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"Memperkuat Produktivitas untuk Ketahanan Ekonomi Nasional"

TIPE ARTIKEL: TRAINING MATERIALS

The Symbolic Meaning of Redesign Batik Kawung Solo based on Geometry Transformation and Energy Security Concept (Case Study in Kampung Matematika Karanglo, Karanganyar)

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Abstract

Indonesian Batik by UNESCO was designated as the Masterpieces of the Oral and Intangible Heritage of Humanity since October 2009. The famous Indonesian batik motif from Solo is the Kawung batik motif. One type of batik is stamped batik. In making batik, there is always a clear repetition, so that the image appears repetitive in the same shape. The problem with making stamp batik is the price of expensive batik stamp. Generally, one stamp of batik can only produce one motif. Therefore, the main problem that was solved in this study was how to develop a Solo-Kawung batik motif design that has a uniqueness from one motif in the stamp can produce many patterns of batik without losing the local identity. The values contained in kawung batik are simplicity, regularity, consistency, and mutual cooperation reflected in community life. This problem will be solved by applying the concept of Geometry Analysis with the Symmetry Group Theory which will then be used Geometry Transformation. The Energy Security Concept is Every aspect of development must be environmentally sound while still striving for effectiveness and efficiency. This research was developed and applied in Karanglo Village, Karanganyar Regency as a Batik Mathematics Village. The development of creative industries applied in Karanglo is an industry that originates from the utilization of individual talents to create welfare and employment through the creation and utilization of these creative and creative powers. There are three directions for developing creative industries, namely industries based on creative cultural industries, creative industries and copyright industries with environmental based.

Keywords: Batik; Kawung; Geometry Transformation; Tourism.

INTRODUCTION

The development of batik in Indonesia is quite significant. Indonesian Batik, which was designated by UNESCO as a humanitarian heritage for oral culture and Non-Bendawi (Masterpieces of the Oral and Intangible Heritage of Umanity) since October 2009 (Asti and Ambar, 2011). Batik is the art of color range which includes the process of experience (wax), dyeing (coloring), and pelorotan (heating), to produce subtle motives which all require high accuracy (Asti and Ambar, 2011). But around the middle of the 19th century, "batik stamp" began to be developed. The development of batik in the present is quite encouraging, this has a positive impact on batik producers in various regions. The demand for batik and stamp batik is very high, although the market needs of batik have been partially fulfilled with batik-patterned textiles produced by textile companies with large capitals and have even been flooded with imported products.

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Other batik products are printed or printed batik products using DTG printing machines for fabrics to meet the demands of fans of batik motifs, industry players produce batik fabrics, which are more instant. The advantages of batik printing are among others the products that are produced are good, neat, and precise because the printing process using the machine will produce a better picture, the work in large quantities is faster, the price of production is cheap because the process is very easy and fast and Ambar, 2011). Printing batik products did not get recognition as a batik despite having a batik motif, because batik itself besides its motifs and patterns is a process and technical batik (Nian S. Djoemana, 1990).

Although the impression is more practical and fast, making printed batik still requires high accuracy. The quality of stamp batik is often seen from its fineness. This subtlety can be seen from the precision of laying the canting stamp across the fabric, there is no miss line or everything fits. In most cases, this imperfection is often only seen after the coloring process.

The shape of the motif / pattern on each region's batik has a difference, for example Solo-Yogya batik, easily recognized because it has a characteristic symbolic ornament based on Hindu-Javanese culture and distinctive colors consisting of sogan colors, indigo (blue), black and white. Pesisiran batik is also easily known for its naturalist ornamentation, the influence of various foreign cultures also looks very strong on the variety of ornaments and colors, such as: blue-white (kelengan), red-white (bang-bangan), red -biru (bang-ru), red-white-green (bang-ru-jo) (Hill Parasuraman et al., 1985). Solo batik motifs have a tendency to contain elements of circles or curved fields with bird motifs. Every Solo batik motif has a philosophy and is used at different times.

In making batik, there is always a clear repetition, so that the image appears repetitive in the same shape, with the size of the motif line is relatively larger compared to batik. To make printed batik with a variety of motives, a lot of stamp is needed. While the price of stamped batik is relatively more expensive than the price of canting. For the price of batik stamp in the present conditions with a size of 20 cm x 20 cm around Rp. 450,000, - up to Rp. 1,750,000, - / motive depends on the complexity of the motive, so that in terms of initial capital stamp batik is relatively more expensive. Meanwhile, the selling price of printed batik is relatively cheaper compared to batik but is more expensive than printed batik, because it is usually large in number and has one and the other similarities, not special and less exclusive.

Therefore, the main problem that will be solved in this study is how to develop Solo batik motifs that have the uniqueness of one motif in the stamp can produce many patterns of batik. This problem will be solved by applying the concepts of geometry and fractal transformations, both to produce the main products and their derivatives, as well as stamp / mold geometry. With one stamp designed based on the motif, it can produce many patterns of batik without losing the local identity contained therein. Because every stroke in the pattern of batik has a meaning that describes a certain state of society and great expectations for the wearer.

Karanglo Village won several awards at the Village Competition in Central Java, one of which is the Mathematics Village. Karanglo village is a village with Academic quality of human resources, especially in the knowledge of mathematics which is quite high. So that Batik Matematika can be useful as a support and a means of promotion of Karanglo Village Mathematical Village. Tourism activities consist of something-to-see related to tourist destination attractions, something-to-buy related to souvenirs and something-to-do related to activities that can be done in tourist areas. Along with the change in the tourism paradigm, which is a change from tourism activities that initially just to fulfill something-to-see, it has now shifted to become a tourism activity capable of fulfilling something-to-do. The shift in the tourism paradigm is based on conventional tourism activities (mass tourism) which are oriented towards economic growth but tend to place the community (tourists) as part of the process of providing tourism

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products and not as parties that should be facilitated to obtain tourism experience. In line with the shift in tourism, economic development has also shifted. Economic shifts began from agricultural economics, then turned into industrial economics, and now experience a shift towards the information economy and creative economy (Sartono, 1994). One of the things that needs to be considered in the application of batik green eco is the use of energy in the batik production process. The level of energy use in the production process will have a significant impact on the environment (Astra, 2010). Therefore, energy management both from the supply side and from the demand side needs to be considered carefully. From the demand side, companies need to do energy conservation in the production process. This is because energy use is not yet efficient (So, P.Y., 2014). Efforts to conserve energy, among others, can be done by saving energy consumption (Febrian, 2015). This is also in line with the Indonesian government's target to increase greenhouse gas mitigation and realize a sustainable development goal (SDG), as well as realizing national energy security by developing green industry concepts. Green industry is an industry which in its production process prioritizes efforts to efficiency and effectiveness of sustainable use of resources (Sugiyono, et.al., 2016). Increasing company productivity can be achieved by increasing the efficiency and effectiveness of resource use (Atmosoeprapto, 2000).

HISTORICAL STUDY AND MEANING OF SYMBOLIC

At first, batik was only done by palace daughters as fillers of leisure time, then spread also to courtiers or *abdi dalem* to the royal family (Amri Yahya, 1971). Batik as one of Indonesia's national cultural arts has developed along with the passage of time. The development that happened proves that batik is very dynamic can adjust itself in the dimensions of space, time and form. The spatial dimension is a dimension related to the area of batik distribution in the archipelago which ultimately results in a regional style. The dimension of time is a dimension related to developments from the past to the present. While the dimensions of form are inspired and inspired by traditional motifs, beautiful motifs are created without losing the philosophical meaning. Talking about the problem of traditional batik cannot be separated from symbolic meaning. According to Ernest Cassirer (1987), humans are animal symbolicum, creatures that can understand and use symbols (*signs*). Humans can also create and understand the meaning of these symbols, so that they can be used as norms, guides (instructions) toward good behavior and actions.

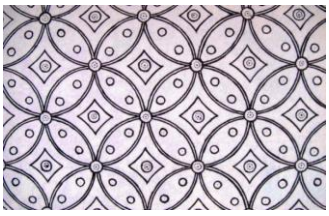


Figure 1. Basic Motives Batik Kawung – Solo

Traditional batik as a cultural heritage contains an interesting value of wisdom to study in terms of processes, motifs, colors, ornaments, and functions of a piece of batik. Symptoms of batik modernization can be witnessed by the emergence of new creative batik motifs. The symptom of the modernization is indeed the development of art and culture towards increasingly rational creativity, but in the creation of new motifs, it should still pay attention to the distinctive and meaningful symbolic elements that are extracted from the roots of local culture with diversity. Thus the batik motifs created contain high cultural

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values and distinctive Indonesian characteristics which in turn will play a role in improving people's welfare because people can live with batik and batik can support the community. Wisdom in traditional Kawung batik motifs inside and outside the palace is still preserved. Among other things, Jumenengan, performances of dance and traditional rituals are still well maintained and batik plays an important role in all activities of the ritual activities. Historically, the Kawung motif was created by Sultan Agung Hanyokrokusumo in Mataram. He created by taking materials from nature, or things that are simple and then appointed as good batik motifs (Koeswadji, 1981).

TECHNICAL SPECIFICATIONS

This research was carried out based on encouragement to be able to create (develop) printed batik motifs and derivative product innovations, by applying geometric transformation theory and the concept of field transformation in designing the motif. Through mathematical formulations tasting basic motifs will produce many patterns. This tasting is carried out without overlapping one another, and repeating repeatedly according to the suitable composition of rotation, translation and reflection. Tasting results based on rotation, translation or reflection operations and their composition are associated with a geometric transformation.

Now looking at the flat plane (*Mori* cloth) will be filled with polygons - square polygons that contain a basic motif that does not overlap each other except on the adjacent sides. By moving this polygon according to the composition of the rotating generators, reflections, translations and reflections that are suitable will be obtained by a tasting pattern. By starting at the base polygon and periodically moving the base polygon according to the selected generator and periodization, the entire flat plane (*mori* cloth) will be met by basic polygons so that new patterns can be obtained.

Development of stamp batik motifs based on geometry transformation theory, which has also been used to develop symmetrical batik motif designs (Kartono et al, 2013). Although there are similarities in methodology, there is a fundamental difference about the basic polygon, that in the manufacture of symmetrical batik designs using polygons of various shapes such as squares, rectangles, right triangles, isosceles triangles, equilateral triangle and even triangles with corners that are determined according to their wishes, while in making batik motifs only use a square polygon.

The process of making printed batik is carried out in the following process sequence: (1) *Mori* cloth is placed on a table with a base underneath using soft material, (2) Wax is boiled to a temperature of 60 - 70^{o}C, (3) Stamp dipped in wax melt with a depth of only 2cm from the bottom of the cap, (4) Then the *mori* cloth is stamped with enough pressure so that it is neat. In this process, the night liquid will seep into the porch of the *mori* and form a certain motive, (5) The coloring process by dipping the *mori* cloth that has been stamped into the tank containing dye liquid, (6) *Mori* cloth is boiled so that the sticky night liquid is gone from cloth, otherwise known as the pelorodan process, (7) The process of tasting, coloring, and pelorodan is repeated again, if you want to be given a combination of colors, (8) The process of cleansing and enlightening colors using soda, (9) Drying cloth by drying (Nurdalia , 2006).

Energy consumption in the process of making batik takes place at several stages of the process. Energy consumers at each stage of the process can be seen in Table 1. From Table 1, it can be seen that energy use for the process of making batik can be grouped in the form of electricity, water energy, LPG or gas energy, and fuel wood energy.

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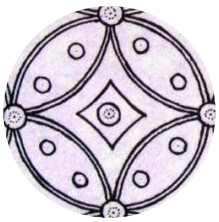
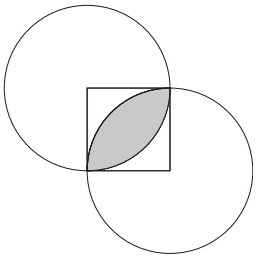
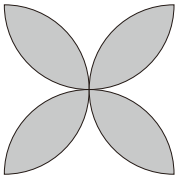
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Table 1. The type of energy in the process of making batik

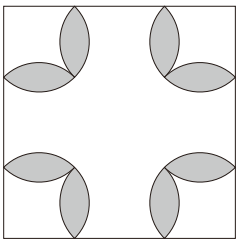
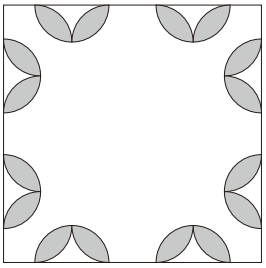
No	Process	Variety of Energy Usage
1	Stamping Process	1. Use of electricity for room lighting
		2. Use of bricket stoves to melt wax
2	Colouring Process	1. Use of water for color solvents
3	Washing Process	1. Use of water for dirt solvents
		2. Use of electricity to pump water to the sink
4	Pe-*lorod*-an Process	1. Use of water for *pelorodan* wax
		2. The use of bricket stoves to heat mineral water

The breakdown of the realm of art and science in this matter especially mathematics became a new breakthrough in the field of science-art without removing the aesthetic and philosophical values contained in kawung batik. The values of batik Kawung which are thick with simplicity, regularity, perseverance (consistency) and mutual cooperation are reflected in the order of community life of the residents of Karanglo Village, Karanganyar Regency. The Javanese philosophy of life that makes unggah ungguh is important in society and is open and reflected adaptable in this developed batik motif.

Table 2. Construction of Redesign Motives and Descriptions of Symbolic Meanings

No	Figure	Descriptions	Symbolic Meanings
1	 Basic Pattern Motives	The basic pattern of the kawung batik motif is a circle. Judging from its symmetrical properties, the circle has a folding symmetry and rotary symmetry which is equal in number to infinity. The circle has a constant geometry (reflection and rotation) transformation.	Circles as embodiments wake up flat with no aspect to describe as a picture of stability (consistency) that is held firmly to face every thing. Circles are like wheels that can rotate to achieve goals in challenges in all fields and conditions
2	 Basic Construction Motives Kawung	In the kawung motif it is constructed by intersecting two circles with a square formed by the radius of the circle. From the analysis that has been done the comparison of the area of the slice with the area of a square formed from the radius of a circle is 4: 3	The intersection of two circles like flower petals displays the basic beauty. The Kawung motif is inspired by palm or palm trees whose oval-shaped fruit is clear white or called kolang-kaling. When viewed according to the image of palm fruit, the Kawung motif has a symbolic meaning of kawung as a driver of the people's economy.
3	 1 Pattern Construction	The pattern with 1 circle construction from the basis of construction that is formed makes the space or area for batik filling to be limited and less explored or developed with motives - stuffing motifs	The basic 4-petal pattern of the intersection of the symbol symbolizes the Pancapat concept which always represents the number of 4 (four) forms that are the same and one center or core.

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		that have quite complicated details	
4	 2 Pattern Construction	The pattern with 2 base circle constructs does not form the kawung batik pattern as a basis for developing motifs even though in construction there is an area to develop detailed entries. In pattern 3 construction is not possible because the square is not of degree 3.	Separate construction from the base of batik kawung is part of the symptoms of modernization. Intended in the construction of batik kawung this modification has symbolic meaning of batik which is open and not confined to certain dimensions. Stretching patterns as a place to write the contents of batik has the meaning of freedom in order, not brutal and remains in the guidelines, such as the desires and ideals of society. The batik field illustrates the flexibility in Javanese society.
5	 4 Pattern construction	By taking the maximum degree of square, which is a pattern with 4 basic constructs, it allows space for the contents of batik to be developed quite broadly, besides the pattern with 4 constructs fulfills all elements of geometric transformation and does not eliminate the basic motives of batik kawung	

From pattern 4, the construction obtained was carried out by developing batik motifs by adding entries. For fields still using and constructed with the basic forms of symmetry such as circles, squares, or n-nodes where n is an even number. From the pattern of motives obtained then it will be used as the basic motive for the formation of batik. To produce many different motifs or motifs with 1 stamp carried out geometry transformation during the process of tasting batik into *Mori* cloth.



Figure 2. Modified Batik Motifs that have been filled in

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The basis of 'kejawen' is the concept of power. There is power in the universe, there is also power among humans. In the Kawung style reflected by the ruler or king who is the center of power in the world, the human leader, the weak and true protector. The king is also considered to be the incarnation of a god. The center of power is surrounded by four shapes of circles or rectangles, or stars. The Javanese believe that the four forms that surround the center are the energy source of the universe, namely:

1. *The East* is associated with the rising of the sun, the source of energy for all life.
2. *The West* is the direction of the sun's setting, a source of energy that causes life to decline or be unlucky.
3. *The south* is associated with Zenith or the peak of everything.
4. *North* is the direction of death, a source of energy that takes life.

The concept with this power center surrounded by four sources of energy is called a *moncopat* (Mari S. Condronegoro, 1995). That is reflected in all geometric patterns. The concept of the *moncopat* is not only adopted by Javanese but also other regions in Indonesia, especially those whose population is farmers such as in Karanglo Village which illustrates the mutual cooperation spirit and populist economy.

1. *Keblat Papat Lima Pancer*, meaning that wherever it is called the four corners of the wind (keblat), always the human is in the middle.
2. *Sedulur Papat Lima Pancer* a traditional view of life, when a baby is born will always coincide with his four twin siblings, namely red blood, amniotic water, placenta, and diaphragm, which are believed to affect each other to a certain age.
3. In the Mataram government, the king was assisted by four advisors, namely in the political-economic, defense, technological and spiritual fields. The State Government is divided into four regions, namely Kutanegara, Negaragung, Mancanegara and Pesisiran, with the Keraton as the center of government.
4. Human behavior is manifested because of the four desires (desires), namely *Mutmainah*, *Amarah*, *Aluamah*, and *Supiah*, where good desires (muthmainah) often conflict with the other three desires (Kushardjanti, 2008).

RESULTS AND DISCUSSION

1 pattern into 6 different motifs

By applying geometric transformation patterns in 1 stamp batik can make 6 different motifs while still having aesthetic value and can not be separated from the philosophical meaning of local wisdom.

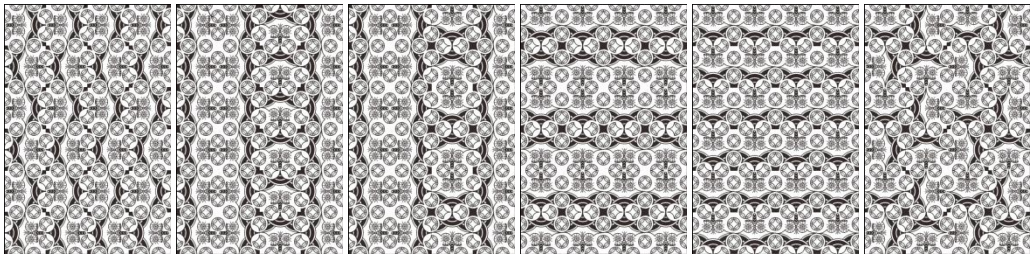


Figure 3. Results Stamps with Geometry Transformation

Product Selling Price is higher

By applying 6 motifs in 1 stamp, it has been automatically found that the profit will also be 6 times compared to the batik stamp which is 1 stamp 1 motif

Has its own elegant value

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For fans of science and art special motifs of batik Mathematics has its own pride of value for its users.

Merging of Science and Art

Breaking the boundaries that science and art are mutually rigid, mathematical analysis with elements of art remain rich in culture that can be carried.

Eco-green batik

We need to develop batik as one of the cultural heritages and wealth of Indonesia and we preserve the development of the times in the current era of disruption. Batik can be one of supporting the resilience of Indonesian culture that supports National resilience.

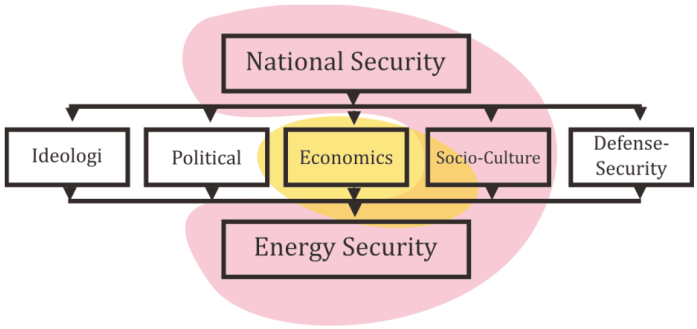


Figure 4. Energy Security to support National Resilience through Cultural Resilience

Environment as one of the factors that must be considered in increasing National Resilience. Every aspect of development and development must be environmentally sound while still striving for effectiveness and efficiency. In the process of making batik, especially printed batik in Karanglo Village, energy is needed in every process from the tasting process to the process of depletion.

Biimplication: Culture-Energy

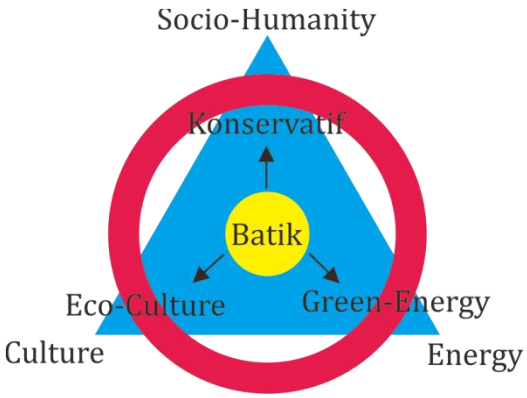


Figure 5. Batik in the Human-Cultural-Energy relationship

Energy that supports culture: In the process of making batik, especially printed batik in Karanglo Village, energy is needed in every process from the tasting process to the process of depletion. One use is to use an energy-efficient bricket stove. The concept of renewable energy to replace fossil energy stoves (petroleum, kerosene).

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Culture that supports Energy: The campaign to use batik within the government / academics / employees is not only to foster a love for domestic products. the use of batik can also save energy so as to realize energy security. Energy saving is the easiest way to create energy security. Because the energy savings do not require investment. It only requires discipline in energy use. Energy savings can be done through lifestyle, by regulating the use of clothing, such as using batik. by wearing batik, the temperature of the air conditioner needed in the room does not need to be low. In this way the electricity needed is also not too much. Different if using after a suit. because it is quite thick, then the temperature of the air conditioner must be below 20 degrees Celsius so that the energy or electricity needed will be even more.

Creative tourism development

Creative tourism development has the advantage: Revive local arts, crafts, traditions, music and costumes; Renew the pride of the local people towards the cultural heritage they have; Popularizing local customs and traditions; Preserve ancient arts and crafts; Preserve cultural heritage; Integrate cultural heritage preservation with community development, education and tourism and encourage in increasing knowledge and public awareness of the importance of cultural heritage; Creating jobs and increasing the income of the creative industry; Spread the level of creativity; Increasing competitiveness of tourist destinations.

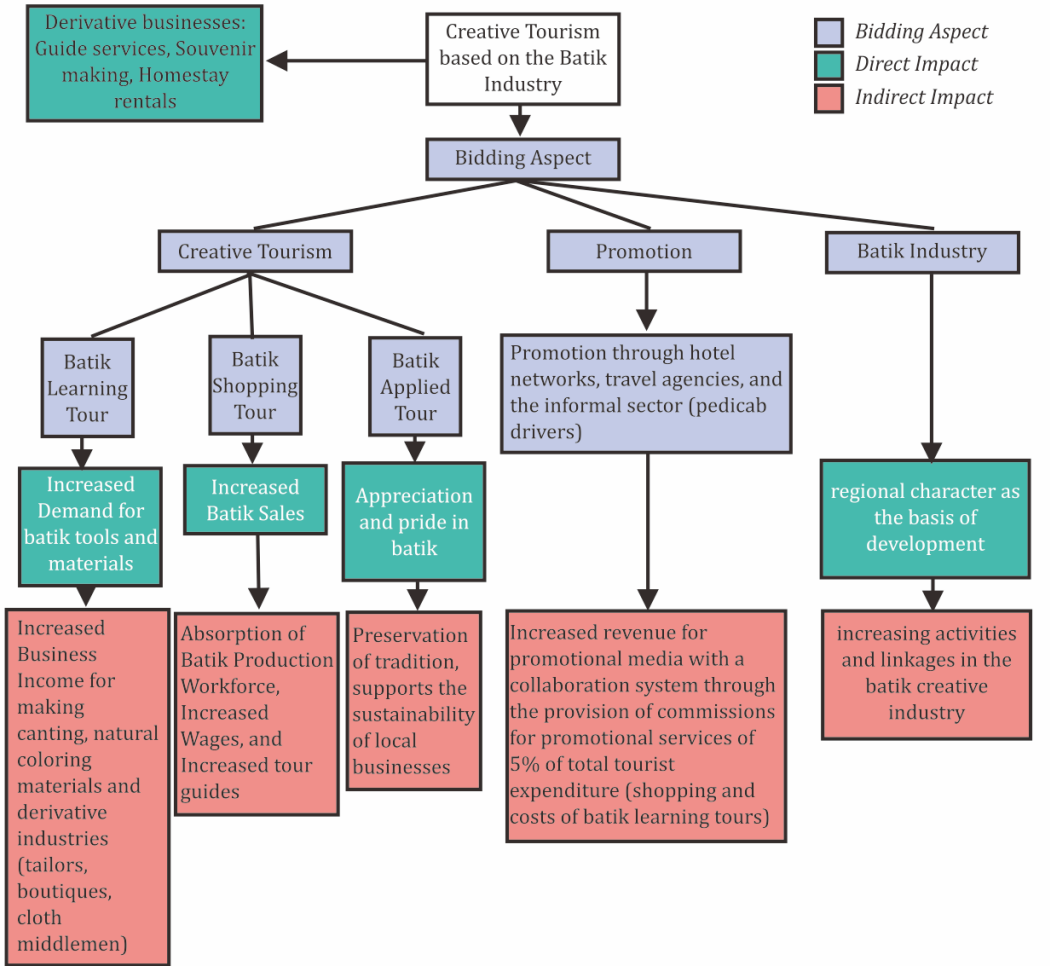


Figure 6. Creative Industry Analysis Flow towards Tourism prospects

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CONCLUSION

The symbolic meaning of kawung batik is inseparable from the historical side of kawung batik itself. Modification of batik is a reflection of the unlimited dimensions that tie kawung batik. Batik kawung with the application of geometry-based mathematical science has several technical advantages in its application in society in terms of economics, aesthetics, culture, and social behavior. The symbolism in traditional batik contains moral teachings on how life is useful, good, right and beautiful so that life becomes more meaningful.

The real influence of the incorporation of creative industries with tourism in Karanglo Village can be seen with several indicators of increasing tourism demand which results in new and interesting tourism experiences; image development through increased application of creativity; fluctuations in the development of soft infrastructure such as creative small business, creative spaces, courses and training, cafes and restaurants that function to enable interaction between producers and consumers; withdrawal of creative talent by improving quality of life, stimulating innovation by adding support for creativity and new technologies for tourism development and challenging the creative industry to find new ways of managing tourism and improving the performance of tourism businesses.

All of this was achieved by remaining environmentally sound and oriented towards national security. Batik in the realization of cultural resilience which is a bridge between energy security and national security.

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