).

The market decline imposed significant financial limitations. The current global market surpasses the US market in power, as evidenced by the increasing global demand for renewable energy (Drzik, 2011). This style of power plants is also present in the US; nevertheless, they are unable to match the rapid advancement of the global energy market driven by renewable techniques. The USA aims to adopt a renewable energy model by establishing institutions for financing and securing the requisite funds to develop solar energy in innovative power plants. Another factor is the economy, which must adapt to facilitate this transformation, necessitating that bank devise methods to simplify credit offerings in these regions. Another issue is the current lack of support from the energy sector. Other green technologies, aside from those involving solar energy, are on the verge of significant enhancement.

Electric energy storage, encompassing both solar and conventional technologies, is a crucial element in enhancing the significance of renewable energy globally, more effective transportation modalities. For example, companies such as Aptera exhibit remarkable innovation in achieving optimal efficiency for both urban and extra-urban everyday transportation. One method to reduce energy consumption is to enhance aerodynamic efficiency, hence minimizing fuel combustion. The model produced by Aptera achieves a fuel efficiency of 1.2 liters per 100 km. The advancement of the technologies results in transport efficiency with zero emissions, exemplified by firms such as Tesla Motors, which offers models like the Tesla S with a range of 480 km on a full charge.

The research model represents an innovation, commencing with the establishment of the Sierra pilot power plant and culminating in the formation of the Indian subsidiary of eSolar, Distributed World Power. The advancement in research is attributed to the testing methodology: two miniature power plants were constructed to supply energy to a household and a freshly established tiny hamlet. This approach evaluates the minimum required volume for efficient manufacturing and the corresponding market to ensure affordability for a big audience (Burlacu et al., 2022).

The European Union is a leading global advocate for the development and consumption of renewable energy. The Lisbon Strategy and the Horizon 2020 structural financing program promote the advancement of producers and infrastructure.

Upon examining the proportion of renewable energy in total power generation at the EU28 level, we will assess the actual economic equilibrium between the share of renewable energy utilized in real consumption at the EU28 level. What is the rationale for implementing this measure? This perspective on final consumption reveals the negative externalities that contribute to the ongoing melting of the Arctic ice and the annual rise in global temperatures.

Norway is unequivocally Europe's leading champion in renewable energy, primarily due to its geographical attributes, with nearly two-thirds of its electricity derived from renewable sources. However, projections indicate that by 2020, Sweden will surpass Norway, currently ranked second in the utilization and implementation of renewable energy systems within the smart grid (Bodislav et al., 2025b).

The European Union's economy is increasingly adopting sustainable practices, adhering to the Agenda 2020 timeline, and assessing the overall development of the renewable energy sector in relation to the hierarchical structure of electricity production, while aligning with final consumption patterns.

In the long term, the European Union is progressing towards establishing a macro-renewable ecological and economic model, particularly by employing solutions that integrate systems through big data analysis and a novel methodology, referred to as innovative disruption within the macroeconomic supply chain.

Conclusions

This may pose a challenge. Similarly, the Americans' training was pivotal to their victory upon entering the Second World War. Following the victory in the war, the subsequent objective was to eliminate poverty, illiteracy, and curb the proliferation of diseases, including cancer and degenerative conditions. The concept posits the existence of a "Game Over," the timing of which remains unknown until it is reached. The possibility of approaching the “end of the game” serves as a compelling impetus for achieving optimal efficiency in technological advancements within the solar energy sector. Does this fact facilitate the technique for generating electric energy from fossil fuels? Negative. The path dependence is anti-cyclical; however, one must not disregard the notion that the gradual evolution of government may be influenced by affluent and powerful individuals whose primary interests lie in acquiring electric energy through conventional means, or who possess coal mines or extensive oil reserves. The "renewable" method in the energy sector faces greater political obstacles than technological challenges compared to the traditional approach.

Returning to the first scenario emphasized in this study article, we can assert that establishing an appropriate framework for process timings, harvest production, and geographical distribution, encompassing both distances and population density. Cost reduction through transportation and product differentiation enhances profit margins for agricultural producers and retailers; however, the equilibrium often favors retailers, as they can capitalize on client-targeted marketing (profit margins are greater in business-to-consumer relationships than in business-to-business interactions). Formulating distribution strategies may serve as a framework to engage a larger retail group as a prospective client for agricultural producers, particularly as circumstances adversely affect another supplier, since the transportation costs incurred by the producer influence the acquisition of a supplier contract (Georgescu, 2020).

In the long term, the impact of innovation and interconnectivity arising from synergistic interactions among the Internet of Things, Big Data analytics, and Business Intelligence will fundamentally alter traditional paradigms regarding the production, distribution, and marketing of bio, eco, organic, and natural products, as well as contribute to reducing the carbon footprint through the utilization of efficient and cost-effective green energy, grounded in the same technological IT&C principles.

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