PAPER • OPEN ACCESS

Improving the visual impressions of wood-based craft products through two-dimensional engraving of patterns

To cite this article: H Nugraha *et al* 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **1116** 012006

View the article online for updates and enhancements.

Improving the visual impressions of wood-based craft products through two-dimensional engraving of patterns

H Nugraha*, F B Leksono, D Angelina

Product Design Department, Universitas Pembangunan Jaya, Jl. Cendrawasih Raya Blok B7/P Bintaro Jaya, Tangerang Selatan, Banten, Indonesia

*Email: hari.nugraha@upj.ac.id

Abstract. Small enterprises in product craft bases are considered to be more resilient in facing the challenges of the current pandemic condition, despite a decline in income during the pandemic's peak. Craft products are one of the sub-sectors of the creative economy that has a contributor to Indonesia's Gross Domestic Product (GDP). Competition occurs between the producers of these crafts products where the makers present products that show aesthetic value and elements of the product's function. Craft products always put forward a stunning visual appearance so that the product is in demand and purchased by consumers. To struggle with the increasingly fierce competition, the quality of visual impressions that are continuously generated must be established. This research focuses on attempts to improve the visual appearance that has the impact of presenting the aesthetics of craft products by using a two-dimensional engraving approach. The engravings are processed using a sandblasting technique. The study process used a pre-experimental design approach, and the results of the improving visual impressions were evaluated using a questionnaire step which was analyzed using factor analysis. The study results show a positive response to changes in visual perceptions, indicating an increased aesthetic perception that is better than the previous craft products. The final study shows that applying two-dimensional engraving patterns on craft products effectively improves visual and aesthetic impressions.

1. Introduction

Small and medium enterprises (SMEs) are the most dominant business sector supporting economic growth in developing countries such as Indonesia. Many potential workers work in this sector. Central Bureau of Statistics notes that in 2019 the number of SMEs in Indonesia was around 64 million [28]. Especially in the handicraft sector, they support economic growth in various developing countries. Play a role in encouraging the development of gross domestic product and Gross Regional Domestic Product, providing employment, reducing poverty levels, and increasing the amount of investment, exports, and taxes [20]. The craft sector SMEs is one of the sub-sectors of the creative industry in Indonesia. In the last five years in Indonesia, 3.1 million workers have been working in this sector [10]. Indonesia has around 816,000 small businesses (SMEs) in this sector, contributing 27% to the country's GDP [12]. In the present day, the current pandemic can be felt as having a negative economic impact on the MSEs in the handicraft sector [27]; this condition causes a slowdown in the MSEs' economy [17]. This decline in economic activity growth in 2020 decreased by 2.07% based on GDP from 2019 [9].

During the pandemic, 28% of SMEs lost almost 50% of their income [8]. Running the business crafts sector in the post-pandemic period is required to develop innovative product-oriented businesses and product diversification with well-maintained quality that can affect marketing improvements [2]. Strategies of product diversification can improve handicraft products. Adding new elements to handicraft products that already exist in the market is an alternative and fastest solution to get products with different visual appearances [15]. Presenting different unique and exciting impressions to improve the appearance of existing craft products can be done by adding or giving other treatments to the surface of the product's material. Improving visual aesthetics is generally added to the surface of a craft product, such as applying a pattern of motifs with a specific design by engraving it on the products.

Most of the wood-based handicraft products in Indonesia make motif patterns on the surface of the product using the technique of carving by hand, as is done in furniture production [24]. There are two methods in carrying out this process: engraving and relief carving. Engraving can be interpreted as deep cutting into a surface of materials to produce a pattern or various specific forms. Engraving has surface depth with a two-dimensional appearance. Relief carving is a flat surface of the material carved to reveal the illusion of a three-dimensional structure [7]. Referring to its historical development, People established this method several centuries ago. The engraving applied to the copper metal plate's surface created beautiful ornamentation patterns on the armor surface [23]. The engraving technique is also used for the printmaking process, where the surface of the wood is incised to create print media. This engraving technique in wood is widely applied as a print of book illustrations, mainly used at the end of the eighteenth century [11]. Subsequently, this carving technique evolved and gained popularity as a function of decorative and artistic elements [1]. In terms of the making process for wood-based craft products, the engraving process is relatively simple because it only takes a two-dimensional shape, different from a relief carving, which is complicated to manufacture and requires craftsman skills.

On the other hand, the engraving technique used to make specific patterns on the surface of various products has applied the latest technology in the production process. The engraving process has begun to involve the use of technology. Computerized Numerical Control (CNC) Router technology, widely used in the furniture industry, presents opportunities for engraving on various materials such as wood surfaces [14]. Another recent technology that is popularly used is laser technology which has been adopted in industrial processes for the manufacture of Engraving. In this way, it is possible to make engravings of different materials.

Actual conditions show that SMEs have many obstacles, such as lack of capital, skills, and less knowledge of technology, with poor competitiveness [21]. These business owners have not entirely accepted using CNC routers and lasers. Another indication in the small-scale handicraft industry also shows that in the wood carving furniture industry, technology has not been widely adopted to assist the production process [5]. Through an alternative innovation approach, other types of engraving technology that are simple, inexpensive, and easy to operate with low skills can be adapted by MSEs with their limitations to improve their business performance.

The engraving process through the sandblasting method can be used as a promising alternative. The sandblasting method is generally used in the cleaning process on the surface of metal materials by blasting sand particles with high pressure (65-110 m/second). Process sandblasting began to be widely used in 1904 [18]. Sandblasting is also known as abrasive blasting. It is a process of blasting a stream of sand material that acts as an abrasive medium onto the metal surface to be cleaned of corrosion, dirt, oil, or paint coating [26]. This method is very economical for small industrial use and can be applied to small object components.

There are two types of sandblasting methods usually used for industry: wet blasting, where the abrasive media is sprayed together with water to smooth the surface, minimize electrostatics and prevent sparks from pouring into the material's surface, while the dry blasting type, where only the abrasive is sprayed on the material's surface. The result of wet blasting is low penetrating depth, and dry blasting is preferred because it produces a better surface depth than the wet blasting method [13].

Sandblasting Dry-type blasting is popularly used for engraving, especially on glass materials, to present various colors and patterns, scatter light, minimalized glare, reduce the translucent appearance,

and make beautiful glass surfaces with a variety of engraving patterns. This treated glass is usually used for interior and exterior applications [18]. The results of engraving on the surface of the glass material can produce a depth of approximately 150 m [25]. It is improved by increasing the blasting pressure and processing time. Referring to the sandblasting method for engraving patterns that can produce a beautiful impression on glass, this technique can be extended to other materials such as wood.

Based on the benefits of the sandblasting process and its ability to produce engraving on the surface of hard materials, this study focuses on the engraving technique using the sandblasting method by carrying out a case study of wood craft products produced by SMEs in Indonesia. Adding decorative engraving pattern elements using the sandblasting method on wooded craft products can provide innovative products, improving visual appearances with an aesthetic and modern design style. This engraving technique can present a diversification of handicraft products that can meet market needs, increase production and have an impressive visual appearance**.**

2. Materials and methods

2.1. Product Materials

The materials of wood handicraft products are taken from the craft market; two craft products are used for the experimental engraving pattern process. The craft product is a wooden bowl with a diameter of 130 mm and 200 mm with a thickness of 18 mm. Both of the products have been finished in dark brown color. The bowl is shown in Figure 1.

Figure 1. Sample of the wooden bowl

2.2. Sandblasting materials

The sandblasting process used a type of cabinet blasting using 10 bar pressurized air compressor (0.5 HP). The size of the blasting cabinet is 600 mm X 1000 mm X 500 mm. The blasting cabinet is shown in Figure 2. The blasting abrasive used as the primary material for engraving is Aluminum Oxide with a grid size of 280.

Figure 2. Blasting cabinet

2.3. Pattern and engraving material

The patterns used for engraving are two types of modifications of traditional Indonesian motifs (Kawung and Semanggi). The pattern design is created digitally using vector-based software and then printed and cut on vinyl sticker type oracal 651. The final design of the Semanggi pattern is made with a length of 410 mm X height of 20 mm, and the second is a length of 630 mm X height of 20 mm (Kawung pattern). The design of the pattern showed in Figure 3. The pattern was printed and cut using desktop cutter printing type Roland CAMM-1 GS-24 to carry out this cutting printing process. The results of the cutting stickers were used for the patterned masking, as shown in Figure 4. The purpose of masking is to cover and protect the part materials surfaces that are not engraved, whereas the reverse is what will result in engraving on the surface of the wooden bowl.
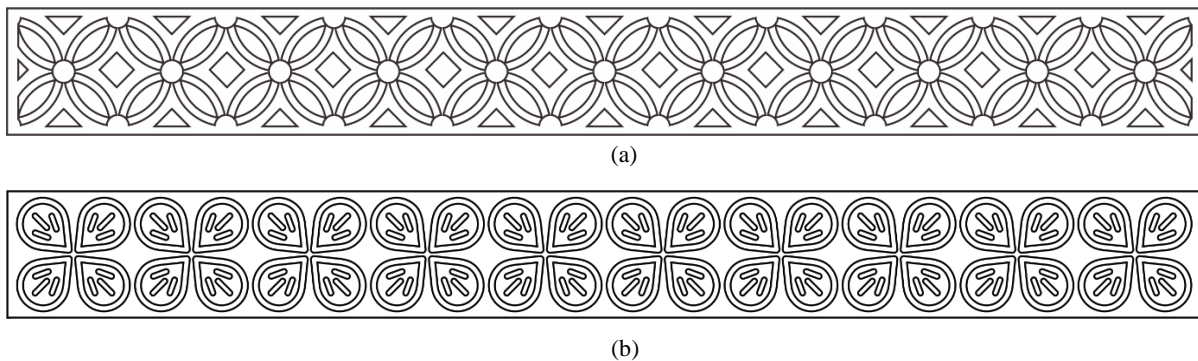

(a)

(b)

Figure 3. Pattern design. (a) Kawung; (b) Semanggi

Figure 4. Cutting sticker of pattern

2.4. Engraving process

Making patterns on the surface of handicraft products applies a pre-experimental design approach. The engraving process using sandblasting goes through four stages, namely; (1) The process of making the pattern to be engraved on the surface of the wooden bowl, (2) The process of cutting and printing the pattern as masking, (3) The process of installing the masking on the surface of wood material, (4) The engraving process using a blasting cabinet, (5) The process of removing the masking and finishing, (6) Evaluation and analysis the improving of a visual impression on the wooden bowl product. The engraving process is shown in Figure 5.

The final stage of the engraving process is replacing the cutting sticker as masking from the surface of the wooden bowl. Next, clean the surface and the engraved part of the blasting media particles by washing them. The engraving pattern area can add color if it presents a more contrasting appearance to

the product's surface. Staining was used the spray method directly to the material's surface. In this study, the engraving results showed no added special staining. The engraving results are left to expose the natural color of the wood, and the contrast effect is obtained from the color finishing from the entire surface of the product without being engraved, which is dark brown. The result of the engraving pattern is shown in Figure 6.

Figure 5. Engraving using sandblasting

Figure 6. The results of engraving on samples of a wooden bowl

2.5. *Preferences analysis*

Based on the reference to the sandblasting process used for the surface of hard materials such as metal, use a blasting speed setting of 31.83 m/s, nozzle diameter of 10 mm, and air pressure of 7 bar. The distance between the nozzles and the material surface is 200 mm. [4]. Another lower setting is to adjust the air pressure set on the compressor engine by 5,5-6 bar; the nozzle distance is 50 mm. The abrasive blasting material generally uses aluminum oxide particles which are safer for human health. The sandblasting process for approximately 60 minutes can produce engraving with a surface depth of 5μ [16].

The reference working duration of the sandblasting process briefly can be done for 0,5-1,5 minutes. The following experimental stage applies variations in the angle of the blasting nozzle to the surface of the wooden bowl material with a distance of 30mm, 45mm, and 60mm, while the nozzle distance is 50mm. Another reference that makes engraving depth on the surface of the wood material is to adjust the compressor pressure and the length of the blasting process. The references show that the sandblasting process is carried out for 0,5-1,5 minutes with a blasting pressure of 6-8 bar, producing an engraving depth of + /- 5μ-10μ [19]. This study of the engraving experiment process refers to the reference of data results. Generally, the result of the experiment shows the engraving depth on the wood material is close to 0.3mm. The result of engraving patterns on the surface of the wooden bowl can demonstrate the

possible depth of the feeling in a two-dimensional visualization. The patterns can be exposed clearly on the surface of the wood material.

The questionnaire results revealed that engraving on the surface of wood materials could present various adjectives related to the appearance of visual impressions. The data uses a factor analysis approach, a multivariate statistical technique generally used to reduce large amounts of correlated data [22]. The factor analysis results then developed the type of visual impression that most represented the perceptions of the questionnaire. In this study, factor analysis was carried out using the rotated component matrix method, which then extracted the factors indicated by the values of eigenvalue >1 and the ratio of the factors that created the total above 50% [16].

3. Results and Discussion
3.1. Identify the visual impression of craft product
Evaluation of visual appearances was to identify the impression impact of the engraving patterns on the surface of craft products on improvements in their visual and aesthetic impressions. The evaluation process starts from the questionnaire stage by creating an impression adjective domain that will be asked to the respondent and then confirming the impression perceptions by the respondent from the results of the engraving pattern applied on the surface of the wooden bowl samples. First, was defined ten adjective domains related to the impressions of visual impressions, namely, Plain, Simple, Traditional, Bored, Ugly, Passive, Static, Cheap, Cool, and Natural. Furthermore, a questionnaire was made with a linear scale format using 7-point scores; the adjective domain was made up of its meaning. The impression described refers to the condition before and after the engraving pattern was made. The linear scale questionnaire form used is shown in Table 1.

The questionnaire was filled out by 28 respondents consisting of 14 men and 14 women aged 18-21 years. The questionnaire procedure firstly respondents as observer seeing directly to the samples of wooden bowl that has not been yet engraved with a pattern. Then expressed the impression by fill in the questionnaire form. Next step continues observe a wooden bowl has already engraved pattern, then write down the impressive results they feel based on the scale determined on the questionnaire form.

A reliability test was then carried out on the questionnaire data obtained from 28 respondents to measure whether the questionnaire data was reliable or showed data consistency [3]. The reliability test results show that Cronbach's Alpha value of 0.95 indicates a value above 0.60, which means that the reliability is highest, and the data index is acceptable [6]. The results of the reliability test are shown in Table 2.

Table 1. Questionnaire form

Adjective	Scale							Opposite
Plain	1	2	3	4	5	6	7	Patterned
Simple	1	2	3	4	5	6	7	Complicated
Traditional	1	2	3	4	5	6	7	Modern
Bored	1	2	3	4	5	6	7	Interested
Ugly	1	2	3	4	5	6	7	Beautiful
Passive	1	2	3	4	5	6	7	Active
Static	1	2	3	4	5	6	7	Dynamic
Cheap	1	2	3	4	5	6	7	Expensive
Cool	1	2	3	4	5	6	7	Warm
Natural	1	2	3	4	5	6	7	Synthetic

Table 2. Reliability Test Result

Variable	Cronbach's Alpha	Explanation
Without engraving pattern	0,70	Reliable
Engraving pattern	0,95	Reliable

3.2. Comparison the visual impression of craft product before and after engraving pattern

Based on the linear scale questionnaire, the evaluation obtained different impressions before the craft product was engraved and after the respondent's questionnaire felt it. Referring to the results of questionnaire data that respondents disclosed when conducting direct observations on samples of products, there is a difference in the perception of impressions between handicraft products without engraving on their surface and products with engraved patterns. A comparison of the visual appearance of handicraft products before and after engraved processed is shown in Figure 7. It can be seen that products without engraving tend to produce the impression is Ugly, Cheap, Cold, Bored, and Traditional. In contrast, products with engraved have the appearance of Beautiful, Interested, Active, Modern, and Expensive.
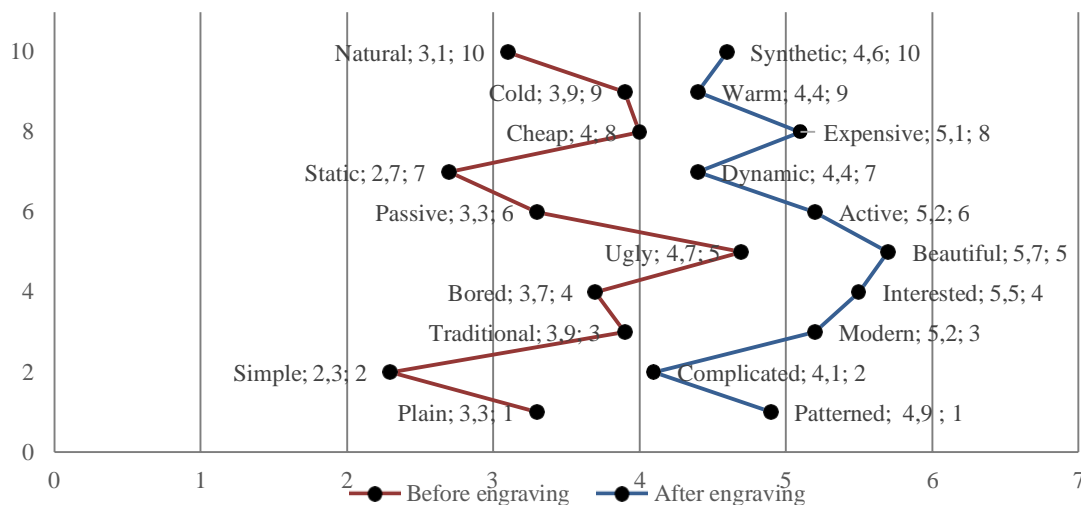

Figure 7. Comparison visual impression

3.3. The cost of engraving patterns using sandblasting process

Based on the obstacles handicraft SMEs in Indonesia, which have limited capital for operational costs and equipment investment, the production costs incurred are a sensitive factor that determines these SMEs in adopting technology and production equipment. Therefore, the production cost for making engraving on handicraft products using the sandblasting process must be economical and lower than the current technology. This study will compare the engraving cost using sandblasting with laser CNC engraving. The costs to be identified are the price per mm for the sandblasting and CNC laser processes.

The calculation of engraving cost per mm is based on wages of the provincial city in Jakarta, Indonesia. The cost calculation components are; (1) The minimum hourly labor wage, (2) The cost of making cutting and masking stickers refers to the retail price offered in the marketplace, and (3) The total engraved quantity of products in one hour. Details of these components are shown in Table 3. These three cost components can identify engraving prices for product units, then can be identified as sandblasting engraving cost per mm. The cost can be compared and shown the percentage of cost efficiency per mm between engraving using sandblasting and laser CNC. The cost result is shown in Table 4.

Table 3. Cost component

Dimension (mm)		Cutting and Masking cost		Production and wage cost		Engraving cost	
Pattern size	Total	cost per mm	Total cost	Quantity	Wage per hour	Unit	mm
410x20	820	Rp 12,0	Rp 9.840	7	Rp 26.250	Rp 13.427	Rp 16
630x20	1.260	Rp 2,0	Rp 15.120	5	Rp 26.250	Rp 20.632	Rp 16

Table 4. Cost comparison

Dimension (mm)		Cost engraving per mm		Cost engraving per unit		Sandblasting cost eficiency
Pattern size	Total	Laser CNC	Sandblasting	Laser CNC	Sandblasting	
410x20	820	Rp 30	Rp 16	Rp 24.600	Rp 13.120	47%
630x20	1.260	Rp 30	Rp 16	Rp 37.800	Rp 20.160	47%

Calculation and identification of production costs are shown in Tables 3 and 4; it can be concluded that the engraving process using sandblasting can be carried out with lower production costs when measured by the working hours of production operation compared to CNC laser. Table 4 shows that the cost of sandblasting engraving per mm is Rp 16, and the efficiency achieved can be about 47% more cost-effective than CNC laser engraving.

3.4 Evaluation of the impressions of engraving patterns on the craft product

The following evaluation is a factor analysis to identify the perception of visual impressions obtained from the questionnaire data. The results of this evaluation are used to reduce various visual impression perceptions expressed by questionnaire respondents when observing the effects of engraving patterns on the surface of handicraft products, such as wooden bowl products. From the factor analysis results, it will be possible to identify the type of visual impression appearance that reflects an increase in the impressions of handicraft products that have been given a touch of engraving patterns.

The results of the factor analysis show that three groups of the adjective visual impression, which is the most dominant referring to the general perception of the questionnaire respondents who have made observations from the appearance of the engraving of wooden bowl product. The results are factor 1 (Bored-Interested, Ugly-Beautiful, Passive-Active), factor 2 (Static-Dynamic, Natural-Synthetic, Simple-Complicated) and factor 3 (Cheap-Expensive, Cold-Warm, Plain-Patterned). The results of the factor analysis are shown in Table 5. Based on the closeness of the meanings of the adjectives in the factor group, it can be identified as a visual impression related to Attractiveness; group two is an appearance that represents Uniqueness, and group three can be interpreted as representing Experience. The results of the factor analysis are shown in Table 6. The final result of visual impressions groupings shows that engraving patterns on wooden bowl craft products can be divided into three perceptions related to the visual appearance of Attractiveness, Uniqueness, and Experience. Overall, the evaluation of factor analysis showed the results of pattern engraving using the sandblasting process on the surface of handicraft products, which could generally renew the product's visual impression. Engraving patterns can trigger positive feelings to improve the aesthetic value of craft products.

Table 5. Factor analysis

Adjective (Impressions)	Factor		
	1	2	3
Bored-Interested	**,953**	-,169	,053
Ugly-Beautiful	**,826**	,004	,116
Passive-Active	**,543**	,195	,171
Static-Dynamic	,187	**,861**	-,029
Natural-Synthetic	,084	**,625**	-,319
Simple-Complicated	-,062	**,344**	,053
Cheap-Expensive	,428	-,109	**,634**
Cold-Warm	,053	-,148	**,541**
Plain-Patterned	,296	,142	**,454**
Traditional-Modern	,121	-,369	**-,405**

Table 6. Improving of visual impression

Attractiveness (Factor 1)	Uniqueness (Factor 2)	Experience (Factor 2)
Bored-Interested	Static-Dynamic	Cheap-Expensive
Ugly-Beautiful	Natural-Synthetic	Cold-Warm
Passive-Active	Simple-Complicated	Plain-Patterned
		Traditional-Modern

Conclusion

The pattern engraving using sandblasting process can effectively improve visual impressions of products. This study can be helpful as an alternative to diversifying craft products with impressive improvements. The factor analysis results showed a change in positive visual impression perceptions, which could add to the aesthetic value of handicraft products. Visual impressions from the results of the engraving pattern process can be related to the perception of Attractiveness, Uniqueness, and Experience. It can identify significant changes in appearance and visual impression of a product before and after engraving. In addition, the calculation of production costs for engraving using sandblasting shows lower production costs, and there is a production cost efficiency of 47% compared to CNC lasers. A future study can be carried out to make an engraving with various patterns and color combinations, then re-evaluate more comprehensively to identify visual impressions appearance of handicraft products by multiple people.

Acknowledgment

References

[1] Najlaa Al Saadi. 2021. The Artist and creative.pdf. *Br. J. Humanit. Soc. Sci.* 24, 2 (January 2021), 73–81.

[2] Diana Aqmala and Febrianur Ibnu Fitroh Sukono Putra. 2021. Rayu : A Competitive Strategy Model of Wood Craft Business in Soloraya Post Covid-19 Pandemic. *J. Manag. Entrep. Res.* 2, 2 (December 2021), 74–87. DOI:https://doi.org/10.34001/jmer.2021.12.02.2-19

[3] Rudy de Barros Ahrens, Luciana da Silva Lirani, and Antonio Carlos de Francisco. 2020. Construct Validity and Reliability of the Work Environment Assessment Instrument WE-10. *Int. J. Environ. Res. Public. Health* 17, 20 (October 2020), 7364. DOI:https://doi.org/10.3390/ijerph17207364

[4] O. Bouledroua, M. Hadj Meliani, Z. Azari, A. Sorour, N. Merah, and G. Pluvinage. 2017. Effect of Sandblasting on Tensile Properties, Hardness and Fracture Resistance of a Line Pipe Steel Used in Algeria for Oil Transport. *J. Fail. Anal. Prev.* 17, 5 (October 2017), 890–904. DOI:https://doi.org/10.1007/s11668-017-0313-4

[5] Freddy Chrisswantra. 2021. Jepara Wood Carving and The Cultural Influences of the Nusantara Maritime Spice Route. *Serat Rupa J. Des.* 5, 2 (July 2021), 254–269. DOI:https://doi.org/10.28932/srjd.v5i2.3786

[6] Khairul Azhar Mat Daud, Nik Zulkarnaen Khidzir, Ahmad Rasdan Ismail, and Fadhilahanim Aryani Abdullah. 2018. Validity and reliability of instrument to measure social media skills among small and medium entrepreneurs at Pengkalan Datu River. 7, 3 (2018), 12.

[7] Jennifer Fortuna. 2019. The Art and Process of Wood Carving as a Meaningful Occupation. *Open J. Occup. Ther.* 7, 2 (April 2019). DOI:https://doi.org/10.15453/2168-6408.1616

[8]   Ahmad Dading Gunadi, Harry Lesmana, Hilda Fachrizah, Mohamad Dian Revindo, and Rama Vandika Daniswara. 2021. COVID-19 Pandemic and MSMEs in Indonesia: Impact and Policy Responses. *J. Ekon. Indones.* 10, 2 (August 2021), 143–171. DOI:https://doi.org/10.52813/jei.v10i2.151

[9]   Gunartin. 2022. The Role of the Creative Economyin Accelerating the Recovery of SMEs from the Impact of the Covid-19 Pandemic (Study on Table and Chai rCrafts fromTires). *SENTRALISASI* 11, 2 (2022), 193–204. DOI:https://doi.org/10.33506/sl.v11i2.1725

[10] Ar R T Hidayat and A Y Asmara. 2017. Creative industry in supporting economy growth in Indonesia: Perspective of regional innovation system. *IOP Conf. Ser. Earth Environ. Sci.* 70, (June 2017), 012031. DOI:https://doi.org/10.1088/1755-1315/70/1/012031

[11] Christopher Hoolihan. 1998. Wood Engraving and the Illustration of American Surgical Texts during the Nineteenth Century. *Can. Bull. Med. Hist.* 15, 2 (October 1998), 351–378. DOI:https://doi.org/10.3138/cbmh.15.2.351

[12] International Labour Organization. 2019. *Financing Small Businesses in Indonesia*. International Labour Organization. Retrieved from https://ilo.primo.exlibrisgroup.com/discovery/delivery/41ILO_INST:41ILO_V2/1259329930002676

[13] Jae Keon Kim, Seung Deok Kim, Jae Yong Lee, Chang Hee Kim, Hyeon-Su Lee, Seong Mo Koo, YoungJin Lee, Jong-Hoo Paik, Da Ye Kim, and Seong Ho Kong. 2021. A Study on TiO2 Surface Texturing Effect for the Enhancement of Photocatalytic Reaction in a Total Phosphorous Concentration Measurement System. *Micromachines* 12, 10 (September 2021), 1163. DOI:https://doi.org/10.3390/mi12101163

[14] Antonela Lungu, Mihai Ispas, Luminiţa-Maria Brenci, Sergiu Răcăşan, and Camelia Coşereanu. 2021. Comparative Study on Wood CNC Routing Methods for Transposing a Traditional Motif from Romanian Textile Heritage into Furniture Decoration. *Appl. Sci.* 11, 15 (July 2021), 6713. DOI:https://doi.org/10.3390/app11156713

[15] D Masruro, S Wahyuni, J Widodo, Sukidin, and M Zulianto. 2020. The strategy of product diversification on SMEs brass craft in Cindogo Village Bondowoso. *IOP Conf. Ser. Earth Environ. Sci.* 485, 1 (May 2020), 012125. DOI:https://doi.org/10.1088/1755-1315/485/1/012125

[16] Hari Nugraha, Sim Teck Ceng, Koichiro Sato, and Fumio Terauchi. Visual Impression of Indonesian Traditional Pattern On the Bamboo Materials. 10.

[17] Hari Nugraha, Fitriah Nurhidayah, and Donna Angelina. 2021. Desain Gerobak Pedagang Keliling pada Masa New Normal Covid-19. *J. Desain Idea J. Desain Prod. Ind. Inst. Teknol. Sepuluh Nop. Surabaya* 20, 2 (December 2021), 72. DOI:https://doi.org/10.12962/iptek_desain.v20i2.11604

[18] Fatuyi O.A. and Aliu E.T. 2019. Glass Surface Decoration by Sandblasting Technique: A Case Study. *Arts Des. Stud.* (April 2019). DOI:https://doi.org/10.7176/ADS/72-03

[19] Hari Nugraha Ranudinata. 2021. The Application of Sandblasting Method for Carving of Batik Pattern on Bamboo Material. (2021), 11.

[20] Reswita, Andi Irawan, and Ketut Sukiyono. 2021. The Role of Small and Medium Enterprises (Sme) On The Economy. *Int. J. Soc. Sci.* 1, 4 (December 2021), 467–472. DOI:https://doi.org/10.53625/ijss.v1i4.743

[21] Irfan Ridwan Maksum, Amy Yayuk Sri Rahayu, and Dhian Kusumawardhani. 2020. A Social Enterprise Approach to Empowering Micro, Small and Medium Enterprises (SMEs) in Indonesia. *J. Open Innov. Technol. Mark. Complex.* 6, 3 (July 2020), 50. DOI:https://doi.org/10.3390/joitmc6030050

[22] Noora Shrestha. 2021. Factor Analysis as a Tool for Survey Analysis. *Am. J. Appl. Math. Stat.* 9, 1 (January 2021), 4–11. DOI:https://doi.org/10.12691/ajams-9-1-2

[23] Adam Smyth and Dennis Duncan. 2019. *Book parts* (First edition ed.). Oxford University Press, Oxford (GB).

[24] Eddy Supriyatna Marizar, Maitri Widya Mutiara, and Agustinus Purna Irawan. 2020. Development of wood carving furniture technology in Jepara. *IOP Conf. Ser. Mater. Sci. Eng.* 852, 1 (July 2020), 012146. DOI:https://doi.org/10.1088/1757-899X/852/1/012146

[25] Nguyen Van Toan, Masaya Toda, and Takahito Ono. 2016. An Investigation of Processes for Glass Micromachining. *Micromachines* 7, 3 (March 2016), 51. DOI:https://doi.org/10.3390/mi7030051

[26] Bhavesh Waghmare, Aadil Khan, Hanish Bari, Dhirendra Patil, and Yusuf Rehman. 2022. Design of Sand Blasting Machine. *Int. J. Res. Appl. Sci. Eng. Technol.* 10, 4 (April 2022), 2589–2592. DOI:https://doi.org/10.22214/ijraset.2022.41649

[27] Ary Widiyanto, Suhartono Suhartono, Marcellinus Utomo, Idin Saepudin Ruhimat, Tri Sulistyati Widyaningsih, Maria Palmolina, Eva Fauziyah, and Sanudin Sanudin. 2021. The Bamboo Business in Tasikmalaya, Indonesia, During the COVID-19 Pandemic. *For. Soc.* (June 2021), 245–260. DOI:https://doi.org/10.24259/fs.v5i2.13704

[28] Rudi Triadi Yuliarto. Problems and Solutions to Improve Banking Performance: In The Pandemic Situation of Covid-19 In Indonesia. 1–8.