

# THE PRESERVATION OF BATIK THROUGH TECHNOLOGY: THE ROLE OF BATIK FRACTAL AND JBATIK SOFTWARE

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## ABSTRACT

Batik Fractal is an innovation that integrates traditional Batik art with modern technology through the application of fractal mathematical formulas to create more complex and innovative Batik designs. This technology developed through jBatik software, allows for a more efficient design and production process without compromising the aesthetic and philosophical value of batik as a cultural heritage. This research aims to examine the application of fractal technology in Batik design, as well as its impact on the preservation of batik art, production efficiency, and batik competitiveness in the global market. A descriptive qualitative research approach is used to collect data through observation and analysis of documents then analyzed to provide a comprehensive understanding of the development of Batik Fractal. The results of this study show that Batik Fractal provides a new dimension in Batik design while strengthening the relevance of Batik in the modern era and the international market.

## KEYWORDS

Batik Fractal, jBatik, Technology, Cultural Preservation



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## Introduction

Batik is one of Indonesia's cultural heritages that has deep historical, aesthetic, and philosophical values. The word Batik comes from the Javanese language, namely from the word Ambhatik which consists of the words Amba and Bhatik. Amba means wide, wide, or large, while Bhatik means dot or mark. It can be interpreted according to its etymology; batik can be interpreted as dots on a wide cloth. According to the Great Dictionary of Indonesian, Batik means a pictorial cloth that is made specifically by writing or pressing the night on the fabric, then processing it through a certain process [1]. There are many types of batik, namely written batik, and stamp batik, and some are produced using printing. In the past, batik became a symbol of the social hierarchy in Indonesia which was mainly associated with the nobility and members of the royal family [2]. Its use is strictly regulated and is often reserved only for those from noble

lineages, reflecting class differences in society. However, in this modern era, Batik faces a great challenge to remain relevant in rapid technological developments and changes in market tastes. One of the innovations that answers these challenges is Batik Fractal. Batik Fractal is an innovation that combines the traditional art of Batik with modern technology through the application of fractal mathematical formulas. This approach not only maintains the uniqueness of Batik as a cultural product but also opens up new opportunities in the development of more efficient Batik design and production [3].

Batik Fractal originated from research that explored the relationship between science and art, conducted by the Pixel People Project group consisting of Nancy Margried, Muhamad Lukman, and Yun Hariadi [4]. The results of the research gave birth to jBatik software, a computing technology that allows fractal patterns to be processed into complex and innovative Batik motifs. This technology allows the design process to be faster and more adaptive without losing the philosophical essence contained in traditional Batik art, making it relevant in the modern era and competitive in the international market [5].

The Batik Fractal approach is not only an innovation in design but also provides a new dimension in the preservation and development of batik art. By utilizing fractal-based technology, Batik Fractal creates unique, complex, and aesthetic visual patterns, while meeting consumer needs for innovative styles. The existence of Batik Fractal is proof that cultural heritage does not have to be static but can develop into a symbol of cultural identity that is dynamic and relevant to technological advances and global market demands [6].

The purpose of this research is to examine the technological innovation of Batik Fractal as an effort to preserve and develop traditional batik art through fractal-based jBatik software, as well as to discuss its contribution to accelerate the design process, improving production efficiency, and strengthening the relevance of batik in a competitive global market.

## Method

This study adopts a descriptive qualitative approach to gain an in-depth understanding of the Batik Fractal. Descriptive research aims to present or describe the collected data as it exists.

In this research, the primary goals are to explore the origins of Batik Fractal, analyze the application of fractal technology in designing batik patterns, evaluate the outcomes of products created using this technology, and assess its influence on cultural preservation and global market competitiveness. This approach is particularly suited

for providing a detailed and comprehensive understanding of complex cultural innovations.

The method involves collecting data through observations and document analysis, which are then systematically organized, analyzed, and interpreted to offer a holistic overview of Batik Fractal. The results are presented in a narrative format, making them accessible yet firmly rooted in scientific rigor. This approach not only uncovers the developmental processes and effects of Batik Fractal but also underscores the transformative potential of merging traditional art with modern technology.

## Discussion

### 1. Batik Fractal

Since 2007, more than 3,000 Batik artisans throughout Indonesia have been involved in efforts to preserve traditional batik through a production process that still maintains manual methods [7]. Batik is traditionally done by skilled hands, especially homemakers, to ensure that artistic values and cultural heritage are preserved. Batik is not only seen as a cultural product that must survive in its original form but also as a work that can develop according to the dynamics of the times. Innovation is an essential element in maintaining the relevance of Batik during changing market needs and technological advances. One of these innovations is Batik Fractal, which offers an innovative approach by integrating the traditional art of Batik with modern technology.

Batik Fractal is the result of a combination of traditional Indonesian Batik art and the concept of fractal mathematics. Batik Fractal motifs have their uniqueness compared to other Batik motifs because they are inspired by the beauty of Indonesian culture. The manufacture of Batik Fractal uses geometric patterns created from fractals [8]. Fractals themselves are geometric patterns or shapes formed from the repetition of the same shape on different scales. By using the fractal concept, various geometric elements such as triangles, circles, and intricate patterns can be combined in one Batik work [2]. Several types of fractals were originally studied as mathematical objects. Many mathematical shapes are fractals, including the Sierpinski triangle, the Koch snowflake, the Peano curve, the Mandelbrot set, and the Julia set.

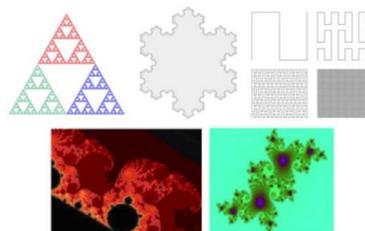


Figure 1. Sierpinski triangle, Koch snowflake, Peano curve, Mandelbrot set, dan Julia set.  
[Source: Reference [9]]

Batik Fractal is an innovation that connects art and science, developed by the Pixel People Project team consisting of Nancy Margried, Muhamad Lukman, and Yun Hariadi in 2006 [10]. This innovation originated from research on the basic patterns of traditional Indonesian batik, including the iconic motif 'Parang Rusak', which was analyzed for its regularity before being converted into a fractal mathematical formula using the L-System algorithm. The formula is changed through parameter adjustments to produce new variations that still maintain the uniqueness of traditional motifs. These patterns are then processed through a computing-based software called jBatik, an open-source technology designed to produce batik designs efficiently and innovatively [8]. The design results are realized in the fabric through traditional Batik techniques such as written Batik, stamp Batik, or printing methods.

This innovation is one of the contributions of Pixel Indonesia, a creative company based in Bandung that is a pioneer in the development of the creative industry in Indonesia. As an innovator of Batik Fractal and a developer of jBatik software, Pixel Indonesia not only modernizes batik art but also plays an active role in sending this technology and design to the artisan community in various regions [2]. This effort aims to increase the creativity, productivity, and economic sustainability of traditional batik artisans while supporting the relevance of batik as a cultural heritage in the increasingly competitive modern era.



Figure 2. Instagram Account of Batik Fractal  
[Source: Reference [11]]

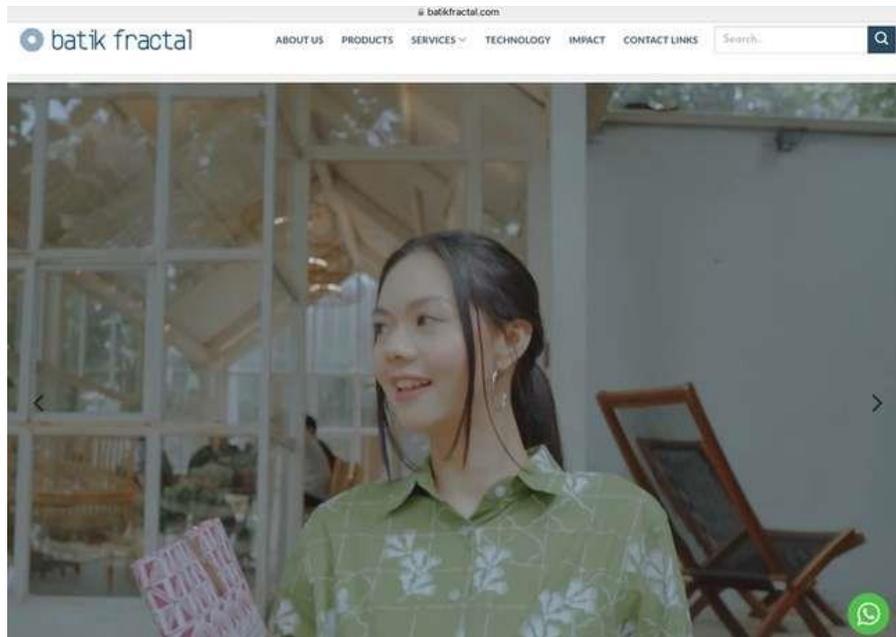


Figure 3. Website of Batik Fractal  
[Source: Reference [12]]

## 2. jBatik Software

To produce detailed Batik motifs, this fractal concept needs to be carried out using software. This software is named Batik. This software provides a practical solution for designers and craftsmen to produce complex, creative, and diverse Batik motifs in a more efficient way than conventional methods [6].

The jBatik application is a paid software that offers various features to design Batik motifs with modern technology, tailored to the needs of users, both beginners, and professionals. The jBatik software package is divided into two, namely jBatik Basic and jBatik Pro. jBatik Basic is a software package specifically designed for beginner users who want to start learning to design Batik motifs with modern technology. Priced at Rp 550,000, users get access to various basic features such as two-dimensional (2D) layouts, the ability to export designs to raster formats, and facilities to edit the motif library. This package also includes unlimited usage time, an integrated collection of motif libraries, and comes with training modules and user manuals. All of these features are designed to make it easier for users to understand and apply Batik design principles efficiently and practically [13]. Meanwhile, jBatik Pro is a flagship software designed to meet the needs of batik entrepreneurs with superior features. For Rp 1,500,000, users can take advantage of various capabilities, such as creating two-dimensional (2D) designs, exporting designs to a raster format, and managing motif libraries flexibly. In addition, this software also supports the creation of three-dimensional (3D) motifs, the

conversion of 3D designs to 2D and 3D formats, and the creation of 2D libraries from 3D objects. This plan comes with unlimited access to use, a built-in motive library, training modules, and a comprehensive guide to help users understand all the features. With these advantages, jBatik Pro is the right choice for professionals and Batik industry players who want to create innovative and efficient designs, as well as support the development of creativity in the modern era.

jBatik utilizes the concept of fractal mathematics, which is a repetitive geometric pattern (self-similarity) that can be found in nature or applied in art [7]. With this technology, designers can create new aesthetic Batik patterns without cutting the typical characteristics of traditional Batik. The design process, which previously took a long time, can now be accelerated through the automation presented by jBatik. In addition, the software allows users to explore a variety of motifs by changing certain parameters, resulting in unique and innovative designs.

The advantages of jBatik lie not only in its ability to create innovative designs, but also in its flexibility in supporting various methods of making Batik, such as written Batik, stamp Batik, and printing techniques [13]. The software is designed to be easily accessible and used, by both professional designers and traditional craftsmen. With an open-source-based approach, jBatik also opens opportunities for collaboration and further development by the creative community in Indonesia and internationally [3].

Apart from being a design tool, jBatik has an important role in preserving Batik culture. By presenting modern technology, jBatik helps bridge the gap between tradition and innovation, so that Batik is still relevant in the times. This technology allows the regeneration of Batik art by involving the younger generation who are more familiar with the technology, while supporting the economic sustainability of artisans by offering a more efficient way of production.



Figure 4. Website of jBatik  
[Source: Reference [13]]

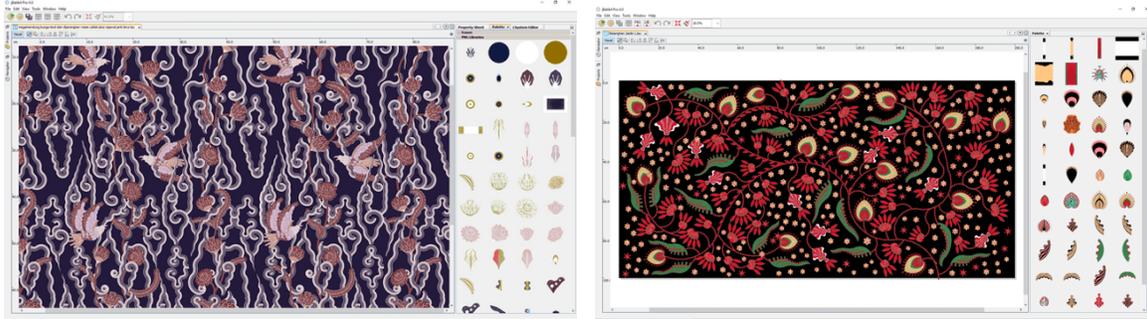


Figure 5-6. User Interface of jBatik Software  
(Source: Reference [13])

Through jBatik, innovation in traditional batik art not only focuses on aesthetics but also pays attention to functional and economic aspects. This software offers new opportunities to develop Batik motifs that can compete in the global market while supporting Indonesia's cultural identity. Thus, jBatik is a clear example of how technology can play a role in supporting creativity and the preservation of cultural heritage.

The following are some of the benefits of utilizing Batik Fractal in the production and development process:

#### a) Cultural Preservation Through Modern Technology

One of the innovations that has succeeded in combining tradition with technology is Batik Fractal, an approach that combines traditional Batik art with fractal mathematical concepts [6]. These innovations show that technology can play a significant role in preserving culture without compromising its traditional values and meanings. Through jBatik software, Batik Fractal offers a new way to create fresh and creative Batik motifs, while keeping traditional elements. This technology allows the manufacture and development of classic Batik motifs with high precision. Traditional motifs that are almost forgotten can be presented again in a more modern form. Batik Fractal still respects traditional batik techniques such as written batik and stamp batik, so that the authenticity and value of Batik art are maintained.

This approach also attracts the younger generation to engage in cultural preservation. By using technology that suits their lifestyle, Batik Fractal gives an exciting new way for the younger generation to understand and develop the art of batik. The easy-to-use jBatik software allows them to create Batik motifs that suit contemporary tastes, without leaving their traditional roots. This ensures that Batik is still alive and thriving in the hands of the next generation.

From an economic point of view, the use of technology such as jBatik provides significant benefits. This technology helps Batik artisans and designers improve production efficiency without sacrificing design quality. So, Batik products are not only

able to compete in the local market but also have competitiveness in the international market. In addition, this technology expands opportunities for Batik to be known as a symbol of Indonesian culture in the global world.

Batik Fractal is clear proof that cultural preservation does not have to be rigid or tied to old ways. By combining art and technology, this innovation ensures that Batik is still relevant and sustainable. This approach proves that tradition can evolve and adapt to the times, without losing its deep value and meaning.

### **b) Empowerment of Traditional Batik Artisans**

The empowerment of traditional Batik artisans does not only depend on the application of technology but also on the close relationship between technology developers and the artisan community itself. Batik Fractal offers innovative solutions that not only make it easier to create modern Batik motifs but also reduce the barriers that exist between artisans and various important accesses, such as technology, information, and a growing market. The purpose of this technology is to support artisans to produce more diverse, efficient, and competitive works, without compromising the value and authenticity of traditional Batik culture.

One of the aspects that is highly emphasized in this empowerment is the importance of direct relationships with artisans in the region. The Batik Fractal team strives to travel around and meet face-to-face with artisans, building close relationships to understand the needs and challenges they face [7]. Through this approach, Batik Fractal can better understand the actual conditions in the field and provide solutions that are more suitable for the existing situation. This relationship also allows for fair and transparent transactions, ensuring that every artisan is rewarded as they deserve.

The beauty of Batik seen on every piece of fabric, line strokes, and colors produced is often not realized by the craftsman himself. Batik Fractal highly values the distinctive character reflected in the craftsmanship of artisans, as the beauty is the result of long-standing skills and experience, which are now enriched with technology to meet the demands of the global market. This technology not only allows craftsmen to innovate but also gives more appreciation to the deep value of batik art so that Batik design is still relevant with the times.

### **c) Contribution to Sustainability**

The innovation of Batik Fractal in jBatik software makes a significant contribution to waste reduction efforts in the Batik production process. One of the main challenges in traditional Batik manufacturing is the level of errors that can occur during the design, molding, or embroidery process, which often results in wasted raw materials and time. jBatik is here as a solution to overcome this problem, by providing software that allows the creation of Batik designs digitally with an important level of precision. This more

structured design process not only makes it easier for craftsmen to create complex and innovative motifs but also reduces the possibility of costly errors [12].

The Batik patterns produced by the jBatik device allow the production process to be more efficient. For example, in digital design, every detail of the pattern can be carefully planned, so that when the printing or Batik process is carried out, the desired result can be achieved more accurately. This reduces the risk of wasting raw materials such as fabrics, waxes, and dyes that often occur due to errors in manual processes. In addition, a more structured design also allows for best use of raw materials, so that every inch of fabric can be used to the maximum to create quality Batik works [5]. This efficiency also has an impact on reducing production time, which in turn increases the productivity of Batik craftsmen.

The use of digital technology is also in line with the principle of sustainability, which is increasingly important in the creative industry, especially batik which is part of the cultural heritage that needs to be preserved. By reducing waste and waste, jBatik supports more environmentally friendly and sustainable production practices. Digital technology is not only a tool to improve efficiency, but also a driver of positive change in the Batik industry, allowing artisans to work more efficiently and responsibly for the environment.

Through the application of jBatik, Batik artisans can utilize technology to improve the quality and sustainability of Batik production, without sacrificing the cultural values and traditions contained in each piece of Batik fabric. The existence of jBatik is proof that technological innovation and cultural preservation can go hand in hand, providing solutions to the challenges of the Batik industry which is increasingly competitive and future oriented.

#### **d) Diversification of Batik Products**

Product diversification in the Batik industry is an essential step to maintain sustainability and competitiveness during changing modern market needs. Today's consumers are looking for more than just traditional Batik fabrics; They want innovative products that are relevant to daily life. Batik Fractal innovation through jBatik technology is a solution to support this diversification [10]. This technology allows artisans to produce more complex, flexible, and structured Batik motifs so that they can be applied to diverse types of products.

Some of the products produced with the support of Batik Fractal and jBatik include apparel, Batik fabrics, company uniforms, merchandise and gifts, home décor, digital Batik motifs, and NFTs (Non-Fungible Tokens). This diversity shows that Batik is now not only a traditional fabric but has also developed into a multifunctional product that attracts various market segments. For example, Batik-based clothing is now available

in modern designs to meet the needs of today's fashion, while Batik-based merchandise and gifts are becoming an attractive choice for various events.

jBatik technology also simplifies the design and production process of products that require many uniform motifs, such as company uniforms. On the other hand, the application of Batik in home decoration, such as pillows, curtains, and wall decorations, is increasingly in demand because it presents a distinctive cultural touch in modern spaces.

In addition, the diversification of Batik products has now expanded to the digital world with the presence of NFTs [13]. Through jBatik technology, Batik motifs can be transformed into digital assets that are unique and have economic value. This not only opens new opportunities for Batik in the global market but also introduces it into future blockchain-based technology.

Batik Fractal also plays an active role in supporting this diversification through training, workshops, and mentoring for Batik MSMEs. The artisans are not only trained to use jBatik technically but also guided in the development of products and marketing strategies that suit market needs. This program helps improve the quality of human resources in the Batik industry while strengthening the sustainability of their business.

The diversification of batik products supported by Batik Fractal and jBatik technology has a significant impact on this industry. With various innovations, Batik products are now able to reflect traditional values while competing in the modern market, both locally and globally. This effort ensures that Batik art stays relevant in the digital era and continues to contribute to the economy.



Figure 7-10. Product Diversification of Batik Fractal (Ready-to-wear Outfit Women & Men)  
[Source: Reference [12]]



Figure 11-13. Product Diversification of Batik Fractal (Uniform, Merchandise)  
[Source: Reference [12]]

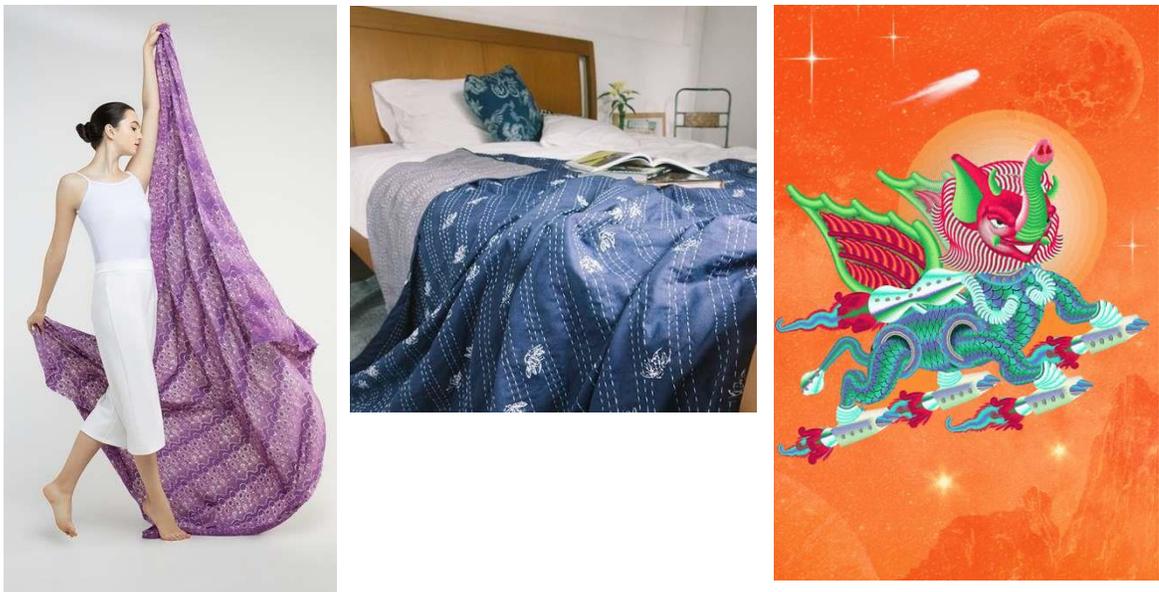


Figure 14-16. Product Diversification of Batik Fractal (Textile, Home Décor, NFT)  
[Source: Reference [12]]

## Conclusion

Technological innovations in the Batik industry, such as those offered by Batik Fractal through jBatik software have proven that cultural preservation can go hand in hand with modernization. This technology not only helps preserve traditional Batik art through a digital approach but also provides opportunities for product diversification and artisan empowerment. By adopting jBatik technology, almost forgotten classic motifs can be revived with high precision without compromising the authentic value of the Batik art itself. The existence of jBatik not only bridges the technology gap for craftsmen but also opens access to a wider market. Through MSME help, intensive training, and workshops, Batik Fractal also supports the development of more competitive human resources in this sector. Direct relationships with artisan

communities allow for the creation of effective solutions, ensuring that local needs and challenges can be effectively addressed.

Diversification of Batik products is the key to sustainability in the global era. jBatik technology supports the development of various products, ranging from apparel, home décor, company uniforms, to digital assets such as NFTs. This diversity shows that Batik can adapt to the changing times without losing its cultural essence. This effort also supports the principle of sustainability through waste reduction and best utilization of raw materials.

All these innovations have a significant impact, both in cultural, economic, and environmental aspects. Batik Fractal proves that tradition does not have to be stuck in old ways but can evolve to be more relevant and beneficial through collaboration between art and technology. Thus, Batik not only survives as a cultural heritage, but also actively contributes to the ever-growing global creative industry.

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