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Developing Business Intelligence Model in Creative Craft Industry To Support Acceleration of the Craft Exporter Industry In West Java

By

Fansuri Munawar[1]
[1]Faculty of Economics and Business, Universitas Widyatama;
fansuri.munawar@widyatama.ac.id

Ghifari Munawar[2]
[2]Department of Computer Engineering and Informatics, Politeknik Negeri Bandung;
Corresponding author: ghifari.munawar@polban.ac.id

Didi Tarmidi[3]
[3]Faculty of Economics and Business, Universitas Widyatama;
didi.tarmidi@widyatama.ac.id

Raniri Munawar[4]
[4]Postgraduate School of Tourism Study, Universitas Gadjah Mada;
raniri.munawar@ugm.ac.id

Abstract

The purpose of this study is to develop a model of a business intelligence system for mapping the exports of West Java's creative craft industry. The fundamental issue is that the craft industry's exports are underperforming due to a lack of responsiveness in capturing export opportunities. Furthermore, the inadequacy of a business intelligence system in the craft industry to assess export mapping in the worldwide market underscores the significance of this research. The study uses the research techniques of data collection, identification of information needs, and develop a business intelligence model. This research uses primary data on craft export sales in West Java in the form of exporter data, export commodity data (HS code), export trade transactions, export destination country data, total value, and export volume. The finding in this study is the proposed model of business intelligence stages for mapping the export of craft creative industries and the design of BI implementation. The dashboard BI design can provide knowledge to stakeholders on vital information to answer the analysis of export potential. This model can be a foundation for developing a business intelligence system to assess West Java's export key performance indicators of handcraft products.

Keywords: Business Intelligence Model, Mapping Analysis of Craft Product Exports, Creative Industries

1. Introduction

Nowadays, World economic growth depends more on the creative industry (De Beukelaer, 2014). That is marked by the domestic and international consumer increase (Kong & O'Connor, 2009). Even though the growth of creative industries in developed and developing countries is not the same. In developed countries, the creative sector is growing

significantly due to the increasing number of products and access to more foreign markets (De Beukelaer, 2014).

According to the UNCTAD definition, the creative industry is a cycle of production of goods and services that utilizes creativity and intellectual capital as its main inputs and is categorized based on its role as inheritance, art, media, and functional creation (Bekraf, 2017). As a developing country, Indonesia has a total contribution of the creative industry to the national Gross Domestic Product (GDP). According to data from the Central Statistics Agency (BPS), in 2017, the contribution of the Creative Economy to the national economy was 7.24%, and the growth rate was 5.06%, which is equivalent to national economic growth (Kemenparekraf, 2020).

Craft, as a subsector of the creative industry, is an applied craft at the intersection of art and design, drawn from historical legacy or current concepts to make works of art, practical items, and ornate or ornamental objects (Bekraf, 2017). Micro, small, and medium-sized enterprises dominate the craft sector in Indonesia. It is on abundant resources and raw materials to sustain its existence. West Java, East Java, Yogyakarta, Central Java, Jakarta, and Bali dominate the Indonesian handcraft sector, necessitating development in other regions.

Most of the Indonesian craft industry's problems are low export acceleration, performance, and global competitiveness (Munawar et al., 2019). Export performance can be determined by sales growth and company profitability in export activities. The higher the sales growth, market share, and profitability, the better the company's performance, and vice versa. Performance is the final result of the company's activities, including the actual results of the company's strategy (Wheelen & Hunger, 2012). The low export performance of the craft industry is because most export activities in developing countries, including Indonesia, are carried out by small companies (Adu-Gyamfi & Korneliussen, 2013). Small companies that export are very vulnerable to many obstacles related to operating activities abroad because they tend to be minor, located far from the primary market, have limited resources, limited management experience in exporting, high export barriers, and a little level of internationalization (Adu-Gyamfi & Korneliussen, 2013).

In addition, obstacles in foreign markets will make it challenging to improve export performance. Market barriers include internal barriers such as functional, informational, and marketing, while external barriers such as procedural, regulatory, and environmental policies (Narayanan, 2015). The craft industry is still finding it difficult to adapt well to the rapid changes in the market, environment, and technology, as well as how to increase creative imagination in product innovation. Still, they do not optimize the exploitation of market opportunities, maximize resource potential, and manage risks to enter new markets.

According to the findings of interviews with the West Java Disperindag Head of Export, West Java Deskranasda, West Java Chamber of Commerce and Industry, and various craft export actors, export constraints and barriers needed to be overcome immediately, and craft business actors in West Java should improve their ability to capture export opportunities. As a result, to expedite product exports, it is essential to employ information technology that can assess the export mapping of craft creative sector products in West Java. It is also done so that business actors may realize the potential of their craft items to compete on a global scale. A business intelligence system is one-way information technology can be used.

Business intelligence (BI) uses technology, applications, and processes to collect, store, access, and analyze data to make better decisions (Nyanga et al., 2020). BI is presently employed in a variety of industries, including educational institutions (Foshay & Kuziemsky, 2014; Scholtz et al., 2018), healthcare institutions (Prayitno, 2018; Vajirakachorn & Chongwatpol, 2017), and tourism (Olszak & Ziemba, 2007). The business intelligence (BI) system was created to convert data into information and knowledge and establish numerous contexts for successful decision-making, strategic thinking, and action in businesses (Olszak & Ziemba, 2007). To investigate the export potential of handcraft items in West Java, a BI system must be designed to analyze business opportunities and obstacles using historical data to estimate future business potential. Primary data from export sales of craft products from the West Java Province Disperindag, related government regulations or policies, interviews and field surveys with craft businesspeople, and secondary data from other external data are some of the data sources that can be analyzed.

This study aims to develop a business intelligence model for mapping analysis of West Java's exports of handcraft industry products. Future craft export market potential can be determined by developing the proposed model into a prototype of a business intelligence (BI) system that can be used by both craft business participants and the government. Therefore, the author underlines the significance of developing a business intelligence model for export maps based on potential, trends, and characteristics to increase exports of West Java's creative craft industry's products.

2. Literature Review

It is essential to perform a comprehensive literature evaluation relevant to the research topic to gain a deeper understanding and comprehension of the mentioned themes. Reviewing the current literature will give a solid theoretical framework for selecting the study methodology and justification that the proposed research expands on the body of knowledge (Qushem et al., 2017). Adopting a BI system from initial concepts includes advancing managers' decision-making processes and facilitating sharing of data insights across the organization. The customization of the BI system is the most critical aspect in the effective adoption of BI, according to the requirements of the managers. In addition, the significance of all system life cycle stages for the successful adoption of BI can be underlined.

The term business intelligence (BI) was first mentioned in 1958 by HP Luhn, an information science pioneer (Vizgaitytė & Rimvydas, 2012). In this approach, he viewed BI as "a system that facilitates the gathering, dissemination, storage, retrieval, and transmission of new information to perform functions more efficiently and use the support of new technologies" (Luhn, 1958). The fundamental goal of business intelligence is to help the decision-making process, enabling successful and innovative management. However, it was not until the late 1980s, when Gartner Group's Howard Dresner was recognized as the pioneer of business intelligence, that the term was popularized and described as a broad term that includes applications, tools, and information analysis that aids in the performance and optimization of organizations' decisions (Becerra-Godínez et al., 2020).

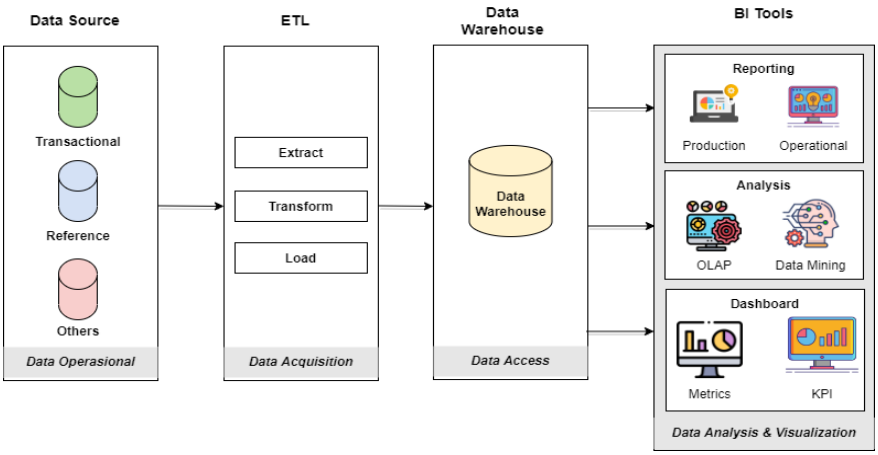

Figure 1: Conceptual BI Framework

BI is a support system that facilitates more accurate data analysis. BI is a common term for architecture, databases, analytical tools, techniques, and applications that can aid decision-making (Vajirakachorn & Chongwatpol, 2017). BI consists of four major components: data warehouse, business analytics, business performance management (BPM), and user interface (Vajirakachorn & Chongwatpol, 2017). The BI system's user interface is typically portrayed as a dashboard or data visualization, allowing two-way communication between the user and the system to see a whole perspective of the company's performance measures (Vajirakachorn & Chongwatpol, 2017). The BI system was created to convert data into information and knowledge to help the firm make better decisions and take more strategic actions (Olszak & Ziemba, 2007). As indicated in Figure 1, the role of the BI system is to support decision-making by gathering and consolidating data via ETL and data warehouse/database, data analysis and reporting via OLAP, and data drilling (data drilling) via data mining.

There are numerous extant BI models, with the majority focusing on technological and business process challenges. In truth, many company organizations are not yet in the advanced stages of BI deployment, that require attention and improvement owing to a lack of focus on other essential areas such as organization (Qushem et al., 2017). However, BI is now widely employed in a variety of industries, including educational institutions (Foshay & Kuziemsky, 2014; Scholtz et al., 2018), health institutions (Prayitno, 2018; Vajirakachorn & Chongwatpol, 2017), and tourism (Olszak & Ziemba, 2007). Vajirakachorn & Chongwatpol (2017) and Saragih et al. (2021) conducted several examples of BI research in the tourism sector. Vajirakachorn & Chongwatpol et al. (2017) undertook a study to apply BI to data on visits to local food festivals in Thailand, with the goal of festival organizers studying visitor behavior based on business success indicators (such as sales, profits, satisfaction scores, costs, loyalty, and revisit intentions) to maximize client satisfaction and future revenue and profits for the organizers. Research by Saragih et al. (2021) has developed a BI-based dashboard system to monitor tourism activities in Bali, where the BI system was developed by studying tourist visit data from the past period to be able to provide forecasting of visit data in the coming period. Concerning export trade, Darman (2018) conducted research related to the implementation of BI in determining national fishery export trends. The study shows that the BI system can help provide critical market analysis, such as the export destination country with the most significant volume, the export destination country with the highest value, the time series of national fishery export value and volume, the highest export commodity, and the lowest export commodities. Visualized export trend data can help make strategic decisions and plans to analyze market

information and handle obstacles to exporting marine and fishery products abroad. These studies show that BI technology can help businesspeople see potential in the future.

This study creates a foundation for a business intelligence system for mapping analysis of craft industry product exports in West Java. The proposed model can evolve into a prototype of a BI system that will help craft business participants and the government see the future possibilities of the craft export industry. The immediate urgency of this research is the lag in craft sector exports caused by a lack of responsiveness in capturing export possibilities. Second, the craft industry lacks a business intelligence system to assess export mapping worldwide. Third, while West Java has several handcraft industries, the share of exports remains low. Fourth, in the Industrial Era 4.0, the craft business should analyze export mapping to boost future export potential.

3. Methodology

3.1 Business Intelligence Stage

Business intelligence has three main phases, namely (1) data acquisition, (2) data access, and (3) data analysis, such as the BI concept presented in research (Khan & Quadri, 2012). Data relevant to the BI process will be sourced from internal organizations, such as operational or transactional data related to craft export business records and reference data such as craft products, businesspeople, etc. Besides that, it is also necessary to explore external data sources that can be processed from various sources, including the government, agencies (third parties), customers, competitors, suppliers, the internet, world trade platforms, etc. The amount of heterogeneous data managed at BI will be processed through an extract, transform, and load (ETL) process to be stored in a data warehouse. The results of the BI analysis will be visualized in the form of a dashboard that can be used as knowledge and information for leaders as part of a decision support system. Figure 2 shows BI modeling stages for craft exports.

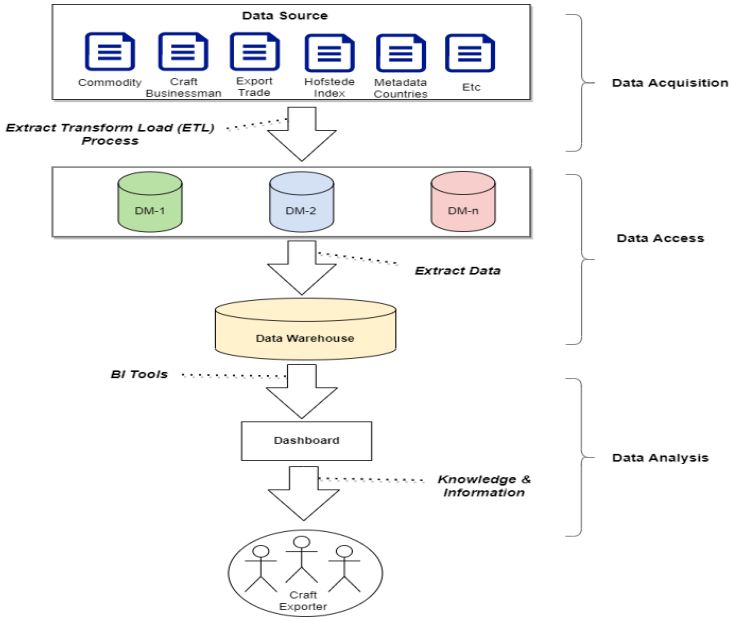

Figure 2: BI Modeling Stages for Craft Exports

3.2 Data Source Setup

At this stage, the data is carried out to obtain operational data. It is related to the craft export business domain, transactional data, reference data, and other data such as export commodity data, export trade transaction data, data for West Java craft business actors, export destination countries, etc. The data to be analyzed is all the data in the data source obtained from various primary and secondary sources into a dataset. The dataset that has been prepared will then be restructured through several stages and stored in a large data repository with standards that meet the needs of the analysis. The analysis is carried out to determine what data is needed to support decision-making for craft businesspeople. The information generated by BI must be clear, complete, and directed and presented in a display that makes it easy for users to understand; this display is generally presented as a dashboard. The method used for primary data collection is through field studies of the West Java Department of Industry and Trade (Disperindag Jabar), the West Java Tourism and Culture Office (Disparbud), and the Central Statistics Agency (BPS) West Java. In this study, the product export with the HS codes 44 for wood and woodworking, 46 for basic materials, 67 for prepared feathers and related works, artificial flowers, and hair works, 69 for ceramic products, and 96 for other works are the main subjects of study. Table 1 shows the HS code of craft export commodities.

Table 1: HS Code of Handicraft Export Commodities

No	HS Code	Description
1	4401, 4402, 4403, 4404, 4405, 4406, 4407, 4408, 4409, 4410, 4411, 4412, 4413, 4414, 4415, 4416, 4417, 4418, 4419, 4420, 4421	44 - HS Code for Wood and woodworking
2	4601, 4602	46 - HS Code for Articles of base
3	6701, 6702, 6703, 6704	67 - HS Code for Prepared feathers and penguins and their works; artificial flowers; hair work
4	6901, 6902, 6903, 6904, 6905, 6906, 6907, 6909, 6910, 6911, 6912, 6913, 6914	69 - HS Code for Ceramic products
5	9601, 9602, 9603, 9604, 9605, 9606, 9607, 9608, 9609, 9610, 9611, 9612, 9613, 9614, 9615, 9616, 9617, 9618, 9619, 9620	96 - HS Code for Miscellaneous works

The business indicators are analyzed from the quality index, which is the determining factor of the export sales of crafts, starting from the commodity quality index, the quality index of business actors, the quality index of the export sales of crafts, the quality index of market trends, the quality index of export market acceptance, the quality index of export reach, the index of quality of market size, quality index of infrastructure facilities supporting export trade, and quality index of cultural comparison.

3.3 Data Warehouse Design

The data warehouse design stage is carried out through the extract transform load (ETL) process. Extraction is carried out to identify and retrieve various relevant data from the data source. This process allows the data source to consist of multiple formats such as spreadsheets, JSON, databases, XML, or other files. Generally, the extraction process will first store data in the "staging area" to overcome data integration issues such as data type format problems, null values, and missing or corrupt data to be handled in the following process. The transformation

process is carried out to change inconsistent data from data sources, such as naming attributes that are not the same or data coding that is not uniform; this process is carried out by filtering data, cleaning data, joining data, splitting data, sorting, changing data type formats and manipulation processes. Other data. This is done so that the data used in the BI system becomes "cleaner" and follows the needs of analysis. The final process of ETL is data load, where the dataset has been processed and will be entered into a data warehouse. Table 3 ETL process in the data warehouse.

The data warehouse schema in this study uses a star schema consisting of tables that function as facts and dimensions. The fact table is data that contains records of "facts" that cannot be changed, such as data tables related to the export trade of craft products or other transactional data. In contrast, the dimension table contains reference data used in BI. Data warehouse dimensional models such as star schemas are generally implemented as the relational model. Research (Abbas et al., 2021) explains three approaches to building a data warehouse: top-down, bottom-up, and hybrid. The data warehouse development method used in this research is bottom-up, where information flow starts from the extraction process of information from various segments, sources, or databases. Various data sources will be processed through ETL into a data mart (DM) which will then be extracted back into one data warehouse. This approach is considered suitable for this study because the data tend to be heterogeneous.

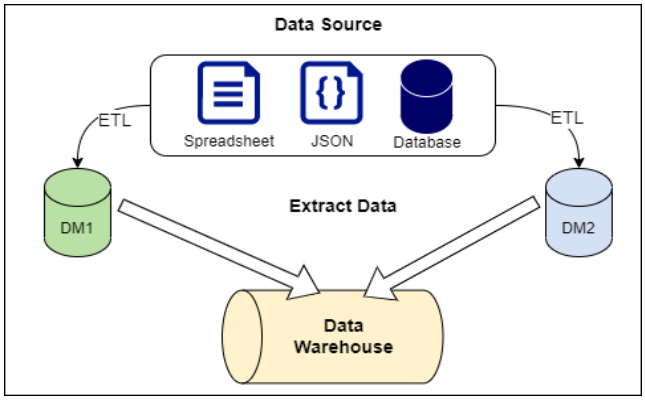

Figure 3: ETL Process in Data Warehouse (Bottom-up Approach)

3.4 BI Dashboard Design

User interface design is vital for computer systems because it will impact user productivity and efficiency (Few, 2006). BI dashboards must be designed effectively to improve data analytics aspects in decision-making. Improper use of visuals affects users so that they can shift focus on the wrong things (Orlovskyi & Kopp, 2021). The steps taken in designing the BI dashboard in this study are adopted from Orlovskyi & Kopp (2021), which divides the stages into five activities, namely (1) preparing data sources on the BI system in the form of data marts (DM) or data warehouses (DW) to be transformed into datasets, (2) prepare a subset of data from the dataset to be visualized, (3) choose a threshold for visualization data, especially to see the achievement of business indicators, (4) determine the appropriate visualization component according to the needs of the dataset and the information

to be conveyed to users, and (5) Place the visualization component on the dashboard screen and connect it to the dataset.

4. Results and Discussion

4.1 BI Dataset

The data used in BI is analyzed from various relevant data sources as needed. Some issues encountered in the BI dataset preparation process were missing values, data inconsistencies, format errors, data type errors, and data content inconsistencies. This is because different data sources generally have different types of data types and data formats. The information stakeholders need includes which country is the leading export destination for crafts, how to compare in terms of total FOB, volume, and quantity for each craft commodity, the export trade trend periodically, etc. These questions are information that needs to be explored by BI by building a suitable dataset. The data that has been obtained from the field study is collected in the form of a spreadsheet format containing several data attributes that suit the needs. There are 13 types of information used in this study, both from primary and secondary data sources containing transactional and reference data, as shown in Table 2.

The datasets obtained are generally transactional data from numbers 2 to 12, while there are only two reference data, namely West Java craft industry data (number 1) and craft export commodity data (number 13). The obstacle faced by this problem is the tendency of the data to have many formats (heterogeneous), so it is necessary to pre-process the data before it becomes a BI dataset.

Table 2: BI Datasets

No	Information Type	Attribute Name	Data source
1	West Java Craft Industry	Company Name, Owner Name, Address (Street, Village, District, City, Province), KBLI2020, Product Type	West Java Disperindag
2	Respondents of West Java Craft Business Actors	Business Name, Location (Regency/City), Product Name, Raw Material, Keg. Business, Number of Employees, Marketing Area, Export Country Destination, Export Time, Turnover	Results of interviews with West Java craft businesspeople
3	Total Country Population	Country, Total Population, Yearly Change Avg. 5 years, Yearly Change Avg. 20 years, Density Inhabitants/km ^{2}	External Sources
4	Distance from Indonesia to the World	Destination Country, Kilometers, Miles, Direction	External Sources
5	The Length of the Highway of the Whole Country	Country, Total (Km), Per Capita (m), Per km ^{2} (m), YearUpdated	External Sources
6	The Length of the Railroad All Over the Country	Country, Total (Km), Per Capita (m), Per km ^{2} (m), Year	External Sources

7	Number of Airports in All Countries	Country, AmountOfAirports, Year	External Sources
8	Countrywide Port Traffic	Country, PortTraffic, YearUpdated	External Sources
9	Country Hofstede Index Value	IDCountry, CountryName, PowerDistance, Individualism, Masculinity, Uncertainty, Long Term Orientation, Indulgence	External Sources
10	West Java Export Trade Data	HSCode, Description, Export Value (US Dollars), Year	BPS West Java
11	World Export Trade Transaction Data	HSCode, Product Description, Exporter Name, Exporter Address, Importer Name, Importer Address, Destination Country, Quantity, Unit of Measure, Gross Weight (kg), Nett Weight (Kg), FOB Value	Trade Data Platform
12	Country Import GDP Data	Country Name, Country Code, Indicator Name, Amount of 1960 – 2021.	Worldbank
13	Craft Export Commodity Data	HSCode (2 digits), HSCode (4 digits), Description	West Java Disperindag

4.2 BI Data Warehouse

Each business process in the data warehouse is represented by a dimensional model consisting of a fact table containing several numerical measurements and surrounded by a dimension table containing the data context. This model establishes the “star join” as an early term for relational databases. BI datasets that have been prepared will be processed through online transaction processing (OLTP) and stored in a database management system (DBMS) such as Oracle, MS SQL Server, MySQL, Informix, etc. Before being entered into the data warehouse, the ETL process will be carried out first to ensure that the data used by BI is clean and as needed. ETL tools such as SQL Server Integration Service (SSIS), Talend Open Studio, Pentaho Data Integration (PDI), etc., can integrate various datasets into the data warehouse. This study uses a bottom-up approach model to design the data warehouse, where the dataset will be collected into a data mart first. A data mart (DM) can be said as a “mini” data warehouse that is generally developed to group data according to the needs of BI analysis. This can facilitate the development of BI prototypes according to the needs and readiness of the data. Some of the data marts (DM) developed in this research are the Profile of Craft Business Actors (DM-1), Craft Export Trade (DM-2), Profile of Craft Export Destination Countries (DM-3), and Craft Export Commodities (DM-4). Figure 4 shows the dimensional model in DM-2 for the export trade fact table flanked by dimension tables in the form of date, country, commodity, and hosted index.

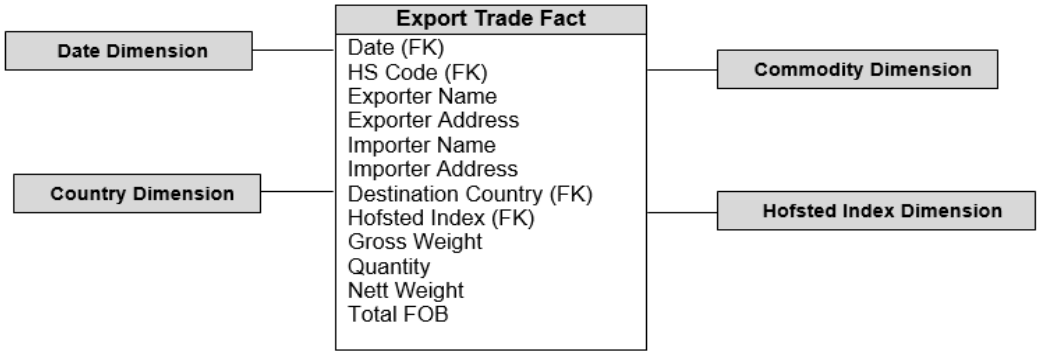

Figure 4: Dimensional Model Export Trade Fact (DM-2)

4.3 BI Dashboard

The dashboard design contains various visualizations, such as graphs and charts, which must be arranged within a particular area. Business Intelligence (BI) dashboard apps may mislead business users and divert their focus and attention to trivial or incorrect matters if they select unsuitable visualization charts that do not match the type of data presented in datasets prepared for visualization. Consequently, the dashboard design is of utmost importance in modern times, when processing and analyzing large volumes of data are vital for making sound business decisions. Due to the problem's non-trivial and sufficiently sophisticated nature, it is necessary to suggest a BI dashboard design approach (Orlovskyi & Kopp, 2021).

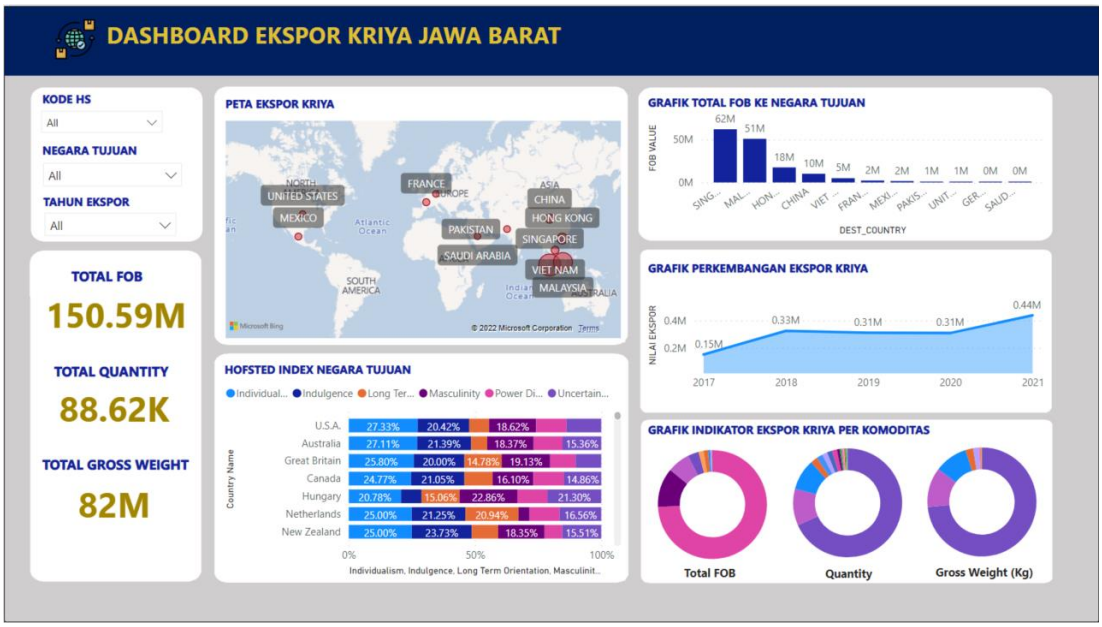

Figure 5: Proposed Model of BI Dashboard

BI Dashboard to visualize data can be designed using BI Tools such as Spago BI, Power BI, Tableau, Qliksense, and Jaspersoft. Research by Gowthami & Kumar (2017) has compared several BI tools. It shows that Power BI has advantages in ease of use, support for multiple data sources, security aspects, and integration into the cloud. It can be considered a tool for implementing BI dashboards. Hansoti (2010) highlighted some of the features that are considered in designing the dashboard: (1) a dashboard must have a filter, sorting, and data analysis features; (2) it has the functionality to drag and drop visual components; (3) must be able to provide drillable charts and graphs, and (4) must be able to make alternative scenarios. Several things must be avoided in designing the dashboard: information overload, limited

information, and complex user interfaces (Hansoti, 2010). Too much information on the dashboard can distract users from the wrong focus, and vice versa; if there is too little information, the essential things become invisible. Dashboards should not be made complex because they are generally used by executives or managers with little time to learn new technologies; the navigation process should be easier for users.

Figure 5 models the BI dashboard proposal according to the dimensional export trade fact (DM-2) model. Various visual components make it easier for users to understand the information. The components used are (1) card components to display the total FOB, total quantity, and total gross weight; (2) map components to display craft export mapping, (3) various types of graphic components to display country-hosted indexes, total FOB to destination countries, systematic development of craft exports, and achievement of craft commodity indicators based on total FOB, quantity, and gross weight (kg). In addition, the slicer component is also used to filter data based on HS code, destination country, and year of export.

The information displayed on the dashboard can answer the following questions:

- Q1: What is the total FOB, total quantity, and total volume of the export trade of the West Java craft industry?
- Q2: Which countries are the export destinations for the West Java craft industry?
- Q3: How is the cultural comparison (based on the value of the Hofstede index) between the export destination countries of West Java crafts?
- Q4: How is the total FOB comparison from the export destination countries of West Java crafts?
- Q5: How is the development of West Java craft exports from year to year?
- Q6: What is the percentage between West Java craft export commodities based on the total FOB, total quantity, and total volume?

The BI dashboard modeling designed to answer these questions is by implementing the BI tools as follows in Table 3.

Table 3: BI Tools Implementation

No	Question	Visual Component	property	Data Attribute	Data Table
1	Q1	Card	Fields Fields Fields	Summary of FOB Value Summary Of Quantity Summary Of Gross_Weight_in_Kg	Export Trade Facts
2	Q2	Folder	Location Size Axis	Destination Country Summary of FOB Value Country Name	Export Trade Facts
3	Q3	100% Stacked Bar Chart	Values	Summary of (Individualism, Indulgence, Long Term Orientation, Masculinity, Power Distance, Uncertainty Avoidance)	Hofsted Index Dimension

4	Q4	Stacked Column Chart	Axis Values	Destination Country Summary Of FOB Value	Export Trade Fact
5	Q5	Stacked Area Chart	Axis Values Legend	year Summary Of FOB Value HS Code	Date Dimension Export Trade Fact Commodity Dimension
6	Q6	Donut Chart	Values Values Values	Summary Of FOB Value Summary Of Quantity Summary Of Gross_Weight_in_Kg	Export Trade Fact

The business intelligence modeling carried out in this study shows that BI can be used to provide knowledge and information to stakeholders to support decisions. Various key questions from craft businesspeople can be visualized in the form of a dashboard through multiple data processing. Several other analytical techniques, such as time series and model charting, modeling, what-if analysis, forecasting, and statistics, can be used through the Online Analytical Processing (OLAP) method. OLAP allows users to explore and study large amounts of data, including processing complex computations, viewing data relationships, and presenting the results visually from various perspectives; this can be a follow-up study for future research.

5. Conclusions

In adopting BI solutions, we must consider the advantages offered in decision-making support: the quality of business information provided, robust tools for data analysis and visualization, reduced decision-making costs, web-based accessibility, and increased effectivity and efficiency in the decision. In a competitive environment, craft industries can gain constant export acceleration by making the right decision based on an effective BI solution at the right time. This study focuses on West Java's business intelligence model for creative craft industries. Through developing of business intelligence model to map the craft sector in West Java, this study aims to identify a method for accelerating the exports of the creative craft industry. The model established in this research is based on a literature review and collection of data from government and private institutions related to export data for formulating an acceptable model for a business intelligence system. With the support of the BI solution, the owner or manager of the creative craft sector in West Java should be able to make export decisions with the potential to boost revenue. In addition, this model can be a foundation for developing a business intelligence system to assess the export key performance indicators of handcraft products in West Java.

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