



## Business strategy for Synthetic Peptides from *Leiurus quinquestriatus* Scorpion in the Indonesian Market

Ilham Wira Nugraha & Sri Herliana  
Institut Teknologi Bandung, Bandung, Indonesia  
Correspondence: E-mail: [ilham\\_wira@sbm-itb.ac.id](mailto:ilham_wira@sbm-itb.ac.id)

### ABSTRACT

*The purpose of this study is to examine the business plan for creating synthetic peptides from the *Leiurus quinquestriatus* scorpion for the Indonesian market. This study analyzes critical elements that impact product success through internal and external analysis and the application of analytical methodologies including SWOT. According to the study's findings, the company's primary obstacles are stringent rules and scarce resources, despite its advantages in technology and raw material potential. The growing demand in the cosmetics and pharmaceutical industries presents excellent potential. To overcome obstacles and seize market possibilities, the suggested tactics include product differentiation, enhancing production capacity, and working with regulatory bodies and academic institutions.*

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## 1. INTRODUCTION

One of the most significant health issues of the modern period is cancer. According to the Global Cancer Observatory report from 2022, there were 19,976,499 new instances of cancer reported globally, and 9,743,832 individuals died from the disease. Asia has the highest cancer burden, accounting for over 49.2% of all cases worldwide. In addition to having a major effect on death rates, the most prevalent cancers lung, breast, and colorectal also negatively affect the social and economic well-being of nations like Indonesia. Because of this, cancer is a major focus of international medical research, which seeks to improve treatment efficacy while minimizing adverse effects on patients.

Cancer is still a major national health concern in Indonesia. A total of 408,661 new cases and 242,988 fatalities were reported in 2022 (WHO, 2022). The three most prevalent cancers are cervical, lung, and breast cancer. However, the lack of advanced cancer treatment technology and low levels of research funding continue to hinder Indonesia's health system's ability to provide the best care possible. Due to this disease, the majority of treatments still rely on traditional techniques such as radiotherapy, chemotherapy, and surgery, which often have negative effects on healthy tissue.

There is an urgent need for innovation in cancer treatment. The use of therapeutic peptides, which are known to have the advantages of high selectivity to cancer cells and minimal adverse effects on healthy cells, is one interesting strategy. These peptides have potential applications as cancer vaccine candidates, immunotherapy, and drug delivery systems. According to the Grand View Research report (2024), the therapeutic peptides market has enormous potential. It is expected to reach USD 69.3 billion in 2030 at a compound annual growth rate (CAGR) of 6.5%, from a value of USD 44.3 billion in 2023. This market is dominated by North America, Europe, and Asia-Pacific.

Peptides from the venom of the scorpion *Leiurus quinquestriatus*, such as chlorotoxin (CTX), have started to gain interest from the medical community in the context of cancer therapy, particularly in studies for aggressive brain malignancies such as glioblastoma (GBM). Chlorotoxin has demonstrated significant promise in the development of CAR T-cell-based therapy, which is undergoing testing at several esteemed institutions, including the United States' City of Hope. Demand for chlorotoxin is still rising, particularly in industrialized nations like the US and Europe where numerous research institutes work together to conduct clinical studies and create peptide-based cancer treatments.

The huge demand for this kind of peptide product has been demonstrated by the global market. According to data, peptides are utilized as antifungals and for metabolic diseases in addition to being a cancer treatment. For example, GLP-1 receptor agonists, which treat metabolic diseases and diabetes, made up around 35.4% of the worldwide peptide market in 2022 and grew by 7% annually (GlobalMarketInsight,2023). Peptides are among the most promising pharmaceutical advances of the future, and the market is still expanding.

However, there are still many obstacles to overcome in the creation and promotion of peptides. Despite having a substantial domestic and worldwide market potential, economic prospects relating to the scorpion venom peptide *Leiurus quinquestriatus* have not been thoroughly investigated in Indonesia. One of the pharmacological products with significant economic worth is chlorotoxin, which is extracted from scorpion venom and can fetch up to tens of millions of dollars per gallon (Anderson et al., 2021). Unfortunately, the biggest obstacles to industry companies entering the global market are regulatory issues, technological limitations in the extraction process, and a lack of relationships with potential purchasers.

One of the biggest challenges in the pharmaceutical sector is the stringent regulations, particularly since scorpion venom falls under the category of high-risk products that need to be tested and approved by regulatory bodies such as the FDA in the US or BPOM in Indonesia. This procedure frequently requires a large deal of technical know-how, money, and time. Furthermore, there is only a small supply chain for peptide raw materials like scorpion venom, and there is a considerable chance that materials will be damaged during manufacture. This research goal is to analyze the external and internal peptide Leirus quinquestriatus business factor on and to analyze business strategy on peptide Leirus quinquestriatus.

## 2. METHODS

### PEPTIDE

Short chains of amino acids are used to create synthetic peptides, which are frequently utilized in biotechnology, cosmetics, and pharmaceuticals. Because of their strong biological activity against certain target cells, peptides from the scorpion species *Leirus quinquestriatus* have tremendous potential as antibacterial and anticancer medicines (Wang et al., 2020). The production of these peptides in the pharmaceutical sector makes it possible to create precision medications for long-term conditions like cancer and antibiotic resistance (Jiang et al., 2021). Given the growing interest in cutting-edge treatments and regional pharmaceutical raw materials, the synthetic peptide market in Indonesia has enormous potential. According to earlier research, the global trend toward bioactive-based goods is also driving the use of synthetic peptides in cosmetics and medical care (Martins et al., 2022).

### PESTEL

An essential technique for assessing company prospects and obstacles in the Indonesian market is PESTEL research. The peptide sector is impacted by political considerations, such as stricter pharmaceutical laws. With a pharmaceutical market that is expected to increase at a rate of 9.6% year, Indonesia has excellent economic potential (Gupta, 2021). The use of synthetic peptides is encouraged by social factors, such as growing awareness of medications based on bioactive ingredients. In terms of technology, peptide synthesis is made more efficient by developments in biotechnology (Smith et al., 2022). However, operations may be impacted by legal and environmental issues, such as managing hazardous waste. This mix of elements implies that in order to maximize market potential and maintain regulatory compliance, a strategic strategy is required.

### VRIO

By evaluating resources according to value, rarity, imitation, and organization, the VRIO model determines a company's competitive advantage. *Leirus quinquestriatus* synthetic peptides are advantageous due to their great therapeutic value and difficulty of imitation. This compound's unique biological source and sophisticated synthesis method, which Indonesia has not generally embraced, make it rare (Barney, 2021). Additionally, businesses with strong organizational skills and exclusive technologies can create long-lasting competitive advantages. Research indicates that VRIO can assist a successful market entry strategy with the appropriate investment in human resource management and research and development (Grant & Jordan, 2022).

### SWOT

The Indonesian synthetic peptide business strategy's strengths, weaknesses, opportunities, and threats are determined via SWOT analysis. The primary advantages are the support of

Nugraha & Herliana, *Business strategy for Synthetic Peptides from *Leiurus quinquestriatus Scorpion* ..*64 synthesis technology and the distinct therapeutic potential of scorpion peptides. High production costs and a dearth of local resources for cutting-edge research are among its drawbacks (Hill et al., 2021). The growing need for novel medications and government assistance for pharmaceutical development present opportunities. Threats, however, include Indonesia's logistical difficulties, international rivalry, and stringent restrictions. When combined with PESTEL and VRIO, SWOT analysis can offer businesses a thorough framework for creating competitive and flexible strategies (Gürel & Tat, 2019). The methodology used in this study is a qualitative approach using secondary data. Secondary data used in this study comes from journal articles, books, research papers, and other official publications. And external data processing uses PESTEL analysis, internal data processing uses VRIO analysis and to analyze the business strategy using SWOT

### 3. Results & Discussion

#### 3.1. EXTERNAL ANALYSIS

The PESTEL framework is used in external analysis to map the variables influencing the business strategy of the organization. This study identifies current possibilities and risks by taking into account political, economic, social, technological, environmental, and legal factors. Politically speaking, the prospects stem from government initiatives that promote the creative industrial sector, such as tax breaks and courses on entrepreneurship. Significant obstacles still exist, however, in the form of copyright laws that may restrict the business's ability to operate freely (Smith, 2020). However, there are still significant obstacles in the form of copyright laws that can limit the ability of businesses to operate freely (Smith, 2020). In addition, there are also drivers such as stable economic growth and increasing purchasing power, the economic sector offers many opportunities for the business sector. However, the risk posed by inflation, which influences raw material costs, can jeopardize the business's profitability and capacity to continue operations (Jones et al, 2019).

In terms of the social dimension, businesses have excellent opportunities to satisfy the expanding market demand due to shifts in consumer preferences and lifestyle that are moving more and more in the direction of innovative products. Companies who are unable to keep up with technical advancements will face significant obstacles, but technological advancements also present opportunities through the creation of more effective digital channels for widespread product marketing (Brown, 2021). Environmentally speaking, the growing demands for sustainability and the requirement to implement eco-friendly practices present opportunities to enhance a business's reputation; however, this also requires additional investments, which could be a barrier, particularly for small and medium-sized businesses. Last but not least, from a legal standpoint, more stringent consumer data protection laws present a significant obstacle, particularly for businesses that depend on digital data for their operations, necessitating significant adaptation and compliance (Johnson & Davis, 2022).

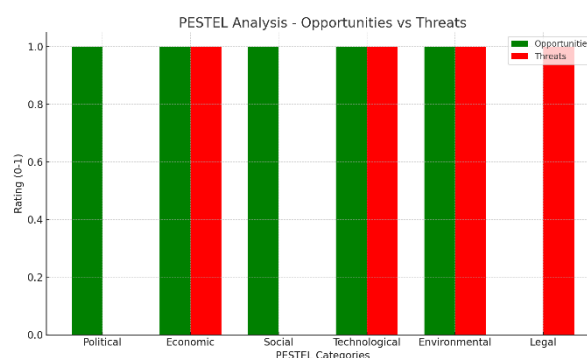


Figure 1. PESTEL Analysis

Based on the previous data and explanation above, PESTEL Result Analysis for business Synthetic Peptides from *Leiurus quinquestriatus* Scorpion in the Indonesian Market is described below:

Table 1. PESTEL Analysis Result

Factor	Opportunities	Threats
Political	Government support with tax incentive policies in the development of the pharmaceutical industry to accelerate product innovation, such as synthetic peptides used as substitutes for main drugs (due to higher effectiveness)	Restrictive copyright laws may limit the operational flexibility of the business.
Economic	Stable economic growth and increasing purchasing power create a favorable market for innovative pharmaceutical products like synthetic peptides.	Inflation can drive up the cost of raw materials, impacting profitability and business sustainability.
Social	Rising consumer demand for innovative and bioactive products provides a significant market opportunity.	Failure to align with evolving consumer lifestyles and preferences can result in competitive disadvantages.
Technological	Advances in biotechnology and digital marketing enable efficient peptide synthesis and wider product reach.	Businesses that fail to adopt or invest in cutting-edge technology risk operational setbacks and losing market share.
Environmental	Adoption of sustainable practices can improve the company's reputation and align with global sustainability trends.	High initial investment in eco-friendly operations can be challenging for small and medium-sized enterprises (SMEs) to afford.
Legal	Compliance with stringent consumer data protection laws can build trust among stakeholders, enhancing long-term customer relationships.	Stricter regulations on data protection and industry compliance require significant investment in legal adaptations, which may burden operational capacity.

Bottom of Form

All things considered, PESTEL offers a thorough summary of the outside influences on a business. Threats, particularly in the legal and economic spheres, cannot be ignored in this situation, even as possibly predominate in some sectors. Businesses must therefore be ready to modify their plans in order to capitalize on current possibilities and counteract risks that could impede their advancement.

### 3.2. INTERNAL ANALYSIS

Since cancer is one of the main causes of mortality worldwide, medical research and the pharmaceutical sector have turned their attention to it. According to the Global Cancer Observatory report from 2022, around 20 million new instances of cancer were reported year, with most of the victims hailing from Asia. Cancer is also a major health issue in Indonesia, where it will affect over 400,000 people in 2022 and cause a starting death rate. The inefficiency of traditional treatments, which often have side effects that harm healthy cells, is one of the main obstacles in the fight against cancer. Advances in cancer treatment, particularly the application of peptides, have shown promise as a safer and more targeted treatment option, particularly for treating malignancies that are challenging to cure, such as glioblastoma. Chlorotoxin (CTX), one of the peptides from the scorpion venom *Leiurus quinquestriatus*, has demonstrated encouraging outcomes in brain cancer treatment and is in

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high demand, particularly in the US and Europe (Global Cancer Observatory, 2022; Grand View Research, 2024).

Even though there is a sizable international market for this peptide, local producers in Indonesia face a significant obstacle in the form of a disregard for the peptide's home business potential. The VRIO approach can be used to assess the difficulties that arise in several internal aspects of the company that produce the peptide (Barney, 1991).

Value: *Leiurus quinquestratus* peptides are extremely valuable in medicine, particularly when used to treat glioblastoma. One of the primary ingredients in this scorpion venom, chlorotoxin, offers a lot of promise for treating extremely aggressive brain tumors. With prices that can reach tens of millions of dollars per gallon, it is therefore one of the most valuable products on the global market. For businesses that can access and efficiently use this product, its distinctiveness offers a huge competitive advantage (Grand View Research, 2024).

Rareness: One of the more costly and uncommon medicinal items is peptides derived from the venom of the scorpion *Leiurus quinquestratus*. This poison is extremely rare in the market because it can only be obtained from specific scorpion species and requires a difficult extraction procedure. This has benefits for manufacturers who can use and develop this product, but it also poses a significant challenge because of the scarcity of suppliers and the challenge of obtaining raw materials. The company's competitive advantage will be significantly impacted by how well it manages the shortage of these basic commodities (Smith, 2020).

Imitability: This substance is difficult to copy since scorpion poison is uncommon and the extraction procedure is complicated. It is challenging for new rivals to generate without significant expenditures in technology and top-notch human resources because the extraction procedure of chlorotoxins involves complex knowledge and equipment. However, if foreign businesses have stronger distribution and research networks, it may be simpler for them to enter the Indonesian market due to the ease of accessing the global market (Barney, 1991).

Organization: The business needs to be well-organized in order to capitalize on the product's worth and scarcity. This entails effective production procedures, capable human resource management, and a strong distribution network to access global markets. Limitations in marketing networks and infrastructure in Indonesia provide significant challenges to maximizing market potential. Furthermore, Indonesia's low investment in pharmaceutical innovation and the government's lack of support for the R&D industry both hinder the company's growth (Hernandez, 2023).

According to the VRIO research, despite the product's great potential for value, rarity, and difficulty of imitation, resolving internal resource management and marketing issues will be the largest obstacle. Building relationships with Indonesian hospitals and research institutes and raising market knowledge of the peptide's possible application in brain cancer treatment requires a successful plan. Furthermore, government assistance in the form of regulations and R&D expenditures will be crucial to overcoming current challenges and optimizing this company's potential in both domestic and foreign markets (Smith, 2020; Hernandez, 2023).

Based on previous data and explanation above, VRIO Analysis for business Synthetic peptides in Indonesia Market is explained below:

## Table 2. VRIO Analysis Result

VRIO Dimension	Analysis	Implications
Value	Synthetic peptides, particularly chlorotoxin (CTX) from <i>Leiurus quinquestriatus</i> , are highly valuable for treating aggressive cancers like glioblastoma.	Offers a significant competitive advantage due to its high market demand and potential for generating substantial revenue in global markets.
Rarity	These peptides are rare as they can only be extracted from specific scorpion species, requiring complex and costly extraction processes.	Creates a competitive edge for businesses that can manage raw material acquisition but also poses significant supply chain challenges.
Imitability	The extraction and production of these peptides are difficult to replicate without advanced technology, expertise, and significant financial investment.	Difficult to imitate for competitors, securing a temporary monopoly for businesses; however, global players with better resources may enter the Indonesian market.
Organization	Effective production, skilled workforce, and robust distribution networks are necessary to capitalize on this product's potential.	Poor infrastructure, lack of government support for pharmaceutical R&D, and limited marketing networks in Indonesia hinder business scalability and growth.

## SWOT ANALYSIS

### Strength:

There are a number of clear benefits to the creation and marketing of synthetic peptides made from the venom of scorpions, *Leiurus quinquestriatus*, especially in the Indonesian market. The product's inherent originality and potential are among its main advantages. Bioactive peptides having a range of therapeutic uses, such as antibacterial, anticancer, and pain-relieving qualities, have been found in scorpion venom (Zhang et al., 2019). These peptides have gained popularity in the international pharmaceutical industry, and Indonesia offers an unexplored resource for peptide manufacturing due to its high scorpion biodiversity. Because of the source material's distinctiveness, businesses have a competitive advantage and can take advantage of opportunities in niche markets. Additionally, companies that can establish themselves as pioneers in the field of peptide manufacturing from native species have an additional potential due to the increased demand for natural, bio-based medicines (Pohl et al., 2021).

The possibility for economical production is an additional strength. The ability to grow, harvest, and process *Leiurus quinquestriatus* scorpions for peptide extraction may provide a competitive pricing advantage given Indonesia's comparatively reduced labor and operating expenses when compared to industrialized markets. Local biotech ventures are also supported by government incentives and the nation's growing emphasis on developing the pharmaceutical and biotechnology industries (Nugroho et al., 2020). This creates an environment that is conducive to the growth of synthetic peptide companies.

### Weaknesses:

Notwithstanding these advantages, a few drawbacks need to be fixed. The lack of knowledge and understanding of synthetic peptides among potential clients, especially in the Indonesian market, is one of the main obstacles. The biopharmaceuticals market in Indonesia is still in its infancy, despite the fact that the global market is expanding. This might reduce the demand and acceptance of synthetic peptides produced from scorpions, particularly when they are up against well-known pharmaceutical medicines (Mohd Noor et al., 2020).

Furthermore, peptide synthesis from venom is a complicated process that calls for certain knowledge and equipment, which could be a barrier to entrance for businesses with little funding. Small and medium-sized businesses (SMEs) may be strained by the significant initial expenditure required for research and development (R&D) and the sophisticated infrastructure required for peptide synthesis and testing. Additionally, quality control procedures and regulatory permissions are required, which can be expensive and time-consuming (Bohlin et al., 2021).

**Opportunities:**

Synthetic peptides have a lot of prospects in the Indonesian market, especially given the growing desire for sustainable, natural products. There is a growing market for biopharmaceutical goods made from biodiversity as consumer attitudes around the world move toward more ethical and sustainable medical sources. Indonesia offers an undiscovered supply of bioactive chemicals for therapeutic research because of its diverse ecosystem and biodiversity (Nugroho et al., 2020). Investigating artificial peptides derived from scorpions could capitalize on this expanding trend and establish Indonesian companies as leaders in biopharmaceutical innovation.

Furthermore, opportunities for synthetic peptide-based medicines are presented by Indonesia's expanding healthcare demands, which are fueled by the country's sizable and expanding population. The need for innovative medicines is increasing as the prevalence of chronic illnesses such as diabetes and cancer rises. Peptides produced from scorpion venom may prove to be a popular therapeutic option because of their promising anticancer and pain-relieving qualities (Pohl et al., 2021). By making it easier to access worldwide markets, partnerships with foreign pharmaceutical companies or research institutes could increase this potential even more.

**Threats:**

Competition from both domestic and foreign biotechnology firms is one of the main risks to the success of synthetic peptide products made from *Leiurus quinquestriatus*. With greater financial resources, larger pharmaceutical companies might enter the market and use their well-established reputation to take control of the sector. These businesses might also benefit from closer contacts with regulatory agencies, more sophisticated technology, and more manufacturing capacity.

Threats of overusing natural resources is another danger. Large-scale scorpion venom extraction could have negative effects on the ecosystem, particularly if it is not handled responsibly. This might lead to public outrage or regulatory restrictions, especially from local communities or environmental organizations (Bohlin et al., 2021). Finally, there may be a serious risk associated with the changing regulatory environment for biopharmaceutical goods. Since the clearance procedure for new medications and peptides is rigorous and time-consuming, it may be difficult for new entrants to comply with local rules and international standards.

Based on previous data and explanation above, SWOT Analysis for business Synthetic peptides in Indonesia Market is explained below:

Table 3. SWOT Analysis Result

Category	Details
Strengths	- High therapeutic potential of synthetic peptides, including antibacterial, anticancer, and pain-relieving properties (Zhang et al., 2019). - Competitive advantage due to the uniqueness and rarity of the bioactive compounds.

Category	Details
Weaknesses	- Cost-efficient production possible due to Indonesia's lower labor and operational costs.
	- Government incentives and increasing focus on pharmaceutical and biotechnology sectors (Nugroho et al., 2020).
	- Limited market knowledge and awareness about synthetic peptides among potential clients in Indonesia (Mohd Noor et al., 2020).
	- High initial investment required for R&D and infrastructure for peptide synthesis.
	- Regulatory approval processes can be expensive and time-consuming (Bohlin et al., 2021).
Opportunities	- Lack of expertise and advanced technology in local biotechnology firms.
	- Growing global and local demand for sustainable, bio-based pharmaceuticals.
	- Potential to lead in bio-pharmaceutical innovation due to Indonesia's rich biodiversity and underexplored bioactive compounds (Nugroho et al., 2020).
Threats	- Increasing healthcare needs in Indonesia driven by a large and growing population and rising prevalence of chronic diseases (Pohl et al., 2021).
	- Partnerships with foreign pharmaceutical companies or research institutions can expand market access.
	- Intense competition from larger domestic and international biotechnology firms with greater resources and established reputations.
	- Risk of ecological harm due to large-scale extraction of scorpion venom, potentially leading to public backlash or stricter regulations (Bohlin et al., 2021).
	- Stringent and complex regulatory requirements for new bio-pharmaceutical products, potentially delaying market entry.
	- Uncertainty in regulatory environments, both locally and internationally, for bio-based pharmaceutical innovations.

## CONCLUSION

According to the study's findings, PESTEL study demonstrates that, while the biopharmaceutical market in Indonesia has enormous potential, there are some hurdles to overcome. Politically, government support for the pharmaceutical and biotechnology industries presents an opportunity, but rigorous regulatory procedures can stifle innovation. Economically, comparatively cheap labor costs and incentives for R&D provide a competitive advantage. However, impediments such as a lack of infrastructure and reliance on foreign technology remain obstacles. Socially, increased awareness of natural and sustainable treatments creates new commercial prospects, but a lack of public knowledge of peptide-based therapies can be limiting. Technologically, the necessity for new technology for peptide synthesis and processing necessitates significant investments, while changes in environmental and biopharmaceutical legislation can have an impact on the business's long-term viability.

VRIO research revealed that synthetic peptides derived from *Leiurus quinquestriatus* venom are very valuable as biopharmaceutical products due to their uniqueness and rarity, which are difficult to replicate. The difficult extraction procedure and scarcity of raw materials provide a competitive edge to organizations who can effectively utilize these resources. However, organizational shortcomings in Indonesia, such as a lack of suitable production facilities and distribution networks, limit its full potential. Government support and collaboration with foreign partners are critical measures for overcoming these issues.

A SWOT analysis revealed that the primary strength of this organization is the uniqueness and promise of peptides as therapeutic treatments, particularly for diseases such as cancer and bacterial infections. Indonesia has a rich biodiversity that can be used for peptide manufacturing. However, shortcomings such as a lack of public awareness, technological restrictions, and expensive starting expenses pose substantial challenges. Growing biopharmaceutical market potential and worldwide partnerships can help businesses thrive,

Nugraha & Herliana, *Business strategy for Synthetic Peptides from *Leiurus quinquestratus* Scorpion* ..70 but dangers such as severe competition from multinational corporations and environmental issues must be considered.

Overall, the synthetic peptide industry offers bright potential in both local and foreign markets, if enterprises can overcome legal, technological, and distribution constraints. Long-term success can be achieved by leveraging government backing, upgrading infrastructure, and sustainable resource management.

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