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# STRATEGIC ANALYSIS OF THE POSSIBILITY OF STARTING THE PRODUCTION OF FAST-GROWING PAULOWNIA TREE

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**Abstract:** Increasing energy needs and demands to reduce environmental impact have expanded interest in exploring sustainable alternative energy sources. The purpose of the article is to analyse the cost-effectiveness of starting the production of fast-growing Paulownia tree, which is characterized by low concentration of ash, sulphur, and nitrogen, as well as high calorific value and absorption of CO<sub>2</sub> from the air. Also, Paulownia is suitable for carving and insulation and it is an excellent raw material for ethanol production. Through the given strategic analysis, it is necessary to observe all-important external and internal factors that affect the success of the production of a quality product and its placement on the market. The paper also provides an assessment of the risks of identified threats arising from the environment and weaknesses related to the observed product.

**Keywords:** strategic analysis, paulownia, profitability

## INTRODUCTION

Wood production through the planting of fast-growing energy crops leads to the preservation of natural ecosystems that are partly disturbed by unsustainable deforestation. Among many fast-growing woody crops, Paulownia is considered a “magic tree” because of its fast-growing rate and a large amount of wood mass delivered in such a short time [1]. Each part of the Paulownia plant, as an energy source, can be exploited for the production of pellets [2].

Paulownia, because of its high percentage of cellulose, can be used for the production of ethanol [3]. In addition to renewable energy, Paulownia has found its purpose in building construction, furniture manufacturing, musical instruments and veneers production, and etc. because of its good insulating characteristics and natural fire resistance.

Additionally, the Paulownia plant has the following characteristic: lightness, firmness, dry quickly, pleasant unchangeable colour, ease to process, and resistance to diseases and insect attacks.

It dries naturally for about 35 to 45 days and does not require storage to dry. Paulownia wood can be installed alone or mixed with particles of other materials (e.g., in plywood production to improve their strength properties) [4].

Paulownia has a low concentration of sulphur, nitrogen, and ash during combustion (by burning one cubic meter of wood, which is about 280 kilograms, as low as half a kilogram of ash will occur) [5]. Paulownia uses highly efficient photosynthesis to fix carbon [6] where one adult tree absorbs an average of about 22 kilograms of CO<sub>2</sub> and emits 6 kilograms of O<sub>2</sub> in a year [7]. After cutting, plants regenerate quickly. The estimated lifespan of the roots is about 70 years, and they can support about 8 to 9 cuttings with a vegetative cycle of 8 years [1]. After the third year of growth tree almost does not require any care.

One of the crucial factors that benefit the Paulownia wood production is the *European Green Deal* from 2014 related to

climate change and the energy framework. This document sets ambitious goals for the European Union countries by 2030, whose legislation in this area country Bosnia and Herzegovina accepted through the *Stabilisation and Association Agreement* which came into force in 2015. To this date, the given objectives, to a certain extent, have been revised. These objectives are as follows [8]:

≡ At least 40 % reduction of greenhouse gases emission compared to the 1990 level (the European Commission proposed in September 2020 the goal of reducing greenhouse gases emissions by 2030 by raising it to at least 55 %),

≡ At least 32 % share of renewable energy sources,

≡ Improve energy efficiency by at least 32,5 %.

The cost-benefit analysis of the production of the fast-growing Paulownia trees in Bosnia and Herzegovina, used as raw material for different types of products, was analysed in this paper.

The external environment, in which complex changing factors operate, imposes on the company the obligation of a strategic way of thinking and timely decision making. It is necessary to establish the firm's and its business units' strategic positions and their environmental factors. Strategic management is a continuous process whose purpose is to optimally prepare the organization for responding to changes coming from the surroundings. Its task is to create a solid strategic position in those markets in which the organization has decided to operate.

## PHASES OF STRATEGIC MANAGEMENT

There are no large differences in defining the phases of strategic management among well-known authors in this field. In his book *Strategic Management in Action*, Coulter talks about situational analysis, formulation, implementation, and evaluation of strategy as phases of strategic management whose result is a series of strategies that an organization applies in its business (Figure 1.) [9].

A well-known researcher in the strategic management field, called Ansoff, suggests that environmental variability and dynamism, strategic and firms open-mindedness to conditions of the environment represent the essence of strategic management. The relationship between listed components of strategic management determines the strategic position of the organization. According to Ansoff, strategic management includes strategic planning (strategic analysis and strategic choice) and strategic action (strategic implementation and control) [10].

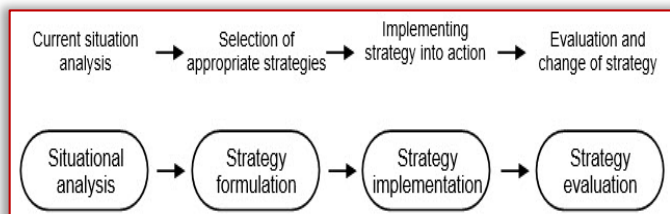


Figure 1. Phases of strategic management

Defining the company's strategy implies setting strategic goals and measures for their realization. It includes the development of long-term plans for managing opportunities and threats from the environment concerning the strengths and weaknesses of the company. There are several types of strategy, according to its design for appropriate hierarchical level: for an entire organization (basic strategy), for the business unit (which is independent within budgeting, target market, marketing mix), and the level of products and services (lowest level of strategy). Above mentioned strategies of the company should be implemented and shaped in compliance with the principle of hierarchical superiority. The product and service strategy, often called the product marketing strategy, should be in with the business unit strategy, and it should be in line with the company strategy.

The marketing strategy, above all, must take into account the needs of the market and the potential of the company to create competitive advantages and overcome the competition strategy. It requires a detailed strategic analysis of the external environment and internal factors of the company.

### STRATEGIC ANALYSIS

The strategic analysis includes the following (Figure 2) [11]:

≡ the forecasting of various trends and events in the external environment in which the company should operate. Analysis of external factors involves customers, markets and competition analysis, and a wide range of other environmental factors, and,

≡ analysis of the internal factors that affect the company's agility and ability to respond to environmental changes.

#### — External environment analysis

≡ *Customer analysis*. Customer satisfaction with parallel profit-making is the fundamental imperative of every company. The aim of the customer analysis is to provide market segmentation on relatively homogeneous groups of customers, identify customer's profiles (number of customers, their needs, behavior patterns, loyalty levels), and to detect unsatisfied needs.

≡ *Market analysis*. This type of analysis aims to determine the market potential (maximum demand estimation) and the size of the market, or total sales.

≡ *Competition analysis*. The competition analysis should determine who are the leading competitors and which part of the target market they capture, the strengths and weaknesses of the competition, their goals, sales volume, product quality, technologies used, development intentions and opportunities, etc.

≡ *PEST(EL)*. This environment contains a wide range of social forces, which significantly affect the organization and consist of demographic, natural, technological, economic, legal-political, and socio-cultural factors.

#### — Internal environment analysis

*Internal environment analysis* aims to identify the strengths and weaknesses of the company. It includes financial analysis (like the total sale and profitability measured by ratios such as return on sales, return on assets, etc. to decide whether or not to launch a new product). Internal environment analysis considers staff, organizational structure, information system, crucial business portfolio process and the allocation of, potentially, successful and unsuccessful products.

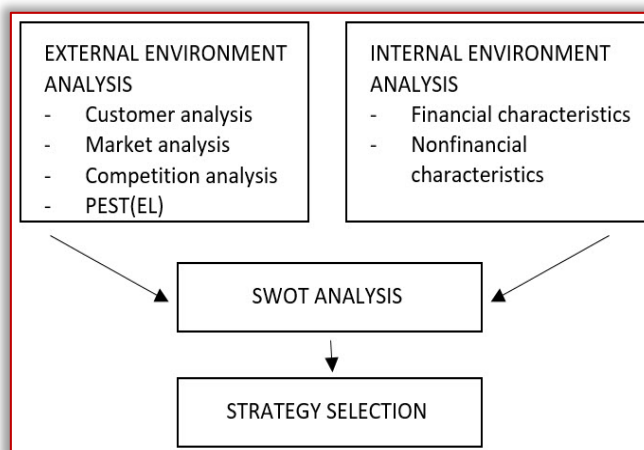


Figure 2. The process of developing and designing marketing strategy

### FEASIBILITY ANALYSIS OF LAUNCHING THE PRODUCTION OF FAST-GROWING PAULOWNIA TREES

“M&M PAULOWNIA” LLC, the company for the production of fast-growing trees, plans to produce Paulownia plants for sale. Sales range includes quarterly seedlings (obtained by “in vitro” technology), sawmill wood products (uses in construction and wood industry for furniture production), wood biomass as a heating fuel (biomass can be used by other companies for the production of pellets and briquettes) and investment cultivation on an area of one hectare. An additional product, coming from the production process, is biomass generated mainly from the waste during the shredding of leaves and branches after pruning trees, which can be used to heat buildings or make briquettes and pellets. The planned location of the plantation - Aleksandrovac, the municipality of Laktaši in Bosnia and Herzegovina.

— **Analysis of the external environment of the company**

The market research process identifies potential buyers and competitors, as well as possibilities of market expansion.

≡ *Customer analysis.* On the domestic market, there is not a dominant presence of Paulownia plant culture. This culture can replace most of our woody species in terms of quality, so a gradual increase of new customers is expected. The most important identified buyers of the company's products (seedlings, biomass, sawmill wood, investment cultivation packages) are those from sector of wood processing (sawmills, furniture factories, and other companies engaged in primary and final wood processing), and companies for the production of pellets and briquettes in the Banja Luka region (thirty companies have been identified of which eleven companies have expressed their interest in business cooperation). There is a possibility of selling products to construction companies (in the form of rafters, slats, planks, beams, etc.), to individual buyers and sales intermediaries.

≡ *Market analysis.* The forestry sector is very significant for the Republic of Srpska and includes the business of the company “M&M PAULOWNIA” LLC. This sector employs 3,11 % of the total working population of the Republic of Srpska [12]. At the annual level, about 1.958.000,00 cubic meters of various wood assortments produced in the forests of the Republic of Srpska. The production of forest assortments in 2019 was lower by 19,81 % compared to the year 2018 according to the Agency for Statistics of Bosnia and Herzegovina.

Some of the main problems in the forestry sector are forest fires and illegal logging. Insect damage and plant diseases did not have a growth trend for a long-time period. Market segmentation has done according to territorial criteria (Table 1):

Table 1. Market segmentation

Market segment	Area
Banja Luka region	Area 1
Bosnia and Herzegovina except for the Banja Luka region	Area 2
Region except Bosnia and Herzegovina	Area 3

≡ *Competition analysis.* In the Banja Luka region and the whole of Bosnia and Herzegovina, there are no Paulownia plantations, but there are only trial plantations on very small areas. There is significant competition in companies that places other types of wood that can be used for the same purposes as Paulownia. The most significant competitors on the main market of the company (Area 1 – Banja Luka region) are PFE “Šume Republike Srpske” (Forests of the Republic of Srpska) and the owners of private forests. In this market, the company “M&M PAULOWNIA” LLC should be able to position itself due to the high demand for wood assortments. Besides that, the company would be able to take advantage of reduced transportation costs due to the proximity of customers.

In Area 2, there is greater competition due to the import of wood assortments from neighbouring countries, especially

in border municipalities, but in this market, the company has great opportunities. There is a lot of competition in the regional market (Area 3) and positioning can be a real challenge. The Republic of Serbia and the Republic of Croatia have the most modern Paulownia plantations and the most modern technology in the region.

The company “M&M PAULOWNIA” LLC seeks to single out and primarily be better than the competition through the offer of investment cultivation, through several sales packages, on a plot of one hectare on which would be planted 500 seedlings of fast-growing Paulownia trees obtained “in vitro” technology of high genetic quality. The presence of strong competition in the region tells us that the market in Bosnia and Herzegovina will experience an expansion of Paulownia trees production.

≡ *PEST(EL).* Population migrations to Western Europe harmed the number of inhabitants, the number of customers, and the choice of the labour force.

The economy in Bosnia and Herzegovina is far behind the economy of neighbouring countries and European Union countries. In recent years, banks have eased the conditions for obtaining loans, and now it is easier for companies to get more favourable loans. Due to the bad rating of the state, the insurance system is quite expensive.

The company has no problems in procuring seedlings and equipment for its products.

In recent years, the weather conditions have been very changeable.

— **Internal Analysis of the company**

≡ *Purchase.* Due to the insufficient presence of fast-growing Paulownia trees in our area, the supplier choice is small. The company decided to buy seedlings from supplier “AGROPLAN” nursery garden located in the City of Bijeljina for 6,50 BAM per piece with VAT included (5,60 BAM without VAT). If a larger quantity of seedlings is taken, it is possible to agree on a discount, when for purchase of 1.500,00 seedlings the supplier gives a price of 4,00 BAM per piece without VAT. The distance between our company and the supplier is 220,00 kilometres, which should be taken into account when agreeing on the delivery of purchased seedlings.

≡ *Finances.* After the establishment of the company “M&M PAULOWNIA” LLC, the key focus will be to purchase: high-quality planting material, drip irrigation system, purchase ten hectares of land (after production stabilise buy additional ten hectares of land), three containers for offices with associated furniture and equipment, connections to electricity grid and water supply network. Previous activities follow terrain preparation works, installation of irrigation systems, planting, procurement of system for hail protection, weather conditions, insects, and purchase of a stationary chipboard machine with a protective canopy, for what is estimated to provide a total of 145.700,00 BAM. This amount of money includes equipment that is not completely necessary for launching the business. According to this, the sum of 132.300,00 BAM is enough to start a business.

After three years of growth from its planting, one Paulownia tree reaches a market value from 40,00 to 60,00 euro. After eight years of growing the Paulownia tree (when the tree is best for lumbering), it can provide from 0,50 to 0,70 cubic meters of usable material worth from 140,00 to 500,00 euro depending on its quality.

The company plans to plant 1.500,00 seedlings every year, and to do lumbering according to the recommended periods. After three years of production, after planting the first seedlings, we can expect plant growth to value between 60.000,00 and 90.000,00 euros, depending on the quality. Every following year company would have the arrival of new 1.500,00 three-year-old trees. In the income statement (Table 2), the total projected revenues after eight years of company operation are 956.550,00 BAM with total expenses for the same period of 627.982,40 BAM.

Table 2. Income statement

	YEAR			
	1.	2.	3.	4.
NET PROFIT “+“	-25.069,4	-29.109,0	14.661,9	32.031,9
(NET LOSS „-“)				
BUSINESS REVENUE	18.750,0	51.100,0	98.200,0	120.000,0
BUSINESS EXPENSES	43.819,4	80.209,0	81.909,0	84.409,0
	YEAR			
	5.	6.	7.	8.
NET PROFIT “+“	45.711,9	59.301,9	79.731,9	113.031,9
(NET LOSS „-“)				
BUSINESS REVENUE	135.200,0	150.300,0	173.000,0	210.000,0
BUSINESS EXPENSES	84.409,0	84.409,0	84.409,0	84.409,0

Table 3. Income statement the payback period of investment (economic flow)

Year	Total investment	Net receipts		
		By years	Cumulative	Uncovered investment part
1	2	3	4	5 (4-2)
1	132.300,00	0	0	-132.300,00
2	132.300,00	0	0	-132.300,00
3	132.300,00	10.346,90	10.346,90	-121.953,10
4	132.300,00	27.716,90	38.063,80	-94.236,20
5	132.300,00	41.396,90	79.460,70	-52.839,30
6	132.300,00	54.986,90	134.447,60	2.147,60
7	132.300,00	75.416,90	209.864,50	77.564,50
8	132.300,00	108.716,90	318.581,40	186.281,40

The payback period of investment, determined according to economic flow, is estimated to be at five years and 143 days (Table 3). Also, a net present value represents a positive value.

≡ *Employees.* A team of young and dedicated people with the required level of expertise makes up the company “M&M PAULOWNIA” LLC. The director manages the company. The operational section of the company includes forestry and agricultural technician who is in charge of the preparation, planting, and maintenance of the plantation.

Besides him, the company needs two wood technicians for felling and chopping of wood.

— SWOT analysis

By analyzing the internal and external environment of the company, key elements are determined and classified: strengths, weaknesses, opportunities, and threats (Table 4)

Table 4. SWOT analysis matrix

SWOT analysis matrix	
<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>- Low product prices</li> <li>- Sale of investment cultivation – an innovative product</li> <li>- Experience and qualification of workers</li> <li>- Quality of equipment</li> <li>- Seed quality</li> <li>- Market potential</li> <li>- Cheap labour</li> <li>- Providing technical support to customers from the moment of planting to felling</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>- Low information about the product by customers</li> <li>- Exploitation period</li> <li>- Satisfying market demand</li> <li>- Relatively long investment repayment period</li> <li>- Insufficient experience in growing Paulownia trees</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>- Lack of Paulownia plantations in the Banja Luka region (Area 1), which is the primary market</li> <li>- Weak competition in Bosnia and Herzegovina</li> <li>- Subsidies</li> <li>- Availability of skilled labour</li> <li>- Quality of the finished product</li> <li>- High demand for wood assortments</li> <li>- In Bosnia and Herzegovina and the region, there is a large number of companies for final wood processing</li> <li>- In recent years, banks have eased the conditions for obtaining loans</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>- Big competition in the region, especially in the Republic of Croatia</li> <li>- Occurrence of pests (insects)</li> <li>- Uncontrolled import of wood assortments</li> <li>- Entry of new competitors</li> <li>- Weather trouble</li> <li>- Presence of coronavirus pandemic (COVID-19)</li> <li>- Small number of suppliers in Bosnia and Herzegovina</li> <li>- Population decline in Bosnia and Herzegovina and the region due to migrations</li> <li>- Due to the bad rating of the state, the insurance system is quite expensive</li> </ul>

— Vision and mission of the company

“M&M PAULOWNIA” LLC company vision is to become a leader in Bosnia and Herzegovina in the production of quarterly seedlings of fast-growing Paulownia trees, raw materials for the sawmills, and the sale of investment cultivation with the ambition to expand the product range and increase production in each subsequent year.

To grow from good roots into a firm and stable organization. “M&M PAULOWNIA” LLC company mission is to provide the more affordable offer of raw materials for the sawmills, which would affect the prices of final products in economic branches with which the company cooperates. Special emphasis is dedicated to stimulating the use of land suitable for planting the Paulownia trees in Bosnia and Herzegovina. The company will have a special aspect of monitoring customer satisfaction, market demand, attracting new customers and retaining existing ones, continuous

improvement of technologies and personnel in order to obtain higher quality products compared to the competition.

— **Strategy of the company**

The strategy of the company “M&M PAULOWNIA” LLC is based on the idea that by combining resources and existing opportunities, with a view to the challenges and environment limitations, find the best way for achieving the strategic goals, mission, and vision of the company.

Strategic goal 1: Offer of innovative products – purchase of investment cultivation.

Measures:

- ≡ At the plantation in Aleksandrovac, parcel the land intended for investment sale on plots of one hectare with a capacity for planting about 500 seedlings of fast-growing Paulownia trees obtained by “in vitro” technology.
- ≡ As part of the business, the company will offer several sales packages on one-hectare plots:
  - PACKAGE 1: Purchase of investment cultivation after three years of growth and independent continuation of work and maintenance until the moment suitable for logging (next 4-5 years);
  - PACKAGE 2: Purchase of investment cultivation after three years of growth with continued maintenance by the company “M&M PAULOWNIA” LLC (irrigation, pruning, and all other actions prescribed by the profession);
  - PACKAGE 3: Independent work on the formation of the plot from planting, through plucking after the first year of growth, and further monitoring of growth until the moment suitable for logging. As part of this packaging company “M&M PAULOWNIA” LLC offers a plot of one hectare, all its knowledge and skills and transfers it to the investor for necessary education. The acquired knowledge and skills can later be used by the investor for independent cultivation and starting a business;
  - PACKAGE 4: Giving the investor opportunity to create the contents of the package where all combinations of the Package 1, 2 and 3, which are already mentioned, are allowed with the possibility of adding new elements (e.g., between rows of Paulownia trees other plant species can be planted [13]; usage for beekeeping during the flowering of Paulownia trees [1] and other).

Strategic goal 2: Strengthening marketing activities

Measures:

- ≡ Create a company's website to improve the visibility in the market, better inform customers, and reach new customers easier,
- ≡ In addition to on-site sales, the company will offer the possibility of selling through the online store on the company's official website,
- ≡ Developing a network of distributors in strategic locations in the country (and later in the region) to deliver products faster to customers.

Strategic goal 3: Placing products on the European Union market

Measures:

- ≡ After gaining the necessary experience and work references, the company plans to expand the scope of its activities to the market of the European Union countries,
- ≡ To achieve this ambitious strategic goal, it is necessary for planting material and other products of the company to pass all strict phytosanitary inspections and successfully meet all the required conditions for export to the European Union countries.
- ≡ To find an adequate business partner and exclusive distributor for our company's products in the European Union.
- ≡ Find new suppliers to ensure a constant supply of planting material and better prices.

— **Risk assessment**

Table 5 provides an excerpt of the risk analysis for the identified hazards coming from the environment and weaknesses of the company with the necessary risk mitigation measures.

Table 5. Excerpt from the risk assessment for identified hazards and weaknesses

RISK	RISK ASSESSMENT		
	POSSIBILITY	CONSEQUENCES	MEASURES
Insect appearance	Low, to 10 %	Partial or complete damage to seedlings; Repeated planting	Application of insecticides from verified manufacturers
Natural disasters	Unable to determine	Partial or complete damage to seedlings; Repeated planting	Installation of protective structure
Irrigation system failure	Low, to 5 %	Slow plant growth	Preventive control and regular maintenance
Theft on plantation	Low, to 5 %	Reduced sales; Repeated planting	Hiring security worker
Low demand for products	Low, to 8 %	Reduced sales; Financial problems	Appropriate promotion and advertising

**CONCLUSION**

The production of fast-growing energy crops, which includes Paulownia trees observed through this paper, can play a major role in increasing the share of renewable energy sources in the Republic of Srpska and Bosnia and Herzegovina. Also, their impact on reducing global warming by absorbing greenhouse gases should not be ignored. Before starting the production of Paulownia trees all-important external and internal factors, that may have an impact on the placement of products on target markets should be considered because all areas where the Paulownia tree production is present have a specific business environment. The analysis that has been done for starting the production of Paulownia trees in the Banja Luka region showed good

profitability and great opportunities for its placement on the Bosnia and Herzegovina market. It is necessary to strengthen product innovation and marketing activities in order for the customer to become better acquainted with its characteristics and advantages.

**Note:**

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