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DESIGNING AN INNOVATIVE PRODUCT TO REACH THE CURRENT TRENDS IN THE POWER TOOLS INDUSTRY

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Abstract: *Power tools industry is known for intense competition, with numerous companies striving to carve out their market share and remain competitive. To gain a competitive edge, businesses often turn to innovation and forecasting techniques to identify current trends and forecast future developments. By analyzing market data, patent records, and potential scenarios, companies can glean valuable insights into emerging consumer preferences and technological advancements. These insights inform the development of new products, enhancements to existing ones, and improved marketing strategies to meet customer demands and outperform rivals. The paper enforces the application of innovation and forecasting methodologies to empower companies in the electrical tools sector to maintain their competitive advantage.*
Keywords: *innovative product, content analysis, trends, competitive advantage, safety, and ergonomics.*

1. INTRODUCTION

The power tool industry is extremely competitive, with many companies vying for market share and looking for ways to stand out from the crowd. In order to gain a competitive advantage, companies can apply innovation and forecasting methods to identify current industry trends and anticipate future developments. The companies can gain valuable insights into consumer preferences and emerging technologies by analyzing market data, patent filings, and developing future scenarios. This information can be used to develop new products, improve existing ones, and improve marketing efforts to better meet customer needs and stay ahead of the competition. In this way, applying innovation and forecasting methods can help companies gain a competitive edge.

2. CURRENT TRENDS IDENTIFICATION IN THE FIELD OF POWER TOOLS

Various innovation and forecasting methods can be applied to determine the current trends in power tools such as:

a. Content Analysis: Conducting market research is a crucial method to determine current trends in the power tools industry. This involves analyzing market data, consumer behavior, and industry trends to identify emerging opportunities and threats [1].

b. Patent Analysis: Analyzing patent records in the power tool industry can provide insight into new technologies and innovations that may emerge.

c. Scenario Method: This involves creating future scenarios and predicting how the power tool industry may evolve based on various variables and trends [2].

Figure 1 shows the methods used to determine current trends in the field of power tools.

Fig.1. Methods used to determine trends in the power tool industry.

The companies and the experts can gain a better understanding of current trends and emerging innovations in power tools, which can help them make informed decisions and stay competitive in the market by using one or more of these methods.

2.1. Application of the content analysis method

Content analysis can be a powerful tool for identifying current trends. Some examples of current industry trends that have been identified through content analysis (figure 2) [3]–[13]:

a. Cordless Power Tools: One of the biggest trends is the move to cordless tools. Many consumers are looking for tools that are more portable and easier to use, and cordless tools provide that flexibility. As a result, cordless power tools are experiencing strong growth.

b. Smart Power Tools: Another trend is the incorporation of smart technology into power tools. Smart Power Tools can be connected to smartphones or other devices and provide users with real-time feedback on performance, usage, and maintenance. This trend is still relatively new but is expected to become more common.

c. Lightweight Power Tools: Another trend in the power tool industry is the development of lightweight tools that are easier to handle and use. Lightweight power tools are often more comfortable to use for long periods, which is especially important for professional contractors who use their tools for long periods.

d. Friendly Power Tools: With the growing popularity of DIY projects, power tool manufacturers are also catering to the needs of DIY enthusiasts by developing power tools that are easier to use and more accessible to non-professionals.

e. Sustainable power tools: There is a growing trend towards sustainable power tools that use renewable energy sources or are designed with sustainability in mind. This trend is driven by a growing awareness of the impact our actions have on the environment and is expected to become more important.

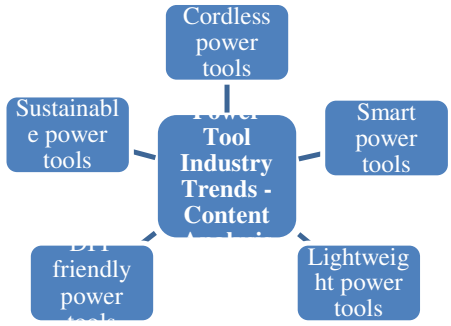


Fig.2. Trends in the power tool industry resulting from the application of the content analysis method.

2.2. Analysis of existing patents

Patent analysis can also be used to identify current trends in the power tool industry. Below are some examples of current industry trends that have been identified through patent analysis (figure 3) [14]–[20], [20]–[25]:

a. Brushless Motors: A trend that has emerged in recent years is the use of brushless motors in power tools. These motors are more efficient, require less maintenance, and offer longer tool life compared to traditional motors.

b. IoT Connected Power Tools: Another trend in the power tool industry is the integration of IoT technology into power tools.

c. Battery Improvement: As cordless power tools become more popular, the development of new battery technologies also becomes more important.

d. Safety Features: Power tool manufacturers are also investing in new safety features to improve the user experience and reduce the risk of accidents.

e. Lightweight and ergonomic tools: There is a growing trend towards lightweight and ergonomic tool designs that are more comfortable to use and reduce fatigue.

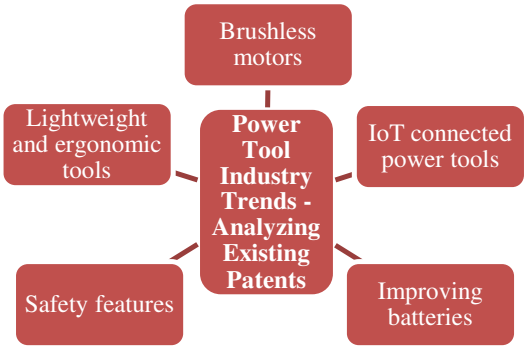


Fig.3. Power tool industry trends from the existing patent analysis.

2.3. Application of the scenario method

Scenario method can be used to identify current trends in the power tool industry by developing and analyzing different scenarios that can play out in the future. Current trends that have been identified through it (figure 4) [13], [27]:

a. Increased focus on sustainability: One scenario that could play an important role in the future is an increased focus on sustainability in the power tool industry. This could lead to the

development of more energy-efficient tools as well as tools that use renewable energy sources.

b. Expansion of IoT technology: Another scenario is an expansion of IoT technology in power tools, which could lead to tools that provide real-time data on usage and performance. This could help improve efficiency and reduce downtime for contractors and DIY enthusiasts.

c. Advances in Battery Technology: As cordless power tools become more popular, there may be increased investment in battery technology to improve the performance and battery life of these tools. This could lead to the development of new types of rechargeable batteries and faster charging times.

d. Customization of power tools: Another scenario is an increased focus on customizing power tools to meet the specific needs of different users. This could lead to the development of modular tools that can be easily customized or upgraded as needed.

e. Development of new materials: There may be a scenario where new materials are developed that can improve the performance and durability of power tools. This could lead to the development of lighter and more durable tools.

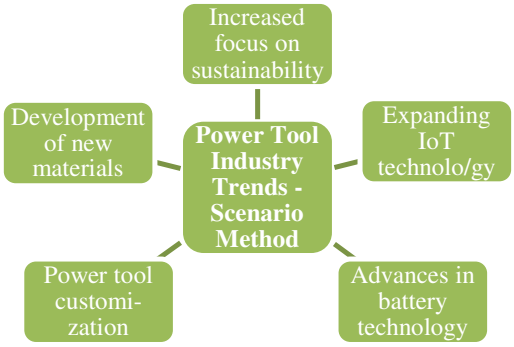


Fig.4. Trends in the power tool industry resulting from the application of the scenario method

2.4. Conclusions following the analysis of current trends in the power tools industry

After applying the above methods to analyze the field of power tools, some conclusions emerge about current trends and potential future developments in the industry:

- Content analysis shows that there is a growing demand for cordless power tools, which is driving innovation in battery technology and the development of lighter and more ergonomic tool designs. In addition, the industry is increasingly focusing on safety features and IoT technology, with companies investing in new features that improve performance and user experience.
- The patent analysis also highlights some of the key trends in the power tool industry, including the use of brushless motors, the development of IoT-connected tools, and advances in battery technology.
- The scenario method suggests that there may be continued investment in sustainability and customization, as well as further developments in battery technology and the use of new materials.

In general, the power tool industry is rapidly evolving, with innovations and technologies constantly developing.

3. ESTABLISHING THE INNOVATIVE PRODUCT SPECIFICATIONS

In order to be successful, a power tool must meet certain specifications and requirements, which may vary depending on the specific tool and its intended use. Some of the key specifications that a power tool should typically meet include [9], [28]–[30]:

Power: A power tool should be powerful enough to perform its intended task as efficiently as possible.

Durability: The tool should be built to withstand the demands of the job and last for a long time.

Safety: The tool must be designed with safety features that protect the user from harm.

Comfort and ergonomics: the tool should be designed as ergonomically as possible, allowing comfortable and easy use for long periods.

Versatility: A power tool that can perform multiple tasks.

Accuracy: Tools that provide accurate results, especially for tasks that require a high level of precision.

Reliability: The tool should be reliable and able to withstand wear and tear without breaking down or malfunctioning.

Figure 5 shows the key specifications that a product must meet to achieve success in the power tool industry.

Fig.5. The specifications of a successful product in the power tool industry.

By meeting these specifications, a power tool can be successful in the market, meeting the needs and expectations of its users.

4. INNOVATIVE PRODUCT DESIGN AND DEVELOPMENT

This chapter creates a comprehensive guide outlining the process of innovatively creating products, spanning from conceptualization to commercialization. It delves into a myriad of strategies and techniques aimed at designing products that not only fulfill customer requirements but also excel in the marketplace.

4.1. Determination of ergonomic conditions

Smart and ergonomic power tools must meet the following conditions:

Comfortable Grip: The tool should have a comfortable grip that is easy to hold and use for long periods without causing hand fatigue or discomfort.

Weight: The weight of the tool should be reasonable enough to allow easy handling and reduce the risk of musculoskeletal injuries.

Balance: the tool must be well balanced so as not to require much effort during exploitation.

Low vibration: the tool must have low levels of vibration to minimize hand and arm fatigue and reduce the risk of developing hand-arm vibration syndrome (HAVS).

Noise level: The tool must produce minimal noise to prevent hearing damage and reduce worker fatigue.

Dust Management: The tool must have an effective dust management system to prevent the inhalation of harmful particles.

Smart Features: The tool should have smart features such as automatic speed control, torque adjustment, and LED lighting to help users work safely and efficiently.

Figure 6 illustrates the ergonomic conditions that must be met by the innovative product developed.

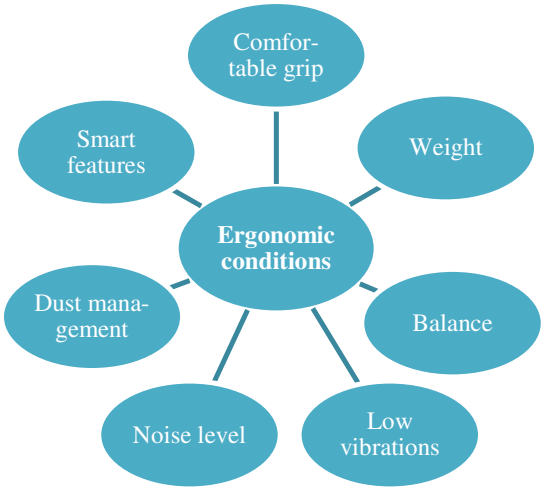


Fig.6. Ergonomic conditions of the new product.

4.2 Innovative product design

The design of the innovative product will be carried out considering trends and the needs identified following the above analysis.

4.2.1. Power tool case design

The design of an electric tool was carried out considering the need to incorporate the support handle. The need was identified by using the content analysis (figure 7).

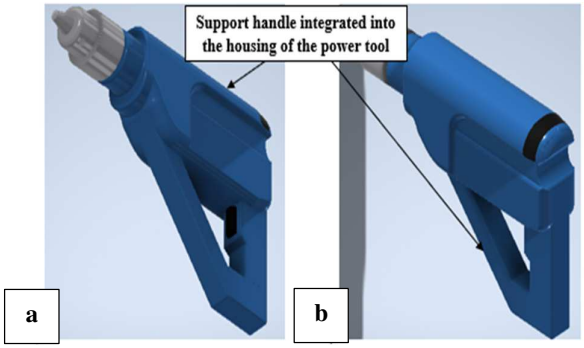


Fig.7. A power tool with a built-in support handle.

4.2.2. Power tool drill guard design

The design of protection for the drill bit of the electric tool has the role of protecting the user during operation due to the ricocheting of detached particles. The need was identified by using the content analysis (figure 8). The drill protection consists of a system consisting of two tubes that are assembled by a bushing. The first tube (fixed guard) is fixed in the body of the power tool, while the second tube (movable guard) is mounted on the extremity of the drill. Through this design, the second tube can move horizontally when pressure is applied to it.

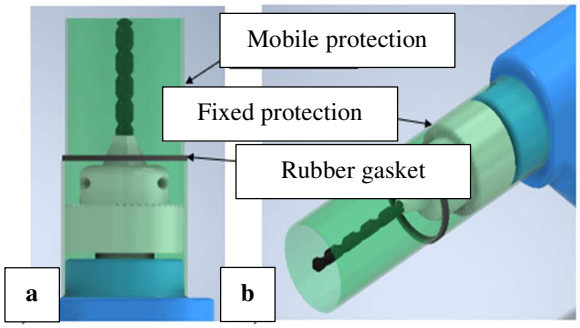
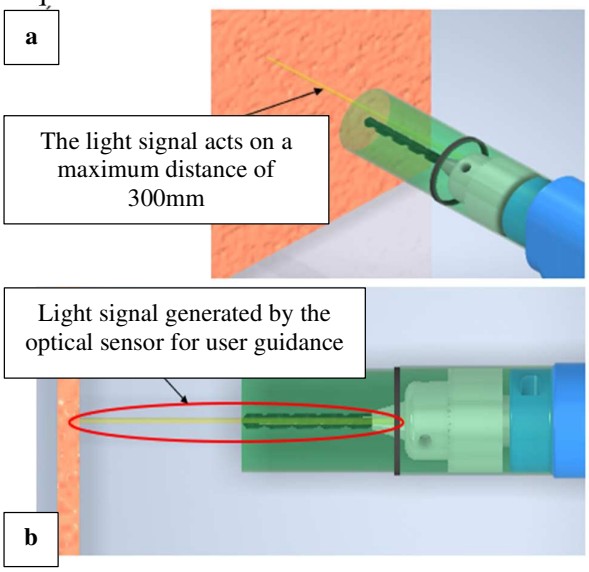


Fig.8. A power tool with anti-particle ricochet during exploitation.

4.2.3. Built-in chuck with optical sensors

The design of an electric tool with optical sensors incorporated in its chuck was realized (figure 9). The need was identified by using the scenario method. The role of the optical sensor is to guide the user at the time of exploitation to ensure high precision by indicating the place to be processed.



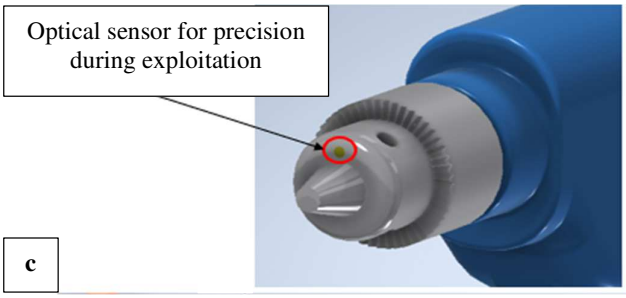


Fig.9. A power tool with an optical sensor for precision.

4.2.4. Design of brushless electric car motor with implemented temperature sensor

The design of a brushless motor with built-in optical fiber was carried out, which aims to monitor its thermal expansion during operation The need was identified by using the scenario method and patent analysis (figure 10). The optical fiber will be connected to the transmitter, and it will send real data to the user through the Bluetooth connection directly to the user's smartphone.

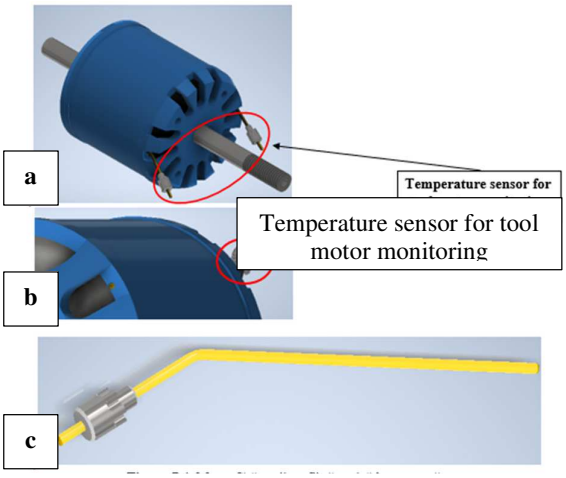


Fig.10. Brushless motor with built-in fiber optic.

4.2.5. Design of smart power tool and storage box with Bluetooth connection

Both the innovative product, the drill, and the smart storage box, have a Bluetooth connection to be able to connect to your smartphone or laptop to transmit information in real time.

In Figure 11a, the user adjusts the parameters of the power tool in real-time from the smartphone without having to interact directly with it. In Figure 11b, the user can see if the smart storage box has the device they need. The devices that are currently stored in the box are

displayed on the smartphone display. The need was identified by using the content and patent analysis.

Fig.11. Smart devices with Bluetooth connection [30], [31].

5. CONCLUSIONS

In a fiercely competitive power tools industry, staying ahead of the curve is paramount for businesses seeking to secure their market share and thrive. The insights gathered through content analysis, patent analysis, and scenario planning from this paper provide invaluable guidance for businesses aiming to develop cutting-edge products, enhance existing offerings, and refine marketing strategies. The key takeaways:

1. Identifying Current Trends: Through the methods of content analysis, patent analysis, and scenario planning, companies can gain a comprehensive understanding of the ever-evolving landscape of the power tools industry. Key trends include the shift toward cordless tools, the integration of smart technology, the development of lightweight and ergonomic tools, and a growing focus on safety.

2. Specifying Innovative Product Requirements: Successful power tools must meet specific criteria to address user needs effectively. These criteria encompass power, durability, safety, comfort, versatility, accuracy, and reliability. By adhering to these specifications, power tool manufacturers can create products that satisfy user demands.

3. Innovative Product Design and Development: Designing innovative power tools involves considering emerging trends and addressing ergonomic needs. Through the exploration introduced several innovative product concepts, including power tools with integrated support handles, drill guards to enhance user safety, chucks with optical sensors for precision, brushless motors with temperature monitoring via fiber optics, and smart power tools for real-time parameter adjustments.

In conclusion, applying innovative methodologies, forecasting trends, and incorporating user-centric design principles, companies can position themselves at the forefront of the industry. These strategies not only empower businesses to meet the evolving demands of consumers but also enhance their competitive advantage, ensuring continued success in this ever-evolving sector.

As technology and consumer preferences continue to evolve, companies that embrace innovation and adapt to change are best positioned to thrive in the power tools industry, ensuring their products remain at the forefront of technological advancement and user satisfaction.

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Proiectarea unui produs inovator pentru a îndeplini tendințele actuale din industria sculelor electrice

Industria sculelor electrice este cunoscută pentru concurența sa intensă, cu numeroase companii care se străduiesc să-și câștige cota de piață și să rămână competitive. Pentru a obține un avantaj competitiv, organizațiile se bazează adesea pe tehnici de inovare și prognozare pentru a identifica tendințele actuale din industrie și pentru a prognoza dezvoltările viitoare. Prin analiza datelor de piață, a înregistrărilor de patente și prin creionarea unor scenarii potențiale, companiile pot obține perspective valoroase cu privire la preferințele emergente ale consumatorilor și avansurile tehnologice. Aceste perspective, la rândul lor, informează dezvoltarea de produse noi, îmbunătățiri ale celor existente și strategii de marketing mai eficiente pentru a satisface cerințele clienților și a depăși concurența. Acest articol explorează aplicarea metodologiilor de inovare și prognozare pentru a împuternici companiile din sectorul uneltelor electrice să își mențină avantajul competitiv.

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