

# Identifying and Averting the Difficulties in Converting Biotechnological Innovations into Successful Commerce: Case of Bahrain

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## Abstract

The purpose of this study is to examine the difficulties encountered by Bahraini entrepreneurs in converting innovative ideas in the biotechnology field to a profitable trade. **Methodology** - The study applies a qualitative approach. Semi-structured, one-to-one interviews with four managers have been done to identify the obstacles they faced. **Findings** - Initial results prove that some factors, including funding, workforce skills, government regulations, and the Bahraini market environment, significantly affect success in the biotechnology industry. Further analysis suggests that the Bahraini market environment is the more fundamental obstacle compared to the others. Two additional factors, namely time management and infrastructure, have an insignificant effect on Bahrain's progress in the biotech industry. **Practical implications** - This study is targeted at regulatory bodies in Bahrain and entrepreneurs to assist them in pinpointing the obstacles faced in the biotech industry and address them subsequently. **Originality** - This research contributes to innovative entrepreneurship literature relating to the biotech industry in the Gulf Cooperation Council (GCC) countries, primarily in Bahrain. As the 2030 vision for Bahrain depends on diversification of income sources, it is interesting to examine the difficulties that challenge entrepreneurs once they try to convert innovative ideas in the field of biotechnology into a successful trade story. **Recommendation** - improving the workforce skills to be competitive in the market with current impacts of the COVID-19 pandemic and validating these results quantitatively are recommended.

**Keywords:** Biotechnological Industry, Entrepreneurs, Innovative, Market Environment, Obstacles.

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## Introduction

The recent decades have witnessed the emergence of numerous biotechnological companies created by scientists in developed countries. Conversely, a few similar firms exist in Bahrain. Given the debate about Bahrain's vision for 2030, rising the importance of investing in biotech startups after the spread-out of the Covid-19 pandemic, and the recession after the partial lockdown, the necessity to discuss and study such startups is vital. Notwithstanding the ample annual



publications about biotechnology issued by universities in Bahrain, only a few are turning into commercial entities. Subsequently, it is critical to identify the issues preventing a bloom in biotechnological ventures for the public. According to Cohen and Caner (2016), the exploitative invention has a more positive innovative effect than exploratory ones. The authors stated that the number of breakthrough innovations increases through the knowledge produced by an alliance of R&D networks.

Nowadays, technology plays a pivotal role in various disciplines. It impacts numerous fields, which in turn benefit humanity, the environment, and the economy. Rapid development in technology leads to revolutionary changes in the biotech industry, which requires continuous innovation. This innovation needs comprehensive collaboration between the science sector through research and industry to deliver science-oriented knowledge to the marketplace. This paper aims to identify the particular difficulties faced during transition mechanisms from innovative academic value to university-industry alliances (Siontorou & Batzias, 2010).

The research problem in this study seeks to identify the difficulties that challenge Bahraini entrepreneurs in establishing a successful firm based on an innovative biotechnological idea. The research question is: What are the difficulties that challenge Bahraini entrepreneurs trying to launch a startup in the biotechnological field?

The research objectives are to identify difficulties cited by innovative Bahraini entrepreneurs in the biotechnological field and recommend several solutions based on the research conclusions.

The qualitative approach is employed in this research. Semi-structured one-to-one interviews are conducted with agents of biotechnological firms in Bahrain to identify the obstacles they face in this domain. Through a number of semi-structured one-to-one interviews, the study will first report the difficulties encountered by some business persons who delved into biotechnological businesses. Subsequent analysis will identify the key factors, the weight of their impact, and approaches to bridge these gaps. The expected outcomes of this study might be incorporated into the policy of some government entities such as the Labor Market Regulatory Authority, Ministry of Industry, Commerce & Tourism, the Labor Fund (Tamkeen), and the Higher Education Council. Additionally, new strategies may be planned to eliminate these difficulties.

While most literature demonstrates recent innovative discoveries from the academic side, this article focuses on identifying obstacles Bahraini entrepreneurs face in the biotech industry. This identification could: 1) accelerate the realization of knowledge-shifting approaches to deliver successful products, and 2) minimize the gap between industry and universities' outputs, which requires careful handling and management by industry through its collaboration with R&D (Siontorou & Batzias, 2010; Al-Alawi & Al-Dughaiter 2019).

## Material and Methods

### *Literature review*

Recently, the biotechnology field witnessed a remarkable revolution over many disciplines, which opens up opportunities for many new lines in industries and promising applications. However, enormous challenges remain in the effort to convert a molecule in the lab into a commercially viable compound or service. This section covers the literature review related to Biotechnology scopes.

## 1. Biotech scopes

Biotechnology covers various sectors, including biomedical, medical, pharmaceuticals, chemicals, food processing, agro-technology, industrial-technology, marine, nano-science, etc. (Tracy, 2015; TNN, 2002).

The biotech industry depends on three combined fields: “material science, surface chemistry, and transducer technology” to commercialize scientific ideas. In addition, there are pre-set levels considered by decision-makers to select a suitable line to go further into the industry, namely, primary research, development, prototyping, and marketed biosensor versions (Siontorou & Batzias, 2010).

## 2. The prospects for the biotech industry

Biotechnology is deemed the most disciplined technology that may have a high economic and environmental impact. Thus, experts of economic committees greatly promote developing young biotech firms. The biotechnology sector comprises countless industries; for example, plant biotechnology includes food processing and methods to improve feed and fiber production. More industries include biofuels, chemicals, pharmacology, and environmental science (Goh & Tan, 1993).

Due to some local factors, including rising food demand, growing population, and climate change, the necessity to invest in agricultural biotechnology is a substantial issue, along with consideration of genetically modified crops’ legal and ethical effects. Therefore, India needs to boost the quality and quantity of biotechnology graduates to meet its obligations (Bundhun, 2013).

The biotech industry sector has reached a state of stability where a steady stream of new therapies is coming out regularly. Some factors in the pharmaceutical industry are associated with biotech’s slow-down in growth due to industry maturity, consolidation of small companies, and elevated concerns for drug safety and side effects (Tsai & Erickson, 2006).

## 3. Models of identifying key factors in the biotech industry

Several models have been offered as summaries of founding biotech startups. The most notable one is Pareto optimization. This approach relies on options-games by combining real options, including costs and demands, and game theory to quantify flexibility and commitments, giving entrepreneurs a sufficient background to choose from various investment strategies (Fujiwara, 2016). Consequently, Fujiwara (2016) converted the considered approach from the prisoner’s dilemma to Pareto optimization through resource sharing. It is the optimum approach to coping with the “valley of death” in biotech startups.

## 4. Sources of obstacles

The factors listed below represent the most significant difficulties in the biotechnology industry in the current market.

### 4.1. Finance factor

Biotech is a field of industry that requires high funding to grow because it carries high risk. Clinical trials for R&D cost tens of millions of dollars, and that’s before actual human trials are even attempted. Therefore, alliances with biotech partners result in positive net

present value (NPV) and provide sufficient cash flow to maintain the company (Tsai & Erickson, 2006).

Furthermore, since R&D requires a substantial initial capital investment, more prominent companies collaborate with smaller firms because it is less disastrous if a program fails in a startup company than in a big company (Visser et al., 2019).

The global investment in biotech reached \$17B and \$14B in 2018 and 2019, respectively. The majority of this fund was allocated to R&D. While raising funds at the outset is a good start, executing strategic plans and maintaining successful growth in all life cycle stages are the most challenging parts of the mission (Murphey, 2019).

Runaway prices by inefficient business models and the number of failed ventures are the main issues preventing investors and shareholders from supporting the biotech industry (Visser et al., 2019).

On-comfort is a startup dealing with stress resulting from medical procedures during cancer chemotherapy sessions via virtual reality methods. Regulatory fees, finances, taxes, accounting, and legal costs need sufficient funding but are ambiguous for the founder and first-time entrepreneurs in dealing with them. Consequently, advisors or boards of consultants offer new entrepreneurs the optimum approach for navigating unfamiliar terrain, which requires funds, too (Vetter, 2017).

Distractions created by continuous scientists' arguments are the main challenge to Ilya Rachman as he has very limited funding. Considering and responding to their claims wastes resources on many fronts, and all for naught. This is the opinion of Rachman, a physician who founded Immix Biopharma to develop drugs for cancer treatment (Immix, 2020).

Professor Ian Frazer, a founder of a biotech company called Coridon that focuses on developing DNA vaccines, found that raising capital with minimal constraints to deliver products for usage in human clinical trials is the biggest challenge in Australia. Investors typically seek short-term gain, while the life cycle of innovative inventions generates long-term profit at best. In addition, investing in scientific research and human capital is a fundamental issue in achieving a milestone on this track (Williamson, 2013).

Evidently, raising capital is the main obstacle since biotechnology is a research-based sector and requires much more time to generate revenue.

#### **4.2. Education and training factor**

The number of fresh-out graduates who are qualified in this sector is below the demand. In addition, most grads lack efficient training and cutting-edge knowledge in the new disciplines. Few candidates are proficient in combining science and business (Nwibo & Okorie, 2013, Al-Alawi et al., 2019). This lack of trained staff was the second most significant factor encountered by local firms in Singapore (Goh & Tan, 1993).

Breschi et al. (2003) approved the knowledge-relatedness hypothesis, which states that innovation and diversification in technology rely on knowledge-relatedness and is considered a critical factor in developing industries. Consequently, they rejected the random hypothesis, which claims that diversification in technology occurs randomly. Evidently, the biotech field needs to generate a workforce able to fix, use, and maintain state-of-the-art devices and is willing to learn continuously.

### 4.3. Regulatory factor

Regulatory systems vary from country to country. Usually, more constraints and conditions apply to small firms in the biotech sector. Given the thousands of regulatory requirements imposed by some regulatory systems on biotech companies, including “the Food and Drug Administration (FDA), the National Institutes of Health (NIH), [and] the Occupational Safety and Health Administration (OSHA),” it’s hard for those firms to comply literally with everything (TNN, 2002; Tracy, 2015).

Due to sharp changes in policies related to specific markets, management, and technology, the status of advanced therapeutic medicinal products is unstable. However, this sector is considerably dynamic and has accommodated resource allocation constraints (Bayon et al., 2015). Nevertheless, biotech firms with complicated rules have no choice but to comply before getting the approval required to take products to market.

### 4.4. Market factor

Since competition is powerful in the biotech industry sector, the ability of a firm to survive depends on continuous innovative developments (Tracy, 2015; TNN, 2002). However, since the process of delivering a new biotech service or product is a fast marathon beginning with discovery until market availability, competitors could provide the exact idea faster and fill a market need sufficiently.

Therefore, R&D should have access to published full-text papers and unique findings. Despite ample online publications that may inspire entrepreneurs with a staggering number of ideas for products that may be converted into commercialized products, most entrepreneurs fail to measure and analyze the reach and impact of these publications. Therefore, using metrics to gather sufficient information is essential, including usage, captures, mentions, social media, and citations. Furthermore, once a product is ready to enter the marketplace, it needs a massive campaign for sales and marketing to elevate awareness of its benefits to the target audience (Al-Alawi et al., 2020; Mullin, 2014).

Although Japan occupies an advanced position in life science research compared to the U.S and Europe, it has not approved any successful achievements in the biotech sector due to a failure to address the decline in productivity rates and intensive competition with generic drugs (similar brands of drugs) (Fujiwara, 2016).

Customer\patient satisfaction is a fundamental issue since the usual talk is about the target audience, not to them (Visser et al., 2019).

Goh and Tan (1993) examined the problems that challenge biotech entrepreneurs in Singapore. The long time between delivering an innovative approach from the development stage to the marketplace requires significant funding for marketing expenses along with the previous capital funding. The industry committee TERMIS-Europe (EU) has examined Advanced Therapeutic Medicine Products (ATMP) transition to the marketplace. They found that the most significant challenges are attributed to two critical reasons. Firstly, awareness of entrepreneurs of the importance of exploitation in innovative breakthroughs, and secondly, market approval (Bayon et al., 2015).

Getting market approval is a substantial issue to avert a downturn in a product’s progress, which may reduce the company’s fair market value, put massive pressure on the owners, and lead investors to withdraw funds. Similarly, management may lose more money on negotiations with consultants and lawyers (Williamson, 2013).

The biotechnology industry may introduce the best service/product, but it will lose a lot if there are no buyers. The founders have to know when and how to enter the market. In addition, estimating demand is essential to avoid financial losses (Visser et al., 2019).

Most biotech startups tend to follow a value chain model, where they either seek other assets or expenses out of capital, so they usually enter a partnering transaction. Furthermore, project-specific factors are observed, including market opportunity, competition, and decisions about the value chain (Dixon, 2011). Evidently, biotech firms must reach the consumer with a novel invention before their rivals.

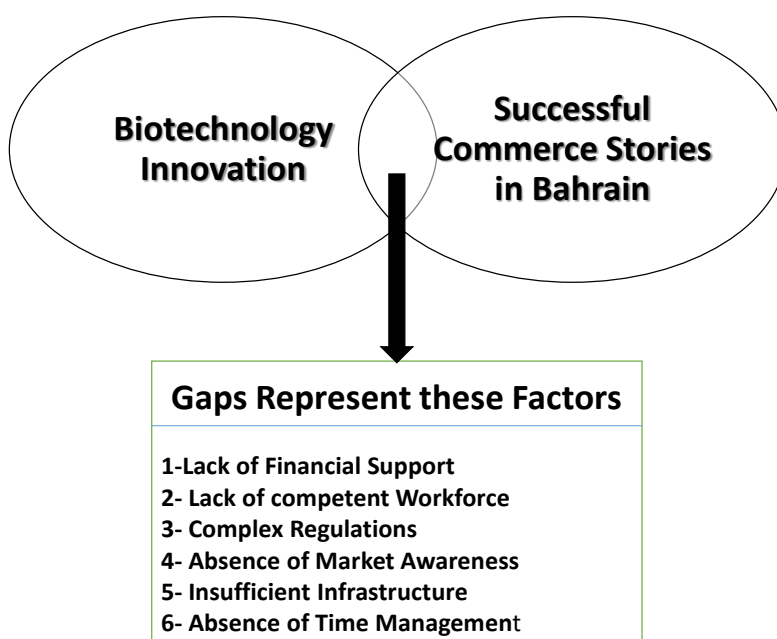
#### 4.5. Infrastructure factor

Most biotech startups in developing countries import their infrastructural requirements, including machines, biological reagents, and chemical solutions, which come at a high cost. Lacking cutting-edge devices in labs push biotech companies to consider outsourcing elements of their production process (TNN, 2002; Tracy, 2015). Dixon (2011) stated that specialized assets such as manufacturing, machines, instruments, engines, and technological devices for transferring knowledge are critical strategic issues for small firms. Evidently, contract manufacturers play havoc in the biotech industry sector.

#### 4.6. Time management factor

Braykion is a digital health company that provides software to minimize healthcare-associated infections. Its founders have learned that time management is the biggest challenge because healthcare workers have full-time jobs and work on Braykison full-time. Furthermore, they seek seed money, so they can't quit their jobs in this situation (Kosmayer, 2019).

Accordingly, there is a gap in successful biotechnology startups in Bahrain due to these mentioned factors. Thus, this research will contribute to bridging this gap, as shown in Figure 1.



**Figure 1. Research Gap**



## 5. Strategies to manage hurdles in the biotech industry

While barriers to entering the marketplace are minimal; there are numerous foundations that can finance startups in the early stages; maintaining the growth of the new firm in later stages has required following one of the below-proposed models:

1. Build: Develop a new product according to research and development recommendations.
2. License: Sign strategic contracts as alliances and partnerships.
3. Exit strategies: Sell, divest, and joint venture (Tsai & Erickson, 2006).

Siontorou and Batzias (2014) developed a framework replacing lower technological alternatives, such as drawbacks and disadvantages, through a fault tree analysis to confront doubts to overcome the gap between ample research and the limited biotech market. Most experts say that future disciplines lie along a nanotechnology path, focusing on a scientific approach in general.

Collaboration with external resources is a key factor of successful innovation management. Walsha et al. (2016) examined this theory on triadic patents in the U.S. with over 1900 participants to measure the effect of collaboration and found that slightly over 10 percent of successful inventions required external co-inventors and 23 percent required external collaborators, either non-co-inventors or external ones. Furthermore, the authors proved that academia-industry collaboration and diverse collaborations lead to high-quality inventions. Evidently, collaboration at the implementation stage to commercialize an innovation is more crucial than academia-industry in the startup stage.

Combining innovative approaches and industry is a difficult task in this technological era that changes continuously. Firms that rely on external collaborations are more likely to achieve future innovation than those that depend on R&D alliances. Thus, the use of collaborative mechanisms determines the outcomes for high-biotech startups in the marketplace (Hohberger et al., 2015).

Notwithstanding the crucial need for strategic alliances in the biotech industry, some of them are terminated before delivering a product to the marketplace when all parties were at fault for making incorrect decisions. Havenaar and Hiscocks (2012) provided a model to ensure alliances in uncertain market situations, which depends on two variables, namely royalties and milestone payment licensing. They demonstrated that huge payments increase the risk of ending the alliances. Thus, licensing is a critical factor in the biotech business model.

Planning for exit strategies, including initial public offerings (IPO) and mergers and acquisitions (M&A), are key routes taken in biotech risk management that represent the option chosen in the beginning to overcome any obstacles that may be encountered in the future (Fujiwara, 2016).

Additional key factors for technologies projects proposed by Schröcker (2013) for successful innovation management include:

1. The combination between technology push and market pull  
As there must be an actual demand for the innovative product, its technological level must be reasonable to satisfy the requirement. Usually, the more innovative the product is, the more demand emerges because the market follows the innovative and unique technology most of the time.

## 2. Many implications

The nature of biotechnology requires contributions from countless disciplines. Thus, it has a multidisciplinary environment and effects. For example, a nanotechnology patent may have implications for semiconductor design, biotechnology, materials science, telecommunications, and textiles.

## 3. Human capital

This includes having a leading director with passion and vision and having a highly skilled team.

## 4. Financial support

Various types of funds are available to finance technologies, including personal savings, contributions from friends and family, capital investors, bank loans, and grants from public funds. Furthermore, public support can have various forms, such as “vouchers, loans, guarantees, prizes, etc.” (Schröcker, 2013).

# 6. Successful models

## 6.1. International models

While regulatory hurdles are the main obstacles in India, it is deemed the third-largest biotechnology industry in Asia after China and South Korea. This is due to its low workforce cost and its competencies, which are factors that lead to India’s being considered a biotechnology hub (Bundhun, 2013). In addition, China, Korea, Singapore, and Malaysia are stiff competitors to India because they have advanced technology, scientific competence, better and deeper infrastructure, reasonable taxes, and more lenient regulations (Bundhun, 2013).

Recently, the Malaysian government overcame its most challenging obstacles to enhance the economic situation of Malaysians. Since 2005, the Malaysian government has shifted its focus toward the biotechnology sector due to the massive impact of innovative biotech firms on both the human and economic lifecycles (Abuduxike et al., 2012). Furthermore, they examined the challenges in this sector in Malaysia by conducting semi-structured interviews. They found that many critical challenges were present previously in Malaysia, including 1) lack of capital, 2) lack of professional workforce, 3) poor connections between public and private sectors, 4) lack of direction and rules to enter the marketplace or register a patent, and 5) lack of awareness about biotech benefits amongst the public, decision-makers, and investors.

Furthermore, biotechnology and information technology are deemed the two most innovative industries in the U.S. nowadays. National investment by the government in these fields maintains U.S. leadership over the rest of the world and sustains its economic growth. Wessner (2001) recommended the following points to discuss in detail the National Research Council (NRC, USA) periodically to overcome any hurdles that could apply to any country seeking successful growth. These points are partnerships in IT, corporations in the biotechnology industry, intellectual property protection, policy concerns, asymmetries in political support for funding, reviewing patent laws, supporting multidisciplinary research, the future of partnerships, frontier technologies based on biotechnology and information technology, space medicine, functional genomics, miniaturization and nanotechnology, and battlefield applications (Wessner & National Research Council, 2001).



## 6.2. Local models

In 2007, King Abdul-Aziz City for Science and Technology in Saudi Arabia launched a new program called “initiative” or “Badir” to provide all kinds of support to entrepreneurs, including education, finance, networking, private and private governmental sectors, and research centers. It is like an incubator to promote young entrepreneurs to found technological firms. To illustrate, “MIDLICIOUS” is a product presented as medicine with different flavors to reduce its nasty taste for patients. “Chitin medical corporate” developed specific bandages for diabetic patients made from shrimp crust by nanotechnology methods. “Endodontic Obturator” is an injection to the roots of teeth during the stuffing process to prevent the passage of bacteria during a root canal (Badir, 2020).

In 2006, the government of Bahrain founded “Tamkeen,” a semi-autonomous government agency to assist entrepreneurs in establishing their startups. It provides diverse support, including consultations, grants, courses, and training. Many more success stories have been supported by (Enterprises, n.d.).

## 7. Potential revenue

Nowadays, the biopharmaceutical industry generates about \$163 billion in global revenue. This value comprises 20 percent of the pharmaceutical industry. Consequently, this domain forms the fastest-growing sector in the biotech industry. In addition, the annual growth rate of biopharmaceuticals is 8 percent, which is double that of conventional pharma (Otto et al., 2014).

The third-largest biotechnology revenue stream in Asia occurs in India. It earned \$4.3 billion in 2016 and is expected to reach \$11.6 billion by 2017. Sixty percent of this revenue gain is from the pharmaceutical sector, followed by services, agricultural, industrial, and informatics sectors (Bundhun, 2013).

At the end of 2017, the international biotech industry was worth \$414.5 billion. This value includes improved personal health through pharmacology and medicine, but genetically modified food meets the demand in some developing countries, such as India and China (DrugPatentWatch, n.d.).

According to Mostafa (2017), Saudi Arabia Riyal of 30 million (about US \$8 million) represents 40 percent of Badir’s budget financed by individual investors in 2017. The Saudi government-funded Badir with SAR 29 million (about US \$7.73 million), representing 39 percent of Badir’s total financing. The private sector invested only SAR 10 million (about US \$2.67), representing only 13 percent. Recently, the number of startups incubated by Badir gradually increased to 158 firms at the end of 2017 compared with 127 at the beginning of the same year.

## 8. Personality traits of successful entrepreneurs

The heart of the biotech industry is the entrepreneur. Successful businesspersons must possess a list of characteristics they may or may not have in the beginning. Some of them can be learned by education or experience if the person is willing.

### 1. A Different Breed:

They have chosen a more uniquely challenging career than others.

### 2. Count\cost:

Basic knowledge of accounting and finance is considered a fundamental requirement

to run small firms. In addition, experience in money management from childhood is an extra advantage.

### 3. Additional Business Skills:

Courses are covering management and innovation topics, including human resources, business strategies, organizational design and behavior, and business ethics, which may be covered in Master of Business Administration (MBA) and Executive MBA programs, are available to learn additional skills.

### 4. Passion and Vision:

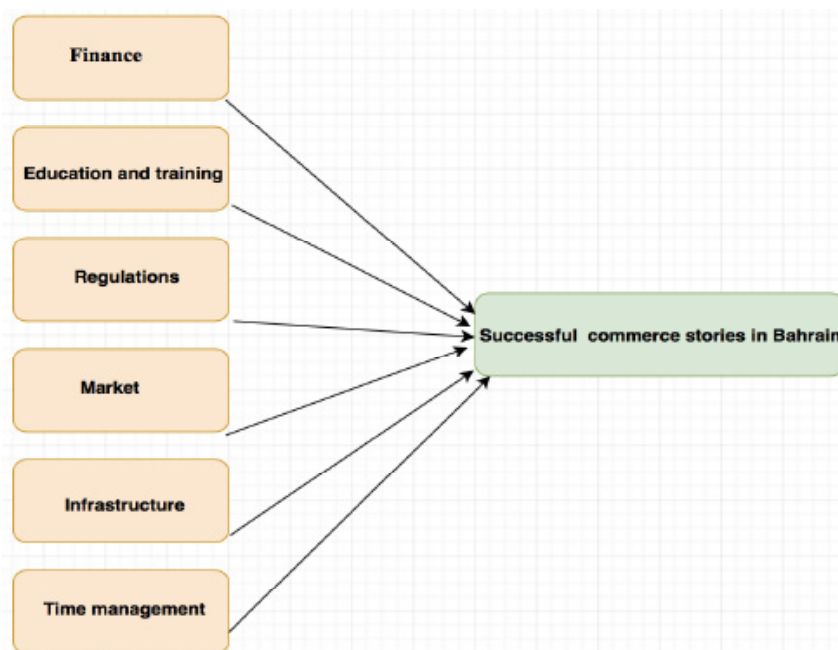
Being proactive and tenacious regardless of failure initially since the entrepreneurs are beginners in such fields, and consequently, the loss rate is high. Also, having insights into the future, which is an innate trait, is essential. Many more have been cited by (Shimasaki 2009).

## Methodology

This section describes the research methodology. It includes the research framework with dependent and independent variables, the research hypothesis and instrument, validity and reliability analysis, the sample size, data collection, and data analysis.

### 1. Research Framework

Based on the literature, countless factors encountered by entrepreneurs in the high-biotech industry prevent them from establishing profitable startups. As illustrated above, the independent variables are the difficulties faced by Bahraini entrepreneurs in converting innovative ideas in the biotechnology scope into a profitable trade. These are a financial factor, education and training factor, regulatory factor, market factor, infrastructure factor, and time management factor. Establishing a successful and profitable firm in the biotechnological sector based on innovative ideas is the dependent variable of this research. The conceptual framework of this research is shown in Figure 2.



**Figure 2.** The proposed framework.

## 2. Research Questions

The **main research question** of this study is that there is a significant impact from all difficulties (the independent variables) on the success of biotechnological ventures (the dependent variables). These research questions are as follows:

**Research Question--1:** *There is a negative association between the lack of financial support and the success of biotech firms in Bahrain.*

**Research Question--2:** *There is a negative association between the lack of a competent workforce and the success of biotech firms in Bahrain.*

**Research Question--3:** *Bahraini regulations negatively affect the success of biotech firms in Bahrain.*

**Research Question--4:** *The Bahraini market negatively affects the success of biotech firms in Bahrain.*

**Research Question--5:** *The infrastructure in Bahrain negatively affects the success of biotech firms in Bahrain.*

**Research Question--6:** *The absence of time management negatively effects the success of biotech firms in Bahrain.*

## 3. Research Instrument

The qualitative approach is considered in this research. Consequently, semi-structured one-to-one interviews were conducted with managers of four corporations in the biotechnological sector in Bahrain to identify the obstacles they faced in this domain. The data is analyzed by thematic content analysis.

## 4. Validity and Reliability Analysis

Reliability and validity are deemed crucial aspects when selecting the research method. Reliability attributes to consistency, i.e., getting the same results multiple times using the same method. At the same time, validity refers to the extent that the instrument measures what it is assumed to measure (Al-Alawi & Al-Alawi, 2014).

Other reviewers check validity. They read the transcript of interviewees' answers to validate the purpose of the chosen design method. Additionally, most factors mentioned in the interviews were adopted by other researchers, as illustrated in the literature review section, which supports the reliability aspect.

## 5. Sample Size

The method of purposive sampling is used to collect the sample of the research to be interviewed. According to this method, the criteria for selecting the sample members depend on their knowledge, cognition, and experience in their field (Freedman et al., 2007; Al-Alawi et al., 2007). Therefore, the selected sample members have sufficient experience related to Bahrain's biotechnological industry. With respect to those members, the participants are managers of four big corporations in Bahrain, specializing in importing medical and biotechnological reagents, devices, and equipment in Bahrain.

## 6. Data Collection

A formal letter was sent by e-mail to these corporations with sufficient detail to give

them a thorough background about the current research topic. They were asked to opt between a face-to-face interview and a phone interview. All of them selected a telephone interview.

The telephone interviews were held during April 2018 and lasted approximately 30 minutes. One manager representing one of the corporations was interviewed each day. Additionally, to ensure accurate and precise data capture, notes from the interview are recorded during the meeting. Ultimately, the discussions proceeded smoothly. Moreover, the participants were willing and excited to participate in the scope of this research. They could discuss various topics even if they were not mentioned in the questions and add more information.

## **7. Data Analysis**

The thematic content analysis considered in this research enables the researcher to gather all data and then sort it into main themes and sub-themes for easy analysis and comparison in the discussion section. While this method assists the researcher in handling in a simple, consistent, and concise way, it also involves a high rate of human error since it depends on the researcher's assessment, which could result in misinterpretation of the data and consequently unreliable conclusions (Krippendorff & Bock, 2009).

## **8. Research Limitations**

As is the case in every study, this research has some limitations:

1. The size of the sample is only four participants, which is considered relatively small. Larger sample size may enhance the results of the study. Hence: as of today, there are only four co-operations.
2. Some big national companies refused to make any form of response.
3. Some participants refused to speak about the current situation in Bahrain.
4. The duration of conducting this research was brief for in-depth elaboration, including getting more participants and applying more than one research instrument.

## **Results and Discussions**

The responses of the interviewees concerning every factor vary due to their diverse backgrounds and experience. Their responses and justifications are summarised below.

### **1. Financial factor**

First and foremost, the financial factor is divided into two sub-elements. The first has to raise capital to launch the venture, and the second is labor cost. For the former, most participants consider funding the major problem that prevents the conversion of biotech ideas into a successful trade. Investing in such projects requires a considerable amount of cash flow, and most banks reject loans for such businesses for many reasons. Firstly, most bankers have insufficient backgrounds in the biotech industry, processes, and profits, so they could not evaluate the proposals of applied projects in a real and actual estimation. Secondly, most banks prefer investing in projects that are already running to ensure estimated profits rather than investing in projects from scratch because they are riskier. Thirdly, real estate is the preferable reason banks offer loans. Fourthly, even if the founder gets a loan, it would be limited compared to the project's actual cost. Respondents who do not see the funding factor as a problem think that strong and

efficient documentation of projects is enough to get a loan from banks in Bahrain. “Banks here are cooperative,” they said.

For the latter element, most interviewees consider labor costs a severe obstacle in Bahrain. Since most state-of-the-art devices and machines are imported from the U.S. or Europe, only foreign engineers or technicians could run them. They also have higher educational degrees, none below a master’s degree. Consequently, the cost of permanent or temporary contracts for foreign staff is too high. To illustrate, in the case of a temporary visit to Bahrain, there are incremental costs for visas, tickets, hotels, transport, and daily expenses in addition to salaries based on their qualifications. For permanent contracts, the same charges apply, plus monthly stipends and allowances based on competencies.

Notwithstanding that some machines and industries require workers from developing countries with only bachelor’s degrees or only one competence or skill, convincing workers to join a small company without a significant name in the marketplace requires massive incentives, such as high salaries or huge allowances. These incentives may push them to quit their job and move to a new, unknown company and an unexpected future. A few who disagree with this opinion say, “the cost is in range.”

*Thus, we verify Research Question-1, which states that the lack of financial support leads to a decrease in the success of biotech firms in Bahrain.*

## **2. Education and training factor**

Most respondents deem the Bahraini workforce as not very competitive in the biotech industry regarding education and training. They need specialized knowledge or training to equip them for the labor market. This difficulty is attributed to a phenomenon raised recently amongst secondary school students in Bahrain working on majors in undergraduate Business Administration or MBAs to be entrepreneurs in the future or engaging in the banking sector to ensure a high level of lifestyle. This trend affects the number of graduates from chemical, electrical, and mechanical engineering colleges and graduates with science degrees, which consequently pushes most manufacturers to hire expats instead of nationals. Furthermore, current graduates need internships to experience the industry’s actual experiments and life processes since there is a huge difference between theoretical and practical experience. On the other hand, a few believe that the current generation is well-educated, studied abroad and has sufficient experience.

*Therefore, we confirm Research Question -2, which declares that the lack of a competent workforce negatively affects the success of biotech firms in Bahrain.*

## **3. Regulatory factor**

Most respondents believe there is a huge problem in the current laws and terms regarding the biotech and health industry. They refer to the early stage of Bahrain in this sector; “it’s a beginner country,” they said. Current conditions that regulate the manufacturing of chemical or risky solutions are out of date in some cases and considerably constrained in other situations for safety purposes. Furthermore, gaining permission for local manufacturing, importing, or exporting is a sophisticated process. At least four permissions are required from various authorities, namely, the ministry of health, the Ministry of Interior, Customs Affairs, and the Supreme Council for the Environment. A few said that they did not encounter any regulatory obstacles.

*Thus, we prove Research Question -3, which claims that Bahraini regulations have a negative impact on the success of biotech firms in Bahrain.*

#### **4. Market factor**

Market factors refer to three sub-elements: market environment, awareness of the audience, and cooperation with universities, government, and the private sector. With respect to the market environment, there is a consensus that the market environment in Bahrain is a substantial obstacle to converting innovative biotechnological ideas into profitable businesses. Due to the small area and size of the population in Bahrain, the Bahraini market environment is inappropriate for local manufacturing. To illustrate, if the company is a wholesaler (importing machines from outside for domestic use), there are only three primary purchasers, namely “Salmaniya Medical Complex, Bahrain Defence Force Royal Medical Services (BDF), and King Hamad University Hospital (KHUH).” This limited number of clients limits the range of profit and inventory accumulation. In addition, the capacity of Bahraini society to consume medical or biotech products is satisfied by the production of these three manufacturers at a maximum since a single machine produces 300,000 tablets/items in a single shift. Moreover, exporting local medical or biotech products is another long and complicated story. The exporter must collect numerous approvals and certificates from every importer to get a permit to export. Consequently, excess products accumulate inventory stocks, lose money over the long run, and pass expiration dates.

Concerning the awareness of the audience, all participants agree that there are no problems with this sub-element. Logically, there is a selective market for the products of such industries, including universities, research centers, nursing homes, and pharmacies, which have sufficient awareness due to their positions and roles in society in the nature and importance of these products. Therefore, the whole population of the community is not a target audience since the company could not push them to buy or use such products.

Regarding cooperation with universities, government, and the private sector, all interviewees accept that there are no obstacles when dealing with these parties. “All of them are cooperative,” they said. One added that the private sector pays invoices faster than the government, which takes at least one year to pay the quoted amount, “but it is a normal procedure for such a considerable amount,” he said.

*Thus, we verify Research Question -4, which declares that the Bahraini market environment is inappropriate for biotech firms to succeed.*

#### **5. Infrastructure factor**

There is an agreement amongst all participants that the infrastructure in Bahrain is superior, and there are no conflicts with this factor. For example, some issues such as roads, bridges, water supply, sewers, electrical grids, broadband speeds, security issues, and online payment systems are convenient and adequate for investors to establish new firms in Bahrain.

*Thus, we decline Research Question -5, which states that the infrastructure in Bahrain negatively affects the success of biotech firms in Bahrain.*

#### **6. Time management factor**

There is consensus amongst all respondents that managing one’s time between



their personal life and professional responsibilities is unique to each person: their characteristics, multi-tasking capability, and a willingness to abandon spare time in favor of more work.

*Therefore, we reject Research Question -6, which declares that the absence of time management negatively affects the success of biotech firms in Bahrain.*

By and large, Bahrain is a small market to manufacture, import or export new devices or products compared to the neighboring markets in GCC countries. The investor ought to understand the capacity of the Bahrain market very well while conducting a feasibility study.

## Conclusion

While the local environment restricts manufacturing expansion, Bahrain is considered the most significant handicap factor due to its geographical and population limitations. All other factors, including funding, regulation, education, and infrastructure, could be adequately exploited to overcome the difficulties that avert the conversion of biotech ideas into successful trade stories.

Accelerated changes in technology play a pivotal role in the 21st-century biotechnology industry, especially after the outbreak of the Covid-19 pandemic and the urgent need for biotech breakthroughs, including ventilators and breathing systems, thermometers, face shields, masks, kits of viruses' detectors, and later on, the vaccines. Thus, the biotechnology industry as a source for next-generation wealth needs intense cooperation amongst various sectors, including government, universities, industry, and financial institutions. This is attributed to its role to correct the current vulnerable condition of Bahrain's economy over the next few decades and accelerate the pace of research in innovation and biotechnology, which represent the core of the Bahrain 2030 vision.

## Recommendation

The Kingdom of Bahrain should prioritize the following recommendations to overcome the difficulties in the biotech manufacturing field. There is a need for intense concentration on improving the skills and qualifications of the Bahraini workforce to be competitive in the marketplace. Additionally, big manufacturers need to invest in new ideas while sharing low profits to benefit their infrastructure and experience and avert bankruptcy in the early stages. Moreover, a collaboration agreement between end-users, universities, and hospitals on one side and all authorities in Bahrain on the other is needed to update current conditions and constraints to bridge the gap between those parties and ease the processes of importing, exporting, and manufacturing. Furthermore, a quantitative study is recommended for future studies to determine numerically the most significant factors that affect the success of the biotech firms in Bahrain based on the suggested factors in this paper. Ultimately, applying flexible and innovative ideas to cope with some regulations is recommended. For example, there is a need to manufacture food supplements or cosmetic products to avoid the long process of getting approvals on producing medicines or tablets.

There will be two factories manufacturing medicines called "Bahrain Pharma" and "Gulf Biotech" in Bahrain. They will start the production line by the end of 2020 and produce tablets and injections perceptively. The area of these factories is 10,000sqm in Hidd park. Along with producing the medicines, various units include raw material store, final

product store, water treatment unit, air processing unit, and quality control laboratory. By 2021, these two factories will be able to export their products to GCC countries, the Middle East, and North Africa. Then, Bahrain could be considered an exporter of emergency drugs (GDN, 2020).

## Declaration of Interest Statement

We wish to confirm that there are no known conflicts of interest associated with this publication. There has been no significant financial support or funding for this work that could have influenced its outcome.

## References:

- Abuduxike, G., Aljunid, S. & Sulong, S. (2012). Main challenges in developing biotechnology industry in Malaysia: perspectives from the innovative biotechnology firms. *BMC Public Health*, 12(S2), A25. <https://doi.org/10.1186/1471-2458-12-S2-A25>
- Al-Alawi, A. I., & Al-Alawi, E.I. (2014). Measuring occupational stress among management information systems workers and users in the financial services sector: The case of Bahraini bankers. *International Journal of Scientific and Research Publications*, 4(8).
- Al-Alawi, A. I. & Al-Dughaiter, J.T. (2019). Intention to Share Knowledge in the Banking Sector: Examining Human and Organizational Culture Factors, 4th IBIMA Conference proceeding: 13-14 November 2019, Madrid, Spain, Conference Proceeding Part 16 of 16, pp 13925- 13945.
- Al-Alawi, A. I., Al-Marzooqi, N., & Fraidoon, Y.M. (2007). Organizational culture and knowledge sharing: critical success factors. *Journal of knowledge management*, 11(2), 22-42. <https://doi.org/10.1108/13673270710738898>
- Al-Alawi, A. I., El-Naggar, N.F. & AlAlawi, E. I (2020), Managing Change in Organizations: A Knowledge Management Perspective in the Kingdom of Bahrain, 34th IBIMA Conference: 13-14 November 2019, Madrid, Spain, Conference Proceeding Part 6 of 16, pp 3475-3491
- Bayon, Y., Vertès, A., Ronfard, V., Culme-Seymour, E., Mason, C., Stroemer, P. Chiesi, A. (2015). Turning Regenerative Medicine Breakthrough Ideas and Innovations into Commercial Products. *Tissue Engineering Part B: Reviews*, 21(6), 560-571. <https://doi.org/10.1089/ten.teb.2015.0068>
- Breschi, S., Lissoni, F., & Malerba, F. (2003). Knowledge-relatedness in firm technological diversification. *Research Policy*, 32(1), 69–87. [https://doi.org/10.1016/S0048-7333\(02\)00004-5](https://doi.org/10.1016/S0048-7333(02)00004-5)
- Bundhun, R. (2013). *For India's growing biotechnology sector, challenges from within and without*. Retrieved from The National Business: <https://www.thenational.ae/business/for-india-s-growing-biotechnology-sector-challenges-from-within-and-without-1.301299>
- Cohen, S. K., & Caner, T. (2016). Converting inventions into breakthrough innovations: The role of exploitation and alliance network knowledge heterogeneity. *Journal of Engineering and Technology Management*, 40, 29-44. <https://doi.org/10.1016/j.jengtecman.2016.03.002>

- Dixon, J. (2011). *Strategic Issues Facing Biotech Start-ups*. Retrieved from Nature Biotechnology: <http://blogs.nature.com/tradesecrets/2011/08/09/strategic-issues-facing-biotech-start-ups#wpn-more-67>
- Enterprises. (n.d.). Retrieved from Tamkeen: <https://www.tamkeen.bh/foryourbusiness>
- Freedman, D., Robert, P., & Roger, P. (2007). *Statistics. 4th edition*. W. W. Norton & Company: New York.
- Fujiwara, T. (2016). Potential and Challenges for Startups in Japan's Biotech Industry. *Global Journal of Flexible Systems Management*, 17(4), 417-424. <https://doi.org/10.1007/s40171-016-0129-1>
- GDN. (2020 ). *Two new medicine plants to start production in Bahrain by the end of this year*. Retrieved from Zawya: [https://www.zawya.com/mena/en/business/story/Two\\_new\\_medicine\\_plants\\_to\\_start\\_production\\_in\\_Bahrain\\_by\\_end\\_of\\_this\\_year-SNG\\_163938269/](https://www.zawya.com/mena/en/business/story/Two_new_medicine_plants_to_start_production_in_Bahrain_by_end_of_this_year-SNG_163938269/)
- Goh, E., & Tan, W.-L. (1993). Problems Faced By Singapore Entrepreneurs In The Field Of Biotechnology. *Journal of Enterprising Culture*, 1(1), 133. <https://doi.org/10.1142/S0218495893000075>
- Havenaar, M., & Hiscocks, P. (2012). Strategic alliances and market risk. *Drug discovery today*, 17(15-16), 824-827. <https://doi.org/10.1016/j.drudis.2012.03.008>
- Hohberger, J., Almeida, P., & Paradac, P. (2015). The direction of firm innovation: The contrasting roles of strategic alliances and individual scientific collaborations. *Research Policy*, 44(8), 1473-1487. <https://doi.org/10.1016/j.respol.2015.04.009>
- Krippendorff, K., & Bock, M. (2009). *The Content Analysis Reader*. SAGE.
- Mostafa, E. (2017). *Individual investors finance startups in Badir by S.R. 30 M*. Retrieved from Entrepreneur Al-Arabiya: <https://bit.ly/2lF59J7>
- Mullin, R. (2014). *Tufts Study Finds Big Rise In Cost Of Drug Development*. Retrieved from Chemical & Engineering News: <https://cen.acs.org/articles/92/web/2014/11/Tufts-Study-Finds-Big-Rise.html>
- Murphey, R. (2019). *Top biotech venture capital funds of 2018 and 2019*. Retrieved from Bay Bridge Bio: [https://www.baybridgebio.com/blog/top\\_vcs\\_2018.html](https://www.baybridgebio.com/blog/top_vcs_2018.html)
- Nwibo, S. U., & Okorie, A. (2013). Constraints to entrepreneurship and investment decisions among agribusiness investors in Southeast Nigeria. *International Journal of Small Business and Entrepreneurship Research*, 1(4), 30-42
- Otto, R., Santagostino, A., & Schrader, U. (2014). *Rapid growth in biopharma: Challenges and opportunities*. Retrieved from McKinsey & Company - Pharmaceuticals & Medical Products: <https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/rapid-growth-in-biopharma>
- Schröcker, D. (2013). *Innovation - How to convert research into a commercial success story? Part 3: Innovation management for practitioners*. Retrieved from European Commission: [https://ec.europa.eu/research/industrial\\_technologies/pdf/how-to-convert-research-into-commercial-story\\_en.pdf](https://ec.europa.eu/research/industrial_technologies/pdf/how-to-convert-research-into-commercial-story_en.pdf)

- Shimasaki, C. D. (2009). What Makes a Biotech Entrepreneur?. In *The Business of Bioscience* (pp. 9-26). New York; NY: Springer. [https://doi.org/10.1007/978-1-4419-0064-7\\_2](https://doi.org/10.1007/978-1-4419-0064-7_2)
- Siontorou, C. G., & Batzias, F. (2014). A methodological combined framework for road mapping biosensor research: a fault tree analysis approach within a strategic technology evaluation frame. *Critical Reviews in Biotechnology*, 34(1), 31-55. <https://doi.org/10.3109/07388551.2013.790339>
- Badir (2020), Badir Program for Technology Incubators and Accelerators, Retrieved from <https://biac.com.sa/project/badir-program-for-technology-incubators-and-accelerators/?lang=en>
- TNN. (2002). *Issues before the biotech industry*. Retrieved from The Times of India, Business: <https://timesofindia.indiatimes.com/business/india-business/Issues-before-the-biotech-industry/articleshow/6899965.cms>
- DrugPatentWatch (n.d.). Top 6 issues facing the biotechnology industry. Retrieved from DrugPatentWatch: <https://www.drugpatentwatch.com/blog/top-6-issues-facing-biotechnology-industry/>
- Tracy, R. B. (2015). *Top 3 Challenges Facing Biotech Today (and How to Tackle Them)*. Retrieved from ETQ: <https://blog.etq.com/top-3-challenges-facing-biotech-today-and-how-to-tackle-them>
- Tsai, W., & Erickson, S. (2006). Early-Stage Biotech Companies: Strategies for Survival and Growth. *Biotechnol Healthc.*, 3(3), 49-53.
- Vetter, M. (2017). *Virtual Reality Start-up Uses The Psychology of Gaming To Do Battle With Cancer*. Retrieved from Forbes: <https://www.forbes.com/sites/moiravetter/2017/09/09/virtual-reality-startup-uses-the-psychology-of-gaming-to-do-battle-with-cancer/#69a493361666>
- Visser, T., Chodokufa, K., Amadi-Echendu, A., & Phillips, M. (2019). Small Business Constraints: The Influence of Time. *Academy of Entrepreneurship Journal*, 25(4), 1-16.
- Walsha, J. P., Leea, Y.-N., & Nagaokaba, S. (2016). Openness and innovation in the US: Collaboration form, idea generation and implementation. *Research Policy*, 45(8), 1660–1671. <https://doi.org/10.1016/j.respol.2016.04.013>
- Wessner, C., & National Research Council. (2001). Issues in Biotechnology and Information Technology. In *Capitalizing on New Needs and New Opportunities: Government-Industry Partnerships in Biotechnology and Information Technologies* (pp. 35-49). National Academies Press (US).
- Williamson, S. (2013). Challenges in the biotech business. *Australian Life Scientist*, 10(5), 38-41.

# تحديد وتجنب الصعوبات في تحويل الابتكارات التكنولوجية الحيوية إلى تجارة ناجحة: تجربة البحرين

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## المُستخلص

الغرض من هذه الدراسة هو دراسة الصعوبات التي يواجهها رواد الأعمال البحرينيون في تحويل الأفكار المبتكرة في مجال التكنولوجيا الحيوية إلى تجارة مربحة. **المنهجية** - تطبق الدراسة نهجا نوعيا. وأجريت مقابلات فردية مع أربعة مديرين لتحديد العقبات التي يواجهونها. **النتائج** - النتائج الأولية تثبت أن بعض العوامل، بما في ذلك التمويل، ومهارات القوى العاملة، واللوائح الحكومية، وبيئة السوق البحرينية، تؤثر بشكل كبير على النجاح في صناعة التكنولوجيا الحيوية. وتشير النتائج أيضاً إلى أن بيئة السوق البحرينية هي العقبة الأساسية مقارنة بالعقبات الأخرى. هناك عاملان إضافيان، هما إدارة الوقت والبنية التحتية، حيث يؤثران تأثيراً ضئيلاً على تقدم البحرين في صناعة التكنولوجيا الحيوية. **التطبيقات العملية** - تستهدف هذه الدراسة الهيئات التنظيمية في البحرين ورواد الأعمال لمساعدتهم في تحديد العقبات التي تواجه صناعة التكنولوجيا الحيوية ومعالجتها لاحقاً. **الأصالة** - يساهم هذا البحث في الأدب المبتكر لريادة الأعمال المتعلقة بصناعة التكنولوجيا الحيوية في دول مجلس التعاون الخليجي، في البحرين في المقام الأول. وبما أن رؤية البحرين لعام 2030 تعتمد على تنويع مصادر الدخل، فمن المثير للاهتمام دراسة الصعوبات التي تواجه رواد الأعمال لمحاولتهم تحويل الأفكار المبتكرة في مجال التكنولوجيا الحيوية إلى تجارب تجارية ناجحة. **التوصية** - يوصى بتحسين مهارات القوى العاملة لتكون قادرة على المنافسة في السوق مع الآثار الحالية لوباء COVID-19 والتحقق من صحة هذه النتائج كميًا.

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**الكلمات الدالة:** صناعة التكنولوجيا الحيوية، رواد الأعمال، الابتكار، بيئة السوق، العقبات.

