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SUN POWERED SYSTEMS: EXPANDING EU GREEN INNOVATIONS UNDER THE AFRICAN SUN

Stanislav Zabojnik[1,a,*] and John Branch[2,3,b]
[1]University of Zilina, Faculty of Operation and Economics of Transport and Communications, Department of Economics, Univerzitna 1, 010 26 Zilina, Slovakia
[2]Ross School of Business, University of Michigan, Clinical Associate Professor of Business Administration and Co-Director of Yaffe Digital Media Initiative, USA
[3]Center for Russian, East European, and Eurasian Studies & William Davidson Institute, University of Michigan, Faculty Associate and Research Fellow, USA
[a]stanislav.zabojnik@uniza.sk, [b]jdbranch@umich.edu
[*]Corresponding author

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Abstract:
Research background: This paper addresses a significant challenge in the decarbonization efforts within the European Union, namely the continual environmental ambitions confronting a company competitiveness. Employing case study methodology widely utilized at the University of Michigan, the authors critically examine the challenges associated with the international expansion of innovative SMEs into remote markets of third countries.
Purpose of the Article: The first section provides an overview of the EU's environmental objectives and the legislative-regulatory framework governing corporate activities within the EU. It elucidates the specific challenges faced by Slovak firms in their internationalization efforts, emphasizing the necessity of technological innovation alongside institutional support mechanisms.
Methods: The study is based on a detailed case analysis of a Slovak start-up engaged in exporting solar-powered agricultural machinery to the Kenyan market. The primary objective is to identify the main obstacles and specifics encountered by small enterprises during export processes, explore viable solutions, and outline the critical measures necessary for successful market entry and expansion within African markets.
Findings & Added Value: The authors delineate the growth potential of African markets for innovative energy solutions developed by startups from the CEE region. They highlight the unique contextual challenges faced by these companies in the African environment and propose feasible strategies for market entry, specifically targeting Kenya. The findings contribute valuable insights for practitioners and researchers, and the study can also serve as an educational resource suitable for pedagogical purposes in master and PhD. studies.

Keywords: decarbonisation; competitiveness; export to Africa; case study

JEL Classification: F10; F13; F60

1. Introduction

"Using my patents, I'm selling a tractor that can operate without diesel and heavy mechanisms."

Robert Demko

In December 2022, Robert Demko[1], the sole manager and owner of the start-up company SUN Powered System was returning to Slovakia from abroad. He moved his start-up forward in the field of innovative technologies based on photovoltaics with products such as photovoltaic panels, autonomous public lighting, autonomous lighting for large advertising areas, photovoltaic chargers for bicycles, and several energy-efficient solutions for companies. However, the latest product was different. He dedicated a lot of innovation efforts, CAPEX, and his patents to it. This product was presented at an important energy event in Brussels. The product had the potential to advance his small, innovative business a step further. These ambitions were confirmed by the response and interest of investors, along with the awards received in Brussels.

From a height of 5,000 feet, he looked at the green fields between Vienna and Bratislava while landing. Together with twenty other "green" businessmen, he was returning from the conference in Brussels on a special flight organized by the Slovak government. He was there at the invitation of the Government Office of the Slovak Republic, as he had been for events in Amsterdam and Rome several times. As the sole owner of his innovative company, he presented his revolutionary patent in the field of environmentally friendly agriculture: a Solar Arm - an autonomous arm using photovoltaic drive (Appendix A) intended for small and medium farmers growing agricultural crops. Solutions based on decarbonization and sustainability principles were at the centre of Brussels' priorities, as the ultimate goal was to make the EU a leader in the field of green technologies by 2030. Today, the response from entrepreneurs was excellent.

But Robert's mind was elsewhere. In four weeks, he was scheduled to attend a meeting with H.E. the President of the Slovak Republic at the Slovak Embassy in Nairobi, where he was to present his product for the local market and decide on the specific mode in which he would be ready to expand his product into the Kenyan market. His CEE firm had some form of institutional support (government) for expansion into the Kenyan market. However, he faced competition from exporters and innovators from countries such as the Netherlands, Germany, and France, which have robust institutional support for entrepreneurs in foreign markets built up over centuries. This investment forum would open the door to unique foreign trade opportunities, but the strategy to enter the Kenyan market had to be decided now. The event under the auspices of the president held significant weight due to strong political support in developing countries; such an opportunity is rare in African destinations, even for medium-sized and large Slovak companies. It was a great opportunity outside the oversaturated European market, but it came with significant risks and potential failures. Robert was a technician—an excellent innovator—but not yet an experienced businessman. If he made the wrong decision, he would not only lose the opportunity in the foreign market but also risk the loss of time and capital, both crucial for an innovative start-up. This decision was all the more difficult.

[1] Ing. Robert Demko is a real character, a Slovak entrepreneur, innovator, and limited liability company owner (s.r.o.) SUN Powered Systems (detailed info here: https://sunpoweredsystems.sk/). This case study is based on the real business problem of the company.

2. Company facts and decarbonization trends

2.1. Scene 1: Decarbonization efforts and competitiveness

Since the Stern review on the economics of climate changes in 2006 (Stern, 2006), the environmental ambitions of the EU have been permanently strengthening as a top priority. The European Commission launched the energy union project in 2014 (2015 in force), focusing primarily on energy security, energy efficiency, decarbonization (renewable energy sources and emission allowances system), and not least, research, innovations, and competitiveness of the "greener" EU producers. There was a deliberate push to increase the share of renewable energy sources in the final energy consumption mix (Nagaj et al., 2024; Fu et al., 2024). This project was of great importance; therefore, Maros Sefcovic as a vice-chairman of the European Commission, was responsible for its implementation. Since decarbonization and investments into renewable sources are challenging industrial producers, particularly exporters, the European Commission emphasized business roles and competitiveness within the "green revolution." In 2016, during the key opening speeches, Maros Sefcovic stated:
„*We have a historic opportunity to look at all initiatives together: our renewables legislation, our energy efficiency legislation, our GHG-emissions legislation, our integrated research, innovation and competitiveness strategy… They all interact with each other, so we should and will be coherent. Finally, the transition to a low-carbon society means that we will have to further mobilize other actors, such as businesses helping them to become true enablers of the EU's sustainable energy and climate policies.*"

Since then, the European Green Deal was approved in 2020, and the Fit For 55 package was publicly introduced in July 2021. This projects dramatically increased the engagement of renewable energy sources and decarbonization of the EU society till 2050. One of the key approaches that can take a society closer to achieving net-zero emissions is the extensive implementation of sustainable energy sources such as PV and CSP (Baur et al., 2024) and photovoltaic modules are a vital source of decarbonization solutions (Nazari et al., 2023). The Russian invasion of Ukraine and the subsequent energy crisis further intensified the need for a greener, energy-self-sufficient Europe. The topic of energy and industry decarbonization thus becomes a key topic for European industry and its industrial exports (Cerna et al., 2022), which the EU has dominated for decades. A big challenge in the EU is compliance with "green" ambitions and industrial competitiveness (living standards driven by businesses). The energy costs of the EU producers, partially to the "green energy revolution," were considerably higher than in the USA or China. The negative externalities of decarbonization are noticeable primarily for industrial production and export companies. According to several authors, energy costs become a critical determinant of the competitiveness of selected EU industrial exporters (Cerna et al., 2022; Faiella and Mistretta, 2022), especially relevant for energy-intensive industries in the CEE region (Balaz and Bayer, 2019). On the other hand, due to "carbon leakage," the EU has had to engage other countries to fight global climate change via active and ambitious sustainability goals. At the international level, African countries have huge potential for the decarbonization objectives of the EU (Pinto et al., 2024; Agyekum, 2024). During an official visit to Africa in 2015, Maros Sefcovic stated:
„*The project is at the heart of the European Union's political agenda but it is outwards looking, involving our partners around the world. As you know, in a globalized economy, energy has no borders. What happens in one part of the world has a great impact on others. When it comes to climate action - that is all the more true!*"

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2.2. Scene 2: Challenges of the Slovak exporters

After the economic reforms of the right-wing government of Mikulas Dzurinda in 1998, the Slovak economy received a massive volume of FDI inflows. Thanks to these, it became one of the most open economies in the world. Multinational companies used a cheap and educated labour force, high labour productivity, and exported the goods produced here to the entire EU common market. The Slovak economy's initial advantage proved insufficient for higher economic growth after 2014. Greater involvement of Slovak small and medium-sized companies in exports was absent. The ten largest export companies (almost exclusively owned by foreign shareholders) accounted for up to 40% of Slovak exports. This was in contrast to the healthy share and critical role of small and medium-sized enterprises (in the US, small enterprises make up 44% of the US GDP) in creating GDP (U.S. Small Business Administration Office of Advocacy, 2019).

The responsible institutions identified as one of the barriers to the export of these smaller Slovak companies the insufficient presence in foreign markets of third countries, where they exported only the minimum, and the government programs until 2020 were largely unsuccessful (Valaskova et al., 2022). To stimulate domestic exporters, the government triggered support schemes of Eximbanka (financing of small businesses in foreign markets), SARIO (support for the development of investments and trade), and support from Slovak embassies abroad (economic diplomacy services). These schemes were established specifically to support them. One of the critical tasks of Slovak companies was a higher rate of innovation, as investments in R&D were at a shallow level, and the rate of innovativeness of Slovak companies was among the lowest in the EU. The most deficient item in the Slovak foreign trade statistics is the category of fees for intellectual property rights, where companies established in the Slovak Republic must import a significantly larger volume of patents and innovative technologies than they can place on foreign markets.

2.3. Product Solar Arm

Even in 2023, SUN Powered Systems operated as a start-up in innovative technologies and basic and advanced products in photovoltaic devices, autonomous devices, and robotics. It had a single owner, and its key products included photovoltaic panels, autonomous public lighting, autonomous lighting for large advertising areas, photovoltaic chargers for bicycles, and several energy-efficient solutions for companies. The company benefited from extremely innovative products that combine elements of photovoltaics and robotics (autonomous). The company was established and has a successful application in the Slovak market due to a difficult environment – marked by extremely demanding regulation in energy consumption, energy savings, and support of renewable energy sources. This boom, especially since 2015, enabled the company's founder to react with his inventions, which he had patented in Slovakia and the EU (currently ten patents). The company's primary goal was to provide innovative, ecological products that would positively impact society in Slovakia and abroad. Thanks to several successfully commercialized patents, the company's turnover had grown permanently since 2018, but in 2022 it reached 1 million €. The company had several activities abroad, but there are no major orders from foreign markets (except the Czech Republic) at present. Currently, the CEO was negotiating expansion on the Kenyan market, the market of the Dominican Republic. The company had only a few smaller competitors in common products (photovoltaics, public lighting, advertising lighting), as larger companies do not deal with such a narrow-profile segment. However, the company's pilot product faced no direct competition, as it embodies its founder's innovativeness.

The company's strategic asset was the constantly innovative Solar Arm product. It is an autonomous arm (Appendix A,B) for a photovoltaic drive. It was produced in two varieties – 12 meters and 18 meters long, and the programmed control panel manages the land in a circular, solar-powered layout. The device is very ecological (it does not use any fossil fuels and is not dependent on their supply, only the sun's energy), sustainable, and energetically autonomous (off the grid). It was designed to perform the function of a small tractor in agribusiness production. The arm was thus fully capable of plowing the soil without human effort, autonomously sowing or planting agricultural products even deep into the soil (planting), and automated irrigation in a defined area (irrigation).

The system used an AC asynchronous motor with a rotational speed of 1500 rounds per minute and a power of 750 W for motion. It can be equipped with commercially available solar modules of small size, as well as LiFePo batteries and frequency regulators. The advantage of the device is its optimized use of photovoltaic energy, so that only approximately 50% of the energy produced by the sun during operation is consumed by the machine. According to the inventor's design, the remaining energy is stored in accumulators. It can be used for other purposes: power for further irrigation, electricity for the water pump, and charging other devices, including smartphones or simple domestic appliances (lamps, etc.). This creates a significant advantage of a universally usable battery in agribusiness, especially in remote areas where accessibility to cities and fossil resources is more problematic. The original plan for dynamic electricity consumption (a conception of “prosumer”) in the EU's decentralized electricity system motivated Robert Demko to develop a kind of "Tesla tractor" and similar agricultural production, where surplus energy would be widely usable. Similarly, to what more western European households do, when the price of electricity is high, discharging their battery electric vehicles into the domestic electrification network at specific time slots for a financial reward.

However, the innovativeness of this product for agribusiness persists beyond the energy parameters. The Solar arm addresses a fundamental problem for many farmers: the high presence of pesticides, herbicides, and insecticides. The way the solar component is utilized and the well-designed technology make it possible to grow organic food without the necessary use of these unwanted synthetic substances, partly due to the lightweight (significantly lower compared to a small tractor and the destruction/suppression of arable land by tires). In essence, the device produces organic food in a very gentle way toward the soil. The device has zero operating costs; the product is fresh and healthy vegetables. That is why start-up farmers and micro and small-sized farms turn to it. It is an enormous advantage, especially for depleted soil types and areas with problematic irrigation. With heavy machinery, the soil becomes drained and damaged. Otherwise, chemical treatments are necessary.

Another fundamental advantage is the maintenance of moisture - rammed earth does not retain water, and nutrients are washed away from it. The soil has the appearance of a soaked sponge with significantly gentler tillage (with lower weight); it maintains its natural biodiversity and bacteria. At the same time, the Solar Arm mechanically but gently removes weeds. In the EU, the device aroused a positive response, especially from German farmers, being the leader of the EU's "decarbonization transformation," not only minimizes the consumption of fossil fuels but also intensively tackles the release of CO2 in agriculture more intensively. It may sound unbelievable from outside the EU, but German farmers who avoid disturbing the soil by plowing at greater depths are even specially rewarded (subsidized) for a gentle and eco-friendly way of agricultural production, resulting in lower levels of CO2 emissions, after demonstrating this effect. Solar Arm does not disturb the root systems of plants

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in the soil and CO2-impermeable layers, as is the case with heavy machinery used in agriculture, by gently plowing the soil.

3. Kenyan market and decarbonization plans in agrobusiness

3.1. Market potential in Kenya

The Kenyan economy is one of the more advanced African economies. The average life expectancy is about the same as India. Promising potential for business opportunities is indicated by economic growth, which in the pre-pandemic period ranged from 4 to 5% per year, and the standard of living expanded dynamically. The main export partners in the top five include the USA, the Netherlands or the UK. Kenyan companies are the largest exporters of coffee, tea, cut flowers (the top exporter in the world) and other agricultural products and mineral raw materials. A strategic port for export to the Kenyan market is Mombasa on the east coast of Kenya and the terminal port of Lamu.

The population of this country is approximately 55 million, but according to the World Bank's predictions, up to 92 million people are expected to live here by 2050. The youth population will more than double (World Bank Group, 2025), so there is an urgent need for solutions to increase agricultural productivity while also considering climate goals and minimizing the consumption of fossil resources. Indeed, Kenya, like some developed market economies, has ambitious goals in renewable energy sources as a path to decarbonization. Based on research results of Odhiambo (2022), it can be concluded that the current burgeoning FDI inflows that Kenya has attracted in recent years are largely driven by strong economic growth and prudent macroeconomic policies that the country has been pursuing in recent decades.

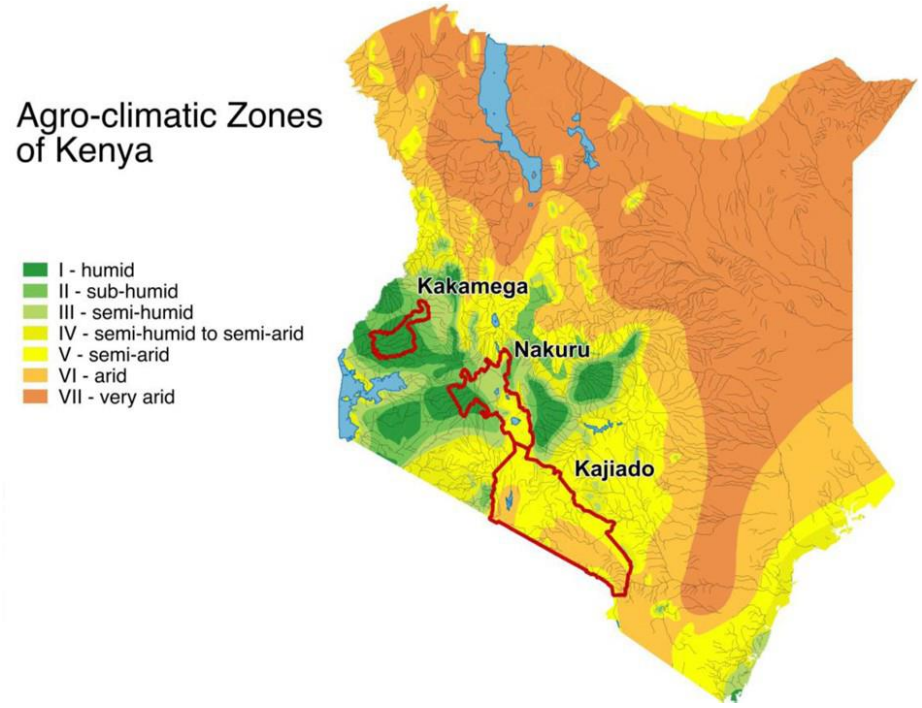
By African standards, the living standards here are relatively high — indicating potential for selling European products. Companies consider Kenya very promising also because, if they manage to expand into this market, they can leverage the duty-free expansion to the entire East African region (AfCFTA, EAC). However, the risk to the local market is high due to corruption. Some unexpected advantages are the range of telecommunication services and 5G coverage comparable to European countries, an unexploited market, and a relatively less competitive environment. According to some authors (Andersen et al., 2022), there appears to be overall quite strong business incentives to go circular among Kenyan companies, although these incentives are not necessarily realized by the companies — a factor that could be exploited in policymaking. The specifics of the Kenyan economy also include the energy mix, as most electricity is produced from renewable sources, with geothermal energy playing a vital role. However, energy consumption per capita needs to increase, limiting the growth of living standards in the area.

3.2. Business opportunities in Kenyan agriculture

"Today more than ever, farmers in Kenya face profound changes – from climate change, labour shortages and global pandemics such as COVID-19, to an explosive rise in digital technologies, shifting diets and rigorous global and national food safety standards."

John Preissing, the Deputy Director – FAO Investment Centre

Figure 1: Agro-climatic zones of Kenya



Source: Chepkoech et al. (2018)

Agriculture constitutes a significant economic sector for all Sub-Saharan African countries, especially Kenya, where it engages over 80% of the population (Nduru, 2011). In Kenya, agriculture is extraordinarily valuable. Agriculture represents over 50 % of the country's GDP, 60 % of employment, and 65 % of exports (FAO, 2022). The water problem during the dry season characterizes and negatively determines Kenyan agribusiness. After heavy rains, water rapidly washes away nutrients from the soil. Water usually flows away the topsoil. In local agriculture, there is also a problem with the weathering of topsoil during strong winds. Kenya's high-rainfall areas comprise about 10% of Kenya's arable land and produce 70% of its national commercial agricultural output. Farmers in semi-arid regions contribute approximately 20% of the production, while the arid regions account for the remaining 10%. Productivity needs to increase in all areas due to poor incentives and underdeveloped supporting infrastructure and institutions (International Trade Administration, 2022). On the other hand, advanced technologies can help transform Kenya’s agricultural sector, improve productivity, and enable the country to make significant progress toward achieving food security (Strathmore University and Microsoft, 2021). The sector employs approximately 40 % of the total population, with 73 % of farmers being small-scale producers in rural areas (Kenya Agricultural Research Institute, 2022).

3.3. Support of the sustainability and smart solutions

Decarbonization strategies have been proven to be successful in the case of developed countries (Anser et al., 2024). Though, Kenyan agriculture has its own specificities. It is mostly made up of small and medium-sized farmers, despite being a crucial part of Kenya's GDP. These small farmers have only 0.2 to 3 hectares of land (Kenya Agricultural Research Institute, 2022). The fundamental problem of Kenyan agriculture is the obsolescence of production technologies (The Slovak Embassy in Nairobi, Kenya, 2022).

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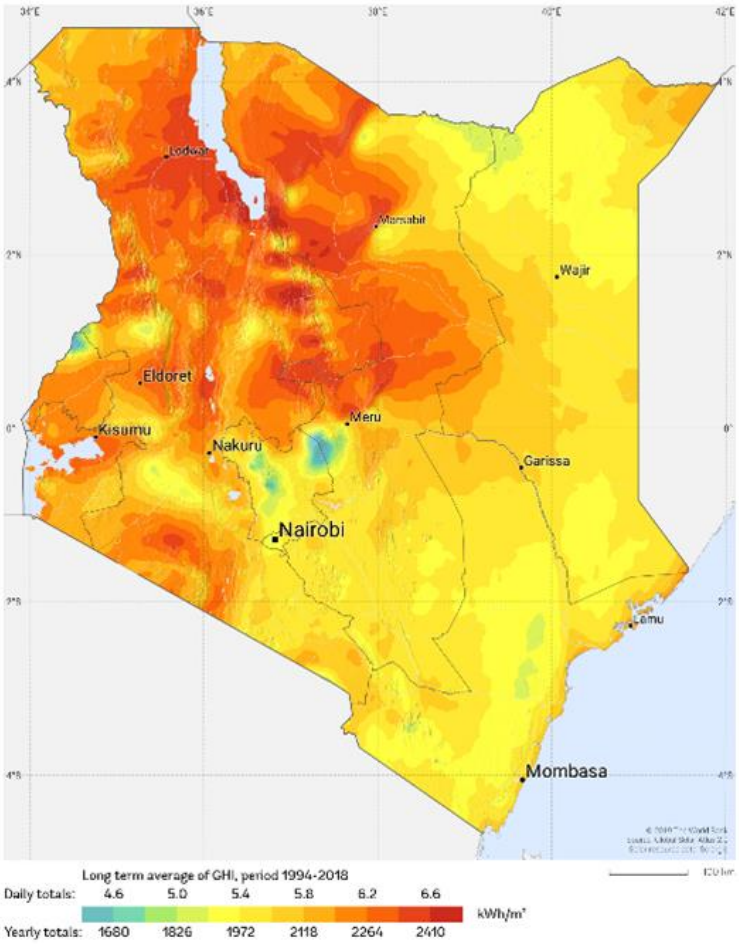
In addition to the mentioned problem with irrigation and pesticides, infrastructure is another challenge. A major problem is the condition of Kenya's rural roads, which make it impossible for Kenyan farmers to procure inputs for agricultural production without difficulties and, in particular, to commercialize their outputs. The government has taken several steps in this area to enable better marketing of the agricultural output.

Another challenge for the Kenyan economy and agriculture is the issue of sustainability and the necessary decarbonization. UN Sustainable development goals and Kenya Vision 2030 aim to make Kenya a newly industrialized, middle-income country with access to reliable, affordable, and sustainable energy (Ndung´u et al., 2011). Most of Kenya's installed electricity production capacity comes from green renewable sources. On the other hand, up to a quarter of the Kenyan population (primarily concentrated in the agricultural sector) lacks access to electricity. The Kenyan government supports diversification within the energy mix, especially if the photovoltaic potential remains to be fully exploited. The potential for producing electricity from panels is vast, since there are 2,525 hours of sunlight per year (World Bank Group, 2023) (compared to about 1,100 hours in central Europe).

Figure 2: Photovoltaic potential in Kenya



Source: World Bank Group (2023)

International trade is a valuable mechanism that saves time and process efficiency, as Kenyan farmers do not have to wait for "green solutions" in agribusiness to develop themselves but can import such products from abroad and benefit from them within a short time horizon. Several international initiatives and key projects, for example, the potential of photovoltaic

sources—as outlined in Vision 2030, represents the country's development program until 2030. Agriculture, infrastructure, and trade are the most important sectors. The new Value Added Tax legislation from 2013 discusses the business potential of photovoltaics in the region (import). The VAT Amendment Act 2014 and the Finance Act 2018 enabled the Kenyan government to remove import duty and implement zero-rated VAT for renewable energy equipment and accessories (USAID, 2019). Strong UK exporters have already contributed to achieving sustainability and decarbonization goals via tree planting by smallholder farmers and CO2 capture (International Trade Administration, 2022). A significant increase in LED lamps across the countryside has already demonstrated the huge market potential (Wagner et al., 2021). The experience of British investors in Kenyan agribusiness indicates that Kenya is progressing toward adopting climate-smart practices in the fight against climate change. However, climate-smart technology requires substantial financing. In August 2021, about 35,000 farmers joined the Drylands Development Programme, which works with farmers to encourage the production of annual crops between or under trees—using a technique called agroforestry—and has supported them by introducing new technologies and improved farming practices to help maintain soil health (British International Investment, 2021).

3.4. A product potential for the Kenyan farmer

Solar Arm represents a promising potential in developing micro, small, and medium farmers in Kenya. The product solves the fundamental problems of the Kenyan farmer, such as productivity, soil loosening, irrigation, automated planting, and a fundamental reduction in the need for pesticides and herbicides. A secondary benefit is battery availability. Depending on the arm size (12 or 18 meters) and the capacity of the accumulator, the initial investment is between €18,000 and €30,000. Robert's presentation to farmers regarding the stable sale of manufactured products to African farmers had a very good response and potential. At a simulated price of agricultural produce at $1 per kilogram of organic vegetables, it is possible to grow 1 ton of vegetables per year on one agricultural cycle. Ten cycles would produce 10 tons per year. A maximum of 20 cycles per year can be farmed with one machine. The return on investment for the device at a price of €1 per kg is within five years, not including the secondary electricity used from the accumulators. Other benefits include the irrigation system supported by this device (using electricity for this purpose) and the reduction of fertilizer consumption. However, it is necessary to account for zero environmental impact, carbon emissions, and unconsumed fossil fuels (imported) when considering the benefits of the device. Additionally, the device emits less CO2 than heavy machinery used in agriculture.

4. Managerial decision – shaping factors

4.1. Sustainable agrobusiness in Kenya – open questions and threats

Based on the success of the European market, Robert was already convinced that the product is competitive, ecological, sustainable, and, on the part of the agro-entrepreneur, able to increase productivity and energy self-sufficiency (autonomy). However, the financing aspect combined with the expansion method, crucial for success in the Kenyan market, needed to be revised. The small agribusiness had a minimal or no liquidity, and therefore, the issue of financing this decarbonization product was directed toward the supplier.

The second topic, which has the fundamental potential to influence the success or failure of a small Slovak entrepreneur in the African market, was the range of differences in the local environment. Robert was worried about the differences in the soil. In Slovakia alone, there are

approximately 12 different soil types, based on which he adapted various product modifications in a "custom-made" style for customers, since the soil may have a more clayey character or be more compact. There was also a question mark regarding the rainy season in Kenya, with high variability in total rainfall across different regions.

As the map of soil fertility and climatic conditions shows, these regions are relatively far from the coast. This presents a potential threat of higher transport costs and the physical unavailability of customers. Commercially, it primarily represented the risk that the equipment might malfunction or that replacement parts would need to be purchased. The smallholder farmers would have to travel tens of kilometres to buy an alternative. However, Robert was confident that sophisticated yet simple solutions, based on standardized components, had already been used during product development. In case of an unexpected failure or damage to a part of the equipment, it is necessary to obtain a spare part from any major city.

Another challenge that Robert personally did not consider crucial was the certification and patent rights protection. The certification mainly involved the risk of technical requirements standardization in the Kenyan market, especially in regulating the renewable resources market. In 2019, the Kenyan government adopted the Kenya Energy Act 2019 (Twesigye, 2022), and the Energy and Petroleum Regulatory Authority (EPRA) began to regulate the supply and use of energy, including the licensing of energy systems. For this purpose, it would be advantageous to expand the Kenyan market by leveraging the valuable know-how of an established European company operating in the market. Moreover, differences in licensing and domestic legislation are quite specific when compared even to neighbouring countries. SUN Powered Systems had highly innovative products supported on the EU market by innovation support programs and subsequently protected by intellectual property legislation (patents used in the Solar Arm). The African market was different, and there was a risk that legislation or its enforceability might need to be revised or clarified. Several years of product innovation and development could be lost in this case.

4.2. Institutional support and partnership

For the product in this "East African corner", after consulting with the economic diplomacy of the Slovak Republic at the Embassy of Slovakia in Nairobi, there are more examples of the companies that were the first in their segment on the market and expanded very successfully. One CEO of an important Slovak company remarked at the time with the words that "you rarely achieve a high margin in a safe and saturated market." The economic diplomat on the local market had accumulated knowledge during several decades of presence on the market; they were ready to help Robert, particularly with the initial overcoming of technical obstacles in foreign trade (certificates, confirmations of product conformity, alignment of technical standards, contacts with local authorities regulating the energy market, etc.).

Last but not least, there was SARIO. An agency with several specialists for African markets who were available as part of state services focused on pro-export and especially pro-investment nature. Should Robert decide to expand with his company on the Kenyan market using more capital-intensive forms (establishment of a branch, office, production facility), specialists from SARIO were prepared to share their experience and highlight key aspects of such a contract and the entire process of establishing a company in cooperation with the embassy.

Eximbanka was the final alternative that was considered for expansion. This state-financed bank in the Slovak Republic was intended for Slovak exporters and investors abroad. Its primary purpose aligned with the situation in which this start-up found itself: to finance expansion into markets where the company would have preferred to avoid operating under

typical business case under market conditions. For Robert, it was primarily an opportunity to access credit options for exporting and export insurance in case of non-payment or payment discipline issues on the part of a foreign business partner. This not only made bank financing more accessible and cheaper but also reduced the risks of expansion in this foreign market considerably.

A month before the official event under the political auspices of both governments, and after listening to the presentation in Amsterdam, Robert was contacted by an essential player in the European agro mechanisms market, HenkAgro Group[2], and approached him with cooperation. He first introduced the company, which offers a wide range of agricultural machines and their operation and opportunities to apply in the Kenyan market. For decades, the Dutch government has actively supported its exporters and investors in the Kenyan market within the institutionalization framework and a rich history in economic diplomacy. They have long-term experience and companies with a long tradition in the region (e.g., many cut flowers in the EU are imported via the Netherlands). In addition to their rich experience in the Kenyan market (certification of products, technical standards, consumer protection), they provided Robert with the opportunity to customize his production specifically for the Kenyan market. However, during the subsequent meeting, the Dutch partner explained to Robert the challenges of the Kenyan market and clarified that the cooperation model would not involve direct confrontation of the Slovak company with the Kenyan market, but rather that SUN Powered Systems would receive a commission of approximately 4% based on the value of each exported machine.

5. Dilemma point in the managerial decision – method of the Kenyan market expansion

Solar Arm is undoubtedly a prospective energy product for low and middle-income countries worldwide. However, Robert knew that the Kenyan market was particular and more demanding than the EU markets where he has been moving so far. On the other hand, it was a very underserved market. Unlike the EU, the rapid population growth, the sales of agricultural production, and especially the available space for innovative energy products offer many opportunities. Additionally, the patronage of the Slovak president over cooperation events served as an important catalyst for building contacts, where there was only a tiny likelihood of a dysfunctional, fraudulent company on the Kenyan side within such a forum. After consulting with an economic diplomat and reviewing the possibilities of expanding into the foreign market (The Slovak Embassy in Nairobi, Kenya, 2022), the key issues to decide were:

- choosing a specific method of expansion in the Kenyan market,
- selection of the capital-intensive expansion model in the foreign market and engagement of an external partner in this area.

Companies that decide to expand into the foreign market have a range of options available for how to realize this market penetration and reach a wider range of customers. According to Hill (2022) and Zabojnik and Ciderova (2022), the basic options include the following:

- wholly owned subsidiaries (foreign direct investment: greenfield),
- joint venture, mergers or acquisitions,
- direct exporting,
- indirect exporting (export alliance, piggy-backing etc.),
- turnkey contracts,

[2] With regard to the company's trade secret, this is a fictitious company name but a real offer.

- licensing,
- franchising.

In the case of SUN Powered Systems, Robert primarily considered the preservation and utilization of his patents in the field of energy innovations, which he could expand and constantly innovate in the final product (BASF Innovation Hub, 2022). However, simultaneously, he was mindful of the substantial capital needed for innovations; many of them were experimental and not fully applicable to the market. Without practical innovations, the Solar Arm would not have been built. In this context, the Dutch offer of a "safe haven" guaranteeing a net profit of 4%, kept appearing in front of his eyes, but he knew that his start-up probably would not grow quickly from such a scheme. Can the company go independently into Kenya's promising agricultural energy market? A fantastic challenge and great potential, but so many specifics of the Kenyan market compared to European standards pose significant questions.

Some experienced businessmen go to the foreign market through excellent contact, and in Asia, there are markets where, according to their expression, "you can sell anything." However, this is a different situation. SUN Powered Systems brings a unique, energetically innovative product with tremendous consumer potential.

- Does the Solar Arm product have the potential for farmers as an innovative energy and technological solution? Do society, community, and Kenyan farmers need and can pay for this energy-efficient product for productivity growth concerning living standards?
- If so, what is the appropriate expansion method for this foreign market? Go into this challenging (in terms of foreign trade technique) foreign market individually, and is the risk worth the opportunity, or play it safe and share the margin with a more experienced player who gets access to the company's patents (a strategic asset)?
- Is it possible to realize the expansion of an energetically innovative way of farming in the form of SUN Powered Systems to the Kenyan market on your own without capital assistance from an external partner?

In a month, with the participation of leading political representatives, his product will indeed, as usual, reap great success from the Kenyan energy industry and especially farmers during the presentation. But whom will he address regarding his preferred expansion method in the Kenyan market at the convention hall? Will he target importers, traders, Kenyan investors, government agencies, or the segment of small and medium-sized farmers? It all depends on the choice of a specific expansion method into the Kenyan market.

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Appendix A

Figure A1: Solar Arm plowing the soil (potatoes)

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Appendix B

Table B1: Net weight of the product parts (12 m arm)

Part	Weight
rotating axis, central body (arm)	85 kg
rotating axis with grounding screws	
long part of the arm (6 m) with solar panels 2kWp	260 kg
undercarriage	120 kg
tool holding device	35 kg
LiFePo4 battery 5,8kWh	35 kg
motor part	40 kg
tool for preparing soil	65 kg
Total	640 kg

Appendix C

Table C1: Transportation costs overview

Parameter	Value
Total weight (netto)	1,920 kg (LCL)
Transportation costs (FOB-CIF)	1,280 € (Slovakia – Mombasa)
Volume	6.00 m3
Delivery from port to port (Hamburg-Mombasa)	45 days
Customer duty + custom clearance	N. A.
Local fees in Mombasa	N. A.

**Comment: total costs for FCL is 2 800 €*

Appendix D

SUN powered systems: Expanding EU green innovations under the African sun[3]

1. Case overview

The study is devoted to the highly innovative energy product from the EU (Slovakia), designed as a result of the stringent decarbonization policy and ready to penetrate the Kenyan agricultural market. The Solar Arm uses several patents to perform autonomous plowing, planting, and irrigation, fully powered by photovoltaic panels. Additionally, battery capacity storing the electricity enables solving several problems of Kenyan small and medium farmers related to electricity deficits. The challenge associated with entering the Kenyan market lies in the critical assessment of its suitability for such a highly innovative and eco-friendly product developed in the "green EU." As a result—ultimately—a managerial decision must be made. Readers will have to determine the appropriate expansion method for the Kenyan agricultural market for this Slovak start-up.

2. Learning objectives

The following learning objectives outline the key competencies and knowledge areas that students are expected to develop upon completion of this module:

- students can understand Porter hypothesis and the potential positive externalities stemming from environmental regulation,

[3] Teaching note

- a brief overview of the EU decarbonization efforts and relation to export competitiveness,
- market overview of the Kenyan economy and particularly Kenyan agriculture, its main features and specifics,
- have a brief overview of the export price calculation,
- understand basic and advanced methods of foreign markets expansion,
- critically assess the advantages and disadvantages of particular foreign market expansion methods,
- overview of the macro and micro business environment of foreign markets.

3. Pedagogy

The business case is suitable for bachelor and MBA classes of business-oriented study programs), business disciplines (suitable for business-oriented programs, particularly for those focused on energy market low and middle-income countries, international studies), and prerequisite knowledge or courses (general economic theory, entrepreneurship basics, basics of global logistics).

4. Recommended supplemental materials

Recommended supplemental materials cover:

- European Commission. (n.d.). *European Green Deal: Decarbonization policies of the EU. European Commission*. Available online: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
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5. Assignment questions

The following questions are designed to guide your analysis and critical thinking based on the information provided in the case study.:
RQ1: *What are the potential impacts of stringent environmental regulations*?
RQ2: *Would this innovative energy market product suit low- and middle-income countries*?

RQ3: *What kind of direct or indirect method of Kenyan market expansion is the most appropriate*?

6. Case analysis

To deeply analyze the text and content of the case study, I strongly suggest to be focused on the problem in the following structure.

6.1. What the potential impacts of stringent environmental regulations?

It is expected to discuss the pros and cons of stringent environmental regulations within the energy market of the EU. It has to be highlighted as a necessity for the decarbonization efforts. The conclusion to this question has to be clearly defined as a possible presence of the Porter effect[4].

The also negative impact of the decarbonization policy has to be clarified. Mainly through a potentially lower consumption due to higher prices (environmental regulation costs). During the discussion, it is recommended to raise a question concerning globally needed environmental measures (CO2 reduction). It must be stressed that ecological regulation can negatively affect businesses in case of incorrect policy design. As a crucial legacy of the European Commission, the case study participants must be assured about an essential pillar of industrial competitiveness and boosting innovation activity triggered by the decarbonization policy.

6.2. Would this innovative energy market product suit low- and middle-income countries?

Firstly, it has to be stressed and clarified among the students that the decarbonization efforts have to be implemented at the global level due to the possible phenomenon of carbon leakage (undesired migration of the corporations establishing businesses in countries with a weaker environmental standard: "environmental colonialism"). Even developing countries and LDCs have their carbon emissions objectives to set. Moreover, better ecological standards within LMIDC help them to protect their natural environment locally. Additionally, clean production helps to place their exported products on western markets more efficiently. Due to high economic growth, these countries need to build incremental energy capacity, which has to be sustainable (renewable) as much as possible. For this purpose, exporting the most recent (advanced) and environmentally friendly technologies from the EU and the USA is crucial. In this regard, the product of the solar arm would also fulfill the environmental objectives in the Kenyan agro sector.

Moreover, technology helps increase the productivity rate and, therefore, the general standard of leaving. Besides the environmental standards that the Kenyan government must support, several other factors favor solar arm usage. They include higher productivity, battery, and spared electricity disposal (smartphone, home electric appliances, water usage, irrigation usage). Additionally, the solar arm brings pesticides, herbicides, and fungicides savings.

One of the most significant Solar Arm benefits represents the disposal of autonomous energy systems (fossil fuels, logistics on pure quality roads.) Comparing tractors, the reliability of the

[4] M.E. Porter has been dealing with this phenomenon since the 1990s. Based on research in American companies, he formulated the so-called Porter's hypothesis, which assumes that strict environmental regulation causes restrictions or increases costs and this forces companies to introduce innovative solutions to reduce energy consumption or increase productivity. Ultimately, these local restrictions (regulation) bring companies higher international competitiveness (export competitiveness) caused by technological innovations, the introduction of cleaner production technologies or more efficient production processes.

equipment is higher. Therefore, small or medium farmers do not need bigger cities to purchase spare parts frequently. The most critically assessed question has to be dealing with the product's affordability. Based on the brief calculation within the case study, the students have to critically determine a crucial need for flat revenues of the farmers based on fixed supplies. Without this "prepaid goods delivery" model and/ or government subsidy, investing 20 000- 30 000 € for a small or medium African farmer would be impossible.

6.3. What kind of direct or indirect method of Kenyan market expansion is the most appropriate?

First, any method used for Kenyan market penetration would not be possible without government support - without Slovak pro-export institutional support (economic diplomat from the embassy, SARIO, Eximbanka). Secondly, the students have to identify capital-intensive and non-intensive methods of foreign market expansion (from the list of methods). Initially, they have to take away capital-intensive methods related to wholly owned enterprises on foreign markets. As a second point, they should determine a possible direct or indirect exportation, advantages and disadvantages of this method. For this purpose, they have to briefly calculate the import price to Kenya (value of the Solar Arm of 18 000 €, transport costs, and customs duty as a DDP price).

Table D1: Entry modes on foreign market, advantages and disadvantages

Entry mode	Advantages	Disadvantages
Exporting	Ability to realize location and experience curve economies	High transport costs Trade barriers Problems with local marketing agents
Tumkey contracts	Ability to earn returns from process technology skills in countries where FDI is restricted	Creating efficient competitors
Licensing	Low development costs and risks	Lack of long-term market presence
Franchising	Low development costs and risks	Lack of control over technology Inability to realize location and experience curve economies Inability to engage in global strategic coordination
Joint ventures	Access to local partner's knowledge Sharing development costs and risks Politically acceptable	Lack of control over quality Inability to engage in global strategic coordination
Wholly owned subsidiaries	Protection of technology Ability to engage in global strategic coordination Ability to realize location and experience economies	High costs and risks

Source: Hill and Hult (2019)

The discussion within the class should be focused on the mentioned advantages and disadvantages of the particular methods.

7. Conclusions

After critical points discussion (particular method advantages and disadvantages, capital intensity, potential theft of technological know-how, price competitiveness, distribution network, specific customer preferences, difficult certification, etc.) The students must identify the following expansion methods as potentially acceptable:

- indirect export to a big Kenyan agricultural supplier on the parity-CIF Mombasa,

- sold patent rights for Kenyan (east-African market) 3. Joint venture – 50/50 shareholders' equity – Robert Demko would pay the shareholder equity by the intangible asset's value (technological patents of the products).

8. Teaching plan

The following table outlines the time-structured teaching plan for the session, including the main topics, focus areas, and learning goals.

Table D2: Time-structured teaching plan

Time	Content
1-13 min	Characteristics of the decarbonizations efforts in the EU. Possible negative effect on the industrial exporters. Porter´s hypothesis.
13-15 min	Institutional support, problem of the Slovak (and many other) smaller countries in economic diplomacy and institutional support of the exporters and investors abroad.
16-30 min	Characteristics of the product, its competitiveness, advantages, unique parameters and problem-solving potential (perceived value). Potential of electricity storage and usage.
31-60 min	Kenyan agriculture and potential for business. A brief SWOT analysis of the market potential in agriculture. Match between the market potential in Kenya and the product (Solar Arm).
61-90 min	Potential foreign market entry modes (methods). Advantages and disadvantages. Conclusions.