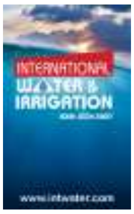

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A Valuation Model of Agricultural Biotechnology Enterprises Under Digital Transformation

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Abstract: Business group specialists examine a company's corporate structure to understand its financial health. Agricultural biotechnology permits profit-sharing, yet the distinctions between large and small businesses impact both biotech companies and the industry overall. Using data obtained from the company, this study aimed to examine the business models used by small and medium-sized firms (SMEs) and evaluate factors influencing the expansion of agricultural biotechnology businesses and the industry as a whole. The study examined the tactics and business models used by agricultural biotechnology companies across several international borders. We arranged the interviews based on predetermined survey questions. We completed twenty surveys, and more than fifty-five percent of the participating firms expressed acceptance. The study highlights the risky agricultural biotechnology research and development system that limits the emergence of specialised businesses and causes a large amount of turnover. SMEs also face challenges with copyright asset development and licensing procedures.

Keywords: Agricultural biotechnology, enterprises, economic health, industry, profit

1. Introduction

1.1 The Role of Agricultural Biotechnology in modern agriculture

One of the main pillars of contemporary agricultural innovation is the field of agricultural biotechnology, which tackles important issues including crop resilience, environmental sustainability and food security [1]. This area of research makes use of innovative biological approaches to raise agricultural yield, strengthen disease and insect resistance, and lessen dependency on chemical inputs. The creation of genetically modified crops, bio fertilizers, bio pesticides and other biotechnological instruments that assist sustainable farming methods are examples of agricultural biotechnology innovations [2].

1.2 The contribution of large and small enterprises

Businesses of all sizes played an important role in their operations in this challenging environment. Larger firms are able to undertake larger research and development (R&D) programs because they have more robust infrastructure, more product diversity, and well-established markets. These firms are developers in large-scale development and adept at regulatory and monitoring frameworks transportation and support them quickly suggestion new goods to the market [3,4]. SMEs, are crucial to the industry due to their diversity and adaptability. SMEs regularly focus on particular markets, creating goods and technology that bigger groups would discover. Because of their tiny length, they could reply to new scientific findings and commercial needs more speedy with more flexibility. But that equal flexibility has its drawbacks, about restrained assets and volatile economies [5].

1.3 Challenges faced by SMEs in agricultural biotechnology

Despite the importantimpact of SMEs on agricultural biotechnology, they face severe challenges. The Research and Development (R&D)procedure in this segment is essentially capital-demanding and riskyoutcomes in higher revenue, SMEs discover difficult to establish themselves as specialist enterprises. Due to the limited resources of small businesses and lack of funding for major sequencesresolvable challenges [6].

In addition, SMEs face good-sized problems when annoyed to navigate the difficult licensing tactics and create intellectual property (IP) properties such as copyrights and patents. Their capacity for development and

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sustainability may be constrained by using these administrative and legal obstacles, which can make more difficult for them to protect and market their creations [7]. Securing IP rights can be extremely high-priced and time-consuming, which can be particularly hard for smaller businesses that could have organization-fixed costs and little cash accessible [8,9].

1.4 Aim of the study

Study's objective is to offer a comprehensiveknowledge of the marketablesets in which agricultural biotechnology companies' function. The study aims to provide insights intothe potential solutions for overcoming these hurdles by identifying the particular problems encountered by small and medium-sized enterprises (SMEs) in agricultural biotechnology.This will help to promote a strong and resilient agricultural biotechnology industry. The research examines the business models, tactics and procedures of agricultural biotechnology corporation's worldwide, drawing on data which gathered the organizations. Twenty organizations participated in the structured surveys, which had an acceptance rate of over fifty-five percent. Although there were certain limits, the information gathered was important.

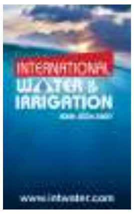
2. Related works

Research on agriculture and sustainability as it relates tothe Industry 4.0 digital technology was examined in the article [10]. It was demonstrated that transformed agriculture was capable of addressing the problems of the modern world by analyzing the notions of sustainability-driven agriculture and sustainable agriculture in the framework of digital transformation. Furthermore, principles for agriculturally-driven sustainable growth via digital transformation factors are outlined.To improve the discovery of the systemic changes associated with digital transformation, they presented a framework in the article [11] that facilitated the processes of problematization and ultimately, responsibilization. They additionally described the various interactions that occur from the impactof digital transformation in the environment of rural and agricultural areas.

To enhance the efficiency of the agricultural business system, the article [12] aimed to investigate the present status of digital technology deployment acrossdifferent economic sectors and the appropriate use of digital technology. The findings demonstrated the necessity for concurrent and collaborative developments in the other technological innovations the research presents, as the food business employs,one of the technologies.The advent of precision agricultural technology, particularly digital farming and plant genome editing which was examined in the article [13] along with the politics of sustainable development in the agri-food industry. They focused attention on the different perspectives of the methods in these developments interact with environmental issues and the opportunities threats wherethey provide.

Researchers in [14] examined the roles that global players have the power to shape the future of food systems were imagining for these technologies. The results obtainedand indicated by examining the potential effects of digital agriculture in the compromises made among supplies, regulating, and ecological facilities for multiple agricultural futures, ecological systems service researchers might contribute a significant contribution to the assessment of the effects of digital farming on the ecosystem. Authorsin [15]examined the critical components of ecologically innovative industries that, by utilizing agricultural waste or by-products, promote a system of recycling both successful and risky. By defining and modifying their methods in their local settings, farmers and agribusiness managers may benefit from the findings collected from the study.

To provide a framework for the creation of smart villages, the study [16] assessed the state of climate-smart agriculture and offered motivation for its values. A broad variety of smart sensor technologies are being used in agricultural development, which includes lowering farming losses, optimizing agricultural processes for higher yield that preventing, tracking and early identification of illnesses in plants and animals. To improve future intelligent and sustainable agricultural systems, a proposal for the complete integration of digital technology was developed in the study [17]. The concept's application might boost data value, farm productivity, efficacy in



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monitoring farm operations, decision-making, and enable novel farm business models, according to the study's identification of its potential benefits.

3. Methods

An established industry is assessed using the following methodology: structure, behavior and performance. Reversing the sequence of analysis could provean accurate way to assess the new and developing agricultural biotechnology sector. Industry structure is a classic area of study for industrial organization scholars to better understand how business practices affect economic performance. However, Agricultural biotechnology lacks well-known business behavior patterns due to its distinct organizational structure, which consists of large established corporations and tiny, start-up businesses. To achieve the intended financial performance, companies may choose to plan in reverse order, concentrating on the structure that supports behavior and ultimately influencing the structure of the industry.

Determining the business models employed by SMEs and assessing the variables to determine the future of agricultural biotechnology companies and the sector are the goals of this research. Identifying that business operations are carried out "in-house" is a crucial part of establishing the business models that biotech companies utilize. Only those employed by the company may provide that kind of information. To achieve its objectives, the present study used primary data instead of data from secondary sources.

3.1 Data collection

This study used telephone interviews to obtain knowledge of the strategies and practices of small and medium-sized agricultural biotechnology companies from different nations. To ensure participation from several continents and agricultural biotechnology sector segments, the businesses were chosen based on a stratified list. Within each continental industry, firms were classified on their product marketplaces. Abouttwenty companies from China, Taiwan, Netherlands, Portugal, Iceland, and Irelandwere invited to participate. To reduce discrimination and capture notes and replies, each interview was organized using a written questionnaire.Interviews took 20 to 30 minutes as the questionnaire was organized so that items could be moved quickly. The longest interviews were over an hour long since the interviewer encouraged all of the respondents' opinions on a number of the topics covered.

4. Findings from the Interview

Twenty surveyswere performed and for companies from China, Taiwan, Switzerland, Sweden, Greece, Spain, Belgium, and the Netherlands, the response rate exceeded 55%.

This study concludes with a table that summarizes all businesses' answers to each question. The sample questions that were asked and the total number of replies are displayed in the table's format. The questions in the table are listed in the sequence they were asked. When it comes to multiple-choice and "yes/no" questions, the number of answers in each category is displayed. Readers may frequently see the responses provided by a single respondent to each question since the line order is preserved throughout. Not every respondent, commented on every question. Table 1 illustrate the sample questionnaire

Table 1: Sample questionnaire

Questions	choices	Type
What items do you manufacture and/or sell?	Nourish, Pet food, Eco fuel Others	Yes/no
Is services what your company offers?	Contract research services, Market feasibility studies	Yes/no

Does the company make or sell this kind of products?	Horticulture, Silviculture, Mariculture, Medicine others	Multiple choice
Is the following the market for your products?	Horticulture, Silviculture, Mariculture, Medicine others	Multiple choice
How many Biotech firms are in (Switzerland, Sweden, Belgium, Greece, Spain, and the Netherlands, and are local contenders or global contenders?	Average, Highest, Lowest medium	Yes/no

4.1 Features of the Research Firms

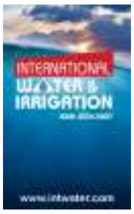
The analysis of agricultural biotechnology companies' business practices, marketing plans, and risk management techniques provides various significant findings. The dominant position of research and product development over marketing is one significant outcome. However, a small portion of these SMEs have items that are ready for the market; the majority remain in the early phases of product development. To maintain operations, this requires additional revenue sources including service sales and intellectual property licenses. To reduce market risks, SMEs in this sector frequently use a "portfolio" strategy for product creation, utilizing their intellectual property in several markets. The objective of this approach is to enhance the probability of market success by exploring many product marketplaces despite budgetary limitations.It also suggests a degree of ambiguity about the amount of market acceptability for any product. According to the statistics, there appears to be a significant degree of cross-industry engagement by SMEs in agricultural biotechnology across many market categories, such as nourish, Ecofuels, and medicine are summarized in Table 2.

Table 2: biotechnology across many market categories (Nourish, Ecofuel, and medicine)

Market categories	Nourish	Ecofuel	Medicine
Percent of all businesses surveyed	39	17	33
Distribute additionally in Nourish	-	67	67
Distribute additionally in Ecofuel	29	-	33
Distribute additionally to Medicine	57	67	-
Distribute all three sectors	29	67	33

The results of Table 2 covering many biotechnology industry categories show different distributions in the Nourish, Ecofuel, and medicine sectors. Of all the companies interviewed, 39% focus on nourish, 17% on ecofuel, and 33% on medicine. Furthermore, a significant percentage of companies 29% diversify their attention among the Nourish and Ecofuel industries, and 67% expand their operations to include both Ecofuel and medicine. Additionally, 57% of companies operate in the medicine and nutrition industries. Lastly, a sizable percentage 29% participate in all three sectors at the same time. This information highlights the varied involvement of biotechnology companies in several market sectors, illustrating the complex interactions among nutrition, sustainable fuel options, and medical research progress.

Figure 1 provides a summary of the answers to the questions. For the products we make and sell, 56% of respondents said "yes". 39% of our attention is focused on our company's services, nevertheless. We also provide technical licenses to other businesses, with a significant 78% involvement rate in this area of our business.



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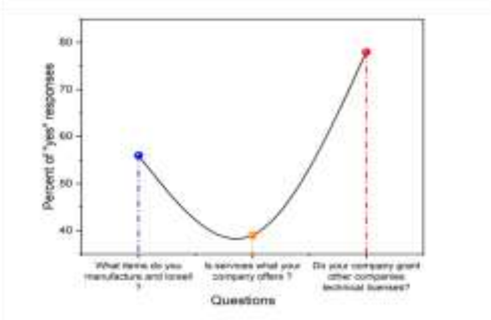


Figure 1: Summary of the answers to the questions

Figure 2 provides a summary of the responses to product questions. The company's primary concentration is on nourish production, accounting for 70% of its operations. It also produces pet food (40%), and Ecofuels (30%). Its involvement in other industries accounts for 60% of its total business activity.

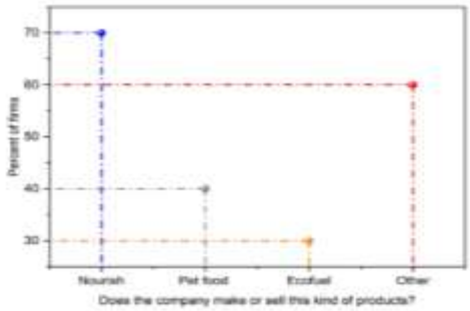


Figure 2: summary of the responses to product questions

Figure 3 demonstrates to the market analysis, that there is a substantial amount of interest in our products among horticulture, as evidenced by the 100% positive reaction. However, silviculture (22%), and mariculture (11%), exhibit a more critical response. At 33%, the medicine sector shows modest interest, while other sectors show potential as well (22%). Though agriculture offers a strong market overall, there are chances for growth in several industries with numerous reasons for interest.

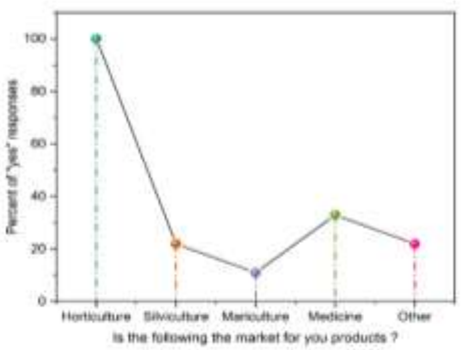
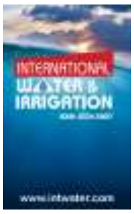


Figure 3: summary of the responses to market product questions

4.2 Competition, Size, and Composition of the Industry

The competitive landscape in the agricultural biotechnology sector is dynamic, with insiders expressingthe differing opinions on enterprises across national borders. The sector is substantial has a high number of SMEs, which promotes monopolistically competitive dynamics despite the unpredictability. Figure 4 indicates that the industry is both competitive and substantial in size.Within the biotech industry; Switzerland has the



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highestaverage number of companies 221.4 with a high point of 800 and a low point of 20. The median is 50. Sweden stands in second with a median of 52.5 enterprises and a range of 100 to 5 at its lowest point. The number of enterprises in Belgium is 47.3 on average, with a maximum of 80 and a minimum of 12, and a median that is equal to that of the US at 50. The numbers for Greece and Spain are comparable, with averages, greatest, lowest, and median values of 390 and 300, respectively. The Netherlands comes in last with just 3 companies in every category. The average number of direct local contenders is 5.9, with maximum of 25, while some companies have none at all. While global contenders average 37.3 businesses and peak at 500, certain locations have no competitors at all, with a median of 7.5.

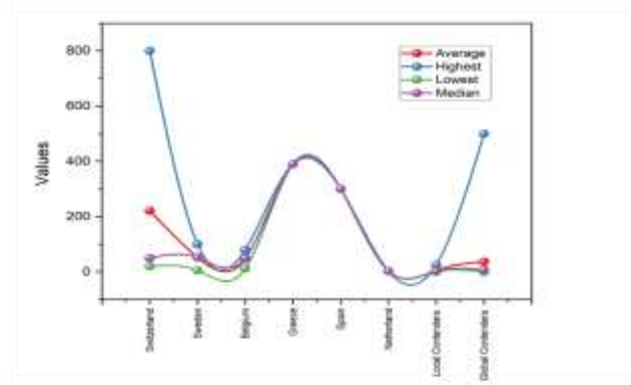


Figure 4: summary of the responses to industry and competition size

4.3 Prospects for Industrial Business

It has a crucial role in stimulating research and innovation inside SMEs in the agricultural biotechnology sector. Although the majority of businesses recognize their importance, countries like Belgium, are concerned about their disappearance. Regulatory barriers and rising compliance expenses present serious difficulties, but they also encourage cooperation between bigger companies and SMEs in search of affordable solutions. The commercial prospects of SMEs are significantly impacted by factors such as industry concentration, patents, and partnership opportunities. Businesses engaged in forestry and animal breeding face exclusive limitations due to dissimilar investment horizons and regulatory environments. SMEs play a crucial role in the development of biotechnology for animal fitness and propagation. They offer precious clinical insights and collaborate with bigger companies on research and marketing accomplishments, which foster innovation in the area.Itcan be seen in Figure 5 and Table 3, companies in three of the biggest market categories nourishment, Ecofuels, and medicineresponded similarly when asked how much local and international competition they faced.

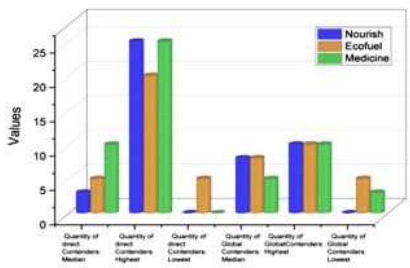


Figure 5: Industry competitor's questions

Table 3: Values of Industry competitor's questions

Direct and globalcontenders	Nourish	Ecofuel	Medicine
Quantity of globalcontenders: Median	3	5	10
Quantity of globalcontenders: Highest	25	20	25
Quantity of globalcontenders: Lowest	0	5	0
Quantity of globalcontenders: Median	8	8	5
Quantity of globalcontenders: Highest	10	10	10
Quantity of globalcontenders: Lowest	0	5	3

Figure 6 shows that many factors were identified by most firms. SME prospects are greatly impacted by industry specialization and the cost of using biotechnologies (61% and 67% affirmative replies, respectively). The SME environment is shaped by patents, collaboration with larger enterprises (both at 61% and 44%), and other variables (50%) combined.

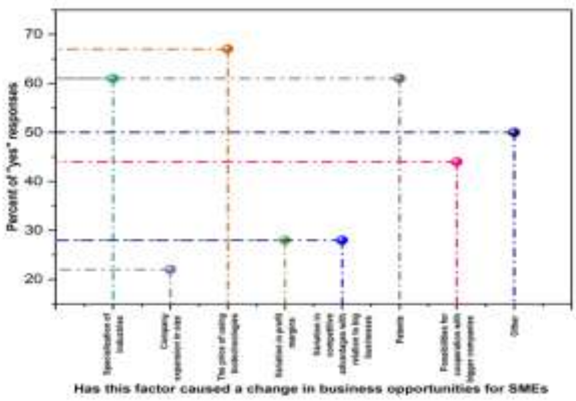


Figure 6: Business opportunities questions

4.4 Prospects for Enterprises in the Sector

The responses from the interviews deliveredaccessto several factors affecting SMEs in the agricultural biotechnology industry. SMEs have aggressive limitations due to technological elements along with expenditures and patents, especially due to the resource gap with larger corporations. Priorities for SMEs are inspired by marketplace evolution, early-stage businesses area greater emphasis on market stores, at the same time as mature groups prepare top resources for product quality. Portugalindustries fund studies cooperatives more than Ireland's counterparts, and they play a critical role. On their feasibility for SME independence, however, views differ extensively. SMEs use their adaptability, threat-taking, and agility to pinpoint place markets, they struggle to secure the capital needed to input new markets and follow guidelines. Despite these limitations, businesses use a variety of strategies, together with associations, environmental sustainability, and technological innovation, to establish prosperity numerous industries have varied levels of control over pricing, some are motivated by commodity prices, while others use their product difference and perceived value to acquire a substantial competitive advantage. SMEs' primary objective is to develop by acquisition, merger, or forward integration, and they define success as growing shareholder wealth. Developing technology or goods with a market value that is used in larger companies for consolidation is the main objective for SMEs.

4.5 Business Models Used by SMEs

Business models in the agricultural biotechnology industry include the organizational structures long- and short-term goal-achieving techniques of enterprises. Although every business has a different model, there are commonalities to develop that make it easier to classify and identify common techniques.Figure 7 shows the types of business models.

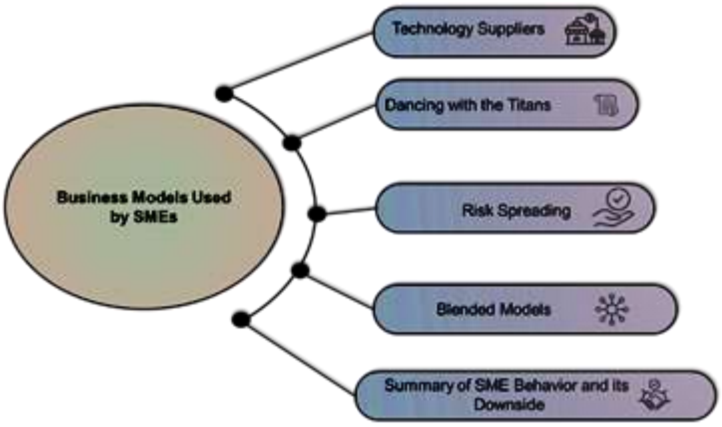


Figure 7: Types of Business Models

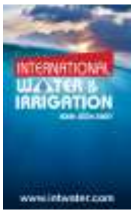
Types of Business Models

- **Technology Suppliers:**
  SMEs concentrate on creating technology for larger companies to sell or license their inventions. Strategies include developing items for other businesses to market and specializing in certain areas.
- **Dancing with the Titans:**
  Utilizing strategic partnerships, SMEs work with larger organizations to make up for resource constraints. Nonetheless, cautious positioning is essential to prevent being overcome by more powerful partners.
- **Risk Spreading:**
  SMEs use horizontal integration to diversify their markets and function to reduce industry risks. Through the maintenance of workforce numbers and resources throughout market downturns, this method ensures sustainability.
- **Blended Models:**
  Firms' models change as they develop, absorbing components from different strategies. Blended models include risk management approaches, partnerships, and technological development.
- **Summary of SME Behavior and its Downside:**
  Due to limited negotiating power and financial constraints, the most common strategy entails producing technology for licensing. In contrast to back-end transactions, front-end transactions could hinder long-term profitability even though they provide immediate cash.

While SMEs in agricultural biotechnology employ a variety of tactics, the most probable path to long-term success in the changing agricultural biotechnology landscape suggests functioning as technical suppliers.

5. The Significance of Business Models in Agricultural Biotechnology

Agricultural biotechnology business models are divided into three categories by the study: big varied enterprises, sustainable firms, and research-intensive start-ups. Research-intensive start-ups prioritize obtaining valuable intellectual property (IP) for licensing, additionally, they fail due to a lack of capital. Specialized SMEs with restricted operations, horizontally integrated SMEs with diverse goods, and vertically integrated SMEs connected to other business units, lowering market risks are examples of sustainable enterprises that are self-sufficient through sales or license fees. Large, diversified companies use both integration techniques to reduce market risks. Businesses that increase their technical offerings conduct it in a way that reflects a mixed model evolution. Due to financing limitations, R&D operations are being separated, which exacerbates industry volatility and emphasizes the need for legislative assistance for SMEs.Supportive policies are also needed because of the short



product life cycle in biotech, which is stimulated by patents and quick technical improvements. These factors make it difficult for SMEs to accumulate patent collections by regulations that favor larger companies.

6. Conclusion

Research employed company-acquired data and interviews performed using pre-arranged survey materials to examine the business models and growth obstacles of SMEs in the agricultural biotechnology industry. According to the research, the distinct dynamics of profit-sharing between large and small businesses have an impact on the sector's overall economic health. The findings show the high risk of R&D in agricultural biotechnology, which generates large amounts of revenue and limits the creation of specialized jobs. All twenty companies analyzed achieved acceptance rates above fifty-five percent. Another important hurdle for SMEs to overcome relates to the creation of IP and licensing schemes. All these problems hinder the development of agricultural biotechnology and the industry as a whole. Future research could examine creative financing mechanisms to reduce R&D risk and improve licensing procedures to support SMEs' sustainable growth in agricultural biotechnology. In addition, global best practice research can inform strategies for increasing technological innovation and financial resilience across the sector.

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