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Decision Support System in Fisheries Industry: Current State and Future Agenda

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Abstract—**Decision Support Systems (DSS) are systems that assist decision-makers and aim to synthesize domain and technical knowledge and package it so non-scientists can use and comprehend it. This study aims to compile initial empirical studies that can objectively reject or confirm the central hypothesis. The materials were retrieved after applying the filtered query across all sources. All search engine providers use five query strings. In each example, five findings were collected, sorted, and compared to one another, and 152 papers were generated. Seventy-six documents were discovered after applying the inclusion and exclusion criteria. Each of the 70 papers was independently examined and analyzed. The method of study followed a specific procedure explicitly developed to minimize the risk of researcher bias. It is primarily concerned with whether fisheries have decision-making systems and what empirical outcomes these systems produce, particularly in real-time analysis. The result shows a dearth of research on intelligent DSS, which accounts for less than 3% of all DSS types discussed in the article. This study offers academics and professionals an overview of the implementation of DSS. These new contributions imply the form of several different new contributions to further research. Furthermore, the possibility of identifying research gaps increases once merged with geoinformation technology or spatial information. We introduced a new model that combines spatial logistics techniques with GIS-based tracing and tracking. The envisioned logistics ensure spatial and logistical traceability in the process of fish products.**

Keywords— **Decision support systems; fishery; systematic literature review; future research agenda.**

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I. Introduction

The fisheries industry plays a critical role in the global food supply, providing a major source of protein for millions of people worldwide. However, overfishing, habitat destruction and climate change have put many fish populations at risk, threatening the sustainability of industry and the livelihoods of those who depend on it. To address these challenges and ensure the long-term viability of the fisheries industry, decision-makers need access to accurate and timely information about fish populations, fishing practices, and the broader marine ecosystem.

DSS can provide fisheries managers with the data, models, and expert knowledge they need to make informed decisions about managing fish stocks and promoting sustainability. DSS can help optimize fishing quotas, assess the impact of fishing on the environment, and evaluate the effectiveness of different management strategies. By improving the efficiency and sustainability of the fisheries industry, DSS can help ensure that it continues to provide an important source of food and income for communities worldwide.

Decision-making in the fisheries industry is a complex decision problem. Predicting how much demand will occur tomorrow depends on market information, harvested fish quality conditions, economic conditions, demand modeling, and others. The ability to make judgments in the face of so many variables and pieces of information is complicated, yet it can aid decision-makers in optimizing corporate operations.

The process of decision-making in the fisheries industry is a multifaceted problem, involving several factors such as predicting the price and size of the fish harvest and determining the best market to sell the fish. Predicting future demand requires considering various factors such as market information, quality conditions of the harvested fish, economic conditions, and demand modeling. Despite the complexity of the task, the ability to make informed judgments can help decision-makers to optimize business operations.

Decision Support Systems (DSS) are systems designed to enable decision-makers to make the right decisions in dealing with complex problems. DSS aims to bring together domain and technical information and package it feasible for non-scientists to use and understand [1]. Decision support systems (DSS) have been around since the 1960s [2] and have been used in various fields. Although the taxonomy and basic procedures for developing, deploying, and sustaining DSS are extensively documented in case studies and research, there is little literature on empirical judgments about their efficacy in a given area. Nevertheless, it has only been included in the decision support systems in treatment, and a systematic review of targeting effects [2]–[4] and how to improve the system has been conducted on the system [5], [6]. Research on spatial DSS in fisheries is more closely connected to DSS research and has been investigated in non-systematic surveys [6]–[8]

Decision Support Systems (DSS) are increasingly being used in the fisheries industry to aid in decision-making processes related to managing fish stocks, reducing overfishing, and promoting sustainability. Here is the present state of DSS in the fisheries industry:

Types of DSS in the Fisheries Industry:

- Data-driven DSS: These DSS rely on large amounts of data from various sources, such as satellite imagery [9], fishing vessels [10], and weather reports [11], to provide insights on fish population dynamics [12] and help fisheries managers make informed decisions [13].
- Model-based DSS: These DSS utilize mathematical models to simulate the behavior of fish populations and predict future trends. They can be used to optimize fishing quotas, assess the impact of fishing on the environment, and evaluate the effectiveness of different management strategies [14].
- Expert systems: These DSS combine expert knowledge with data and modeling techniques to provide advice and recommendations to fisheries managers [15]. They can be used to identify areas where overfishing is likely to occur, evaluate the effectiveness of different management policies, and predict the impact of changes in fishing regulations [16].

Applications of DSS in the Fisheries Industry:

- Fish stock assessment: DSS can help fisheries managers estimate the size and structure of fish populations, predict their growth rates and mortality rates, and evaluate the impact of fishing on their populations [17].
- Fishing quota management: DSS can help determine the appropriate level of fishing quotas to maintain sustainable fish populations and prevent overfishing [18], [19].
- Ecosystem-based fisheries management: DSS can help fisheries managers assess the impact of fishing on the broader marine ecosystem and evaluate different management strategies that consider the interactions between different species and their environment.

Challenges faced by DSS in Fisheries Industry:

- Data availability and quality: DSS requires high-quality data from various sources, but obtaining and managing such data can be challenging in the fisheries industry due to the lack of standardized data collection practices and inconsistent data quality [20].
- Uncertainty and variability: The dynamics of fish populations and their environment are complex and variable, and DSS must be able to account for this uncertainty to provide accurate predictions and recommendations [21].
- Integration with existing management frameworks: DSS must be designed to integrate with existing fisheries management frameworks and regulations, which can vary widely between different regions and countries [4].
- Resistance to change: Implementing new DSS in the fisheries industry requires significant changes to existing practices and policies, and stakeholders may resist these changes due to concerns about their economic impact or other factors [22].

This article aims to present a comprehensive overview of the current status of Decision Support Systems (DSS) in the fisheries industry and to examine the future agenda for their further development. There is a trim or no decision support system for fisheries and the related sectors. A wholly integrated information system with advanced analytical models that accurately reflect real-world circumstances for the fishing business also lacks the industry. Identify relevant techniques and highlight the need for additional research; a mapping analysis of existing research on DSS should be carried out. In this work, we used best practices methodologies developed by prior practitioners to conduct a systematic mapping analysis of the literature that was accessible at the time [23].

We discover that fisheries decision support systems seldom evaluate their plans empirically, implying that further empirical and practical research should be carried out in these fields. As a result, many fisheries industries' decision support systems developed in the previous five years are focused on a single issue rather than providing various features for a diverse range of stakeholders while considering a variety of criteria. We observe that experimental analysis and real-time data analytics are now almost quasi in the domain.

One issue that seems to be prevalent is that many of these systems are focused on a single issue rather than providing a diverse range of features for stakeholders while considering multiple criteria. This suggests that there is a need for more comprehensive and holistic decision support systems that can consider the many factors that affect fisheries management.

In order to address these issues, it may be necessary to conduct more experimental analysis and real-time data analytics. This could involve using advanced technologies and tools to collect and analyze real-time data to understand better how different factors affect fisheries management.

Overall, there seems to be a need for more research and development in fisheries decision support systems. By conducting more empirical evaluations and using advanced data analytics tools, we can better understand how to develop more effective and comprehensive systems that can meet the needs of a diverse range of stakeholders.

II. Materials and Method

A detailed literature assessment was done to ascertain the present decision support system research in aquaculture. This mapping study was conducted according to a specified procedure that was developed specifically for this study to limit the risk of researcher bias [24]. Review procedures are critical components of the process when it comes to giving context and domain categorization. Review protocols should be created independently for each mapping research to specify the essential criteria for performing systematic mapping studies [25]. According to Chong, Lin, and Chen [26], the research questions in mapping studies tend to be larger than those in standard Study Literature Review (SLR) to cover a broader area of study appropriately. A further point made by Vidoni [27] is that mapping studies are likely to result in an extremely high number of investigations, giving a far broader scope than SLR results. For mapping out the characteristics of the DSS field in fisheries industries, four research questions (RQ) were created as follows:

- How could decision support systems be used in the fisheries industries? (RQ1)
- What are the often-discussed DSS topics in fisheries, and how are they developed? (RQ2)
- Are our real-time analytics used by current fisheries disaster-prevention systems (DSSs)? (RQ3)
- Does the DSS model in fisheries use machine learning techniques applied to the data collected? (RQ4)

A. Research Protocol

It has been decided to conduct mapping studies similarly to traditional SLR research since a comparable method for searching is expressly described in the study protocol and published as part of the results in conventional SLR studies [23]. Researchers should consider their motivations for doing an electronic or manual search or a combination of the two [2]. The following sources were used in this investigation i.e., IEEE Explore, Google Scholar, Science Direct, and Scopus Indexing.

Since they are two of the most significant data repositories in science and collaborate on a discussion of the leading digital libraries considered appropriate for this study, these sources were chosen to be included. During this survey, no researchers were personally contacted. Because of the inclusion and exclusion criteria, the results acquired from searching numerous data sources were either rejected or approved in the core research process for selection. It is used to eliminate articles that are irrelevant to answering research questions, and it is one of the activities in mapping studies that is essentially equivalent to SLR. SLR is a research method to identify, evaluate, and synthesize relevant studies on a particular topic. The primary objective of an SLR is to provide an exhaustive and unbiased summary of the available literature on a specific subject. The main advantage of SLR is its rigorous and transparent methodology that ensures the findings are based on the best available evidence. It also minimizes bias by providing a systematic literature selection, evaluation, and synthesis approach.

Another benefit of SLR is that it enables researchers to identify gaps in the existing literature, which can be useful for future research. It also allows researchers to identify inconsistencies or contradictions in the available evidence and helps to clarify the current state of knowledge on a particular topic. Overall, SLR is a valuable tool for decision-making, as it provides a comprehensive and reliable summary of the available evidence, enabling decision-makers to make informed choices based on the best available evidence. Additionally, it is utilized to exclude irrelevant publications to resolve research problems. The following criteria were used to determine inclusion:

- Only published in English is acceptable.
- Study the subject specified in the research question by mentioning or referring to it in the title or abstract of the paper.
- Articles must be published after 2016 to be considered.
- Articles are not restricted to a specific geographical location.

Search phrases in fisheries industries DSS were used to locate relevant publications in line with our review procedure, followed by the letter. Vidoni provided us with a technique for generating query strings, which we used in our review protocol [27]. The search keywords were chosen through a trial-and-error process from a pool of possibilities filled with derived terms generated from the study problem. We arrive at the following final search string: decision support systems, fisheries, systematic mapping, software engineering, and machine learning. These are all examples of topics that fall under this category. For our reference management, we utilized Mendeley. To compile, we classify and record the contents of each paper based on the independent assessments we conducted for each article.

B. Selection Process

Following the application of the filtered query across all sources, a total of 267 items were retrieved. All search engine providers use five query strings. In each case, five findings were gathered, sorted, and then compared against one another. There were 152 papers created when the biggest denominator of the source was used. After applying the inclusion and exclusion criteria, 76 documents were discovered using human and automated searches. After then, each of the seventy-six papers was thoroughly reviewed and analyzed independently. Thirty-three articles were created, with the most relevant issue and meeting the criteria that had been established.

Each evaluator produced a list that included all the articles and a brief explanation of each study and how it contributed to resolving the research issue that this research sought to answer. Separate assessments are examined to correctly determine whether or not the paper should be used in the study. A judgment must be formed based on the list that has been compiled to avoid certain research biases from being introduced. Table 1 contains a comprehensive list of all 27 studies considered for inclusion.

TABLE I
CATEGORIES STUDIES BY TOPIC DISCUSSED

Quotation Content	Document
Fishery (20)	[28]; [29]; [30] ; [31]; [32]; [33]; [34]; [35]; [36]; [37]; [38]; [39]; [40]; [41]; [42]; [43]; [13]; [44]; [45]; [46];
Aquaculture (13)	[47] ; [48]; [49]; [6]; [50]; [51]; [52]; [53]; [54]; [55]; [56]; [57]; [58];

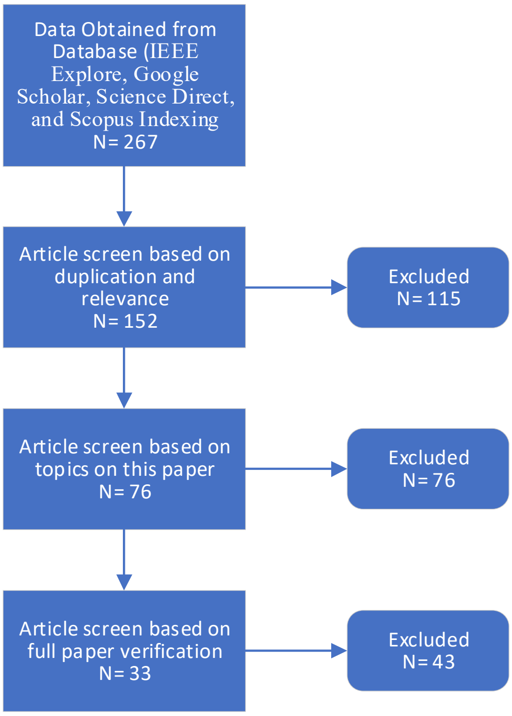

Fig. 1 The steps of the review

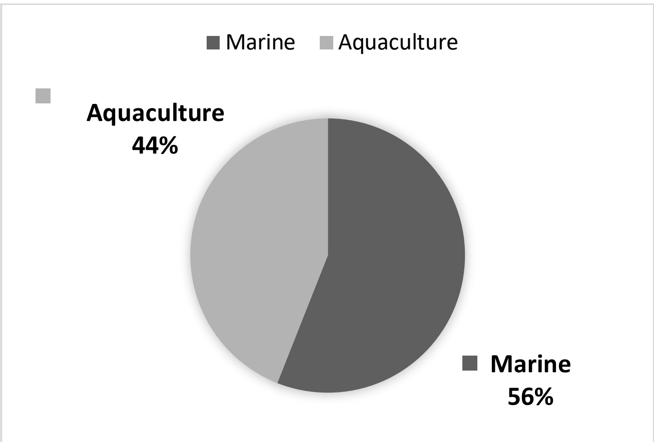

Fig. 2 The percentage of the topic discussed

III. Results and Discussion

A. Results

We began by listing the number of journals discovered during the search phase and sorting them by the year of publication in which they were published. However, it is emphasized that the data given in Fig. 2 only comprises 33 articles and, as a result, serves as the foundation for addressing the research questions. It is primarily concerned with whether there are decision-making systems in fisheries or not and what empirical outcomes these systems produce, particularly in real-time analysis. Most of this study will be based on research questions from mapping studies. We address our studies in the form of a qualitative synthesis comparable to what Vidoni [27] described in the literature

The DSS publishing trend has been steadily increasing over the last five years. Fig. 3 illustrates that fishery decision support systems are fascinating topics to research and discuss and are experiencing steady improvement. According to Canale and Chapra [49], there are more minor publications on multicriteria decision-making in fisheries management compared to other fields such as agriculture, forestry, and finance. In general, the greater the number of publications that appear on a given topic, the greater the amount of research encouraged, and thus the greater the number of publications generated [49]. The absence of published results may cause reluctance to adopt MCDM techniques among decision-makers. It is concluded that using multicriteria decision-making in developing fisheries management policies can be highly beneficial. Each research question is addressed in turn in the following sections, which will be discussed in more detail in the following areas.

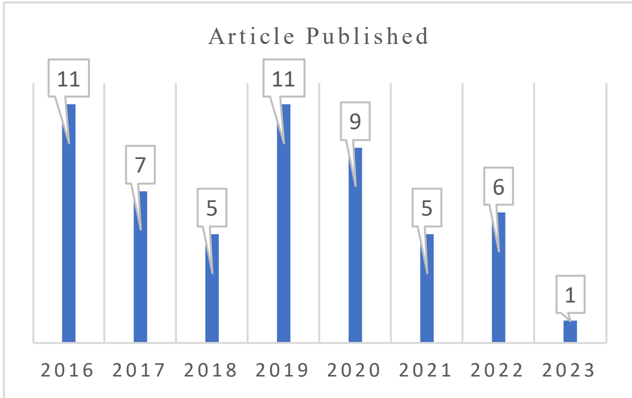

Fig. 3 DSS journal published in fishery

1) (RQ-1) What decision support systems are available for the existing fishing industry?

A rough classification of the DSS discovered during the review portion of the mapping research can be made based on RQ1 and may be separated into two groups. The following findings are reported in Table 1. Table 1 demonstrates that DSS research is more focused on fisheries than on aquaculture; nevertheless, both sectors have a strong basis in research and case studies, as shown in the table. Further categorization has been carried out, and the results are presented in Table 2. The categorization of DSS in fisheries is shown in the first column of Table 3.

TABLE II
DSS Grouped

DSS Type	Fishery	Aquaculture
DSS_Driven_Model	2	
DSS_Spatial	3	3
DSS_Multi_Criteria	1	6
DSS_Grid_Based	1	2
DSS_Knowledge_Based	4	2
DSS_Multiobjective	1	2
DSS_Data_Driven	1	1
DSS_Neural_Network	3	5

In contrast, the classification of DSS in aquaculture is shown in the second column of the same table. Most fisheries' DSS systems use model-based architectures or neural networks, as shown in Table 2. Thus, the model driven DSS or neural network approach is the most appropriate and relevant methodology for the fisheries DSS domain, as demonstrated above.

Table 2 shows that the Neural Network DSS architecture is typical in aquaculture DSS. However, it also shows that multicriteria DSS systems are more extensively employed in aquaculture, consistent with our observations. Table 2 indicates that the aquaculture and fisheries domains have distinct needs that are best fulfilled by diverse approaches to system design. There is also a noticeable minimal overlap in the number of DSS kinds, as seen in Table 2, where 37 publications are listed against 337 studies, indicating that only a few research falls into more than one category.

2) (RQ-2) What fisheries DSS topics have been researched the most, and how have these changed over time.

To categorize the result sets according to their type, as indicated in Table 2, they are also classified according to the issue domain they address. These classifications are illustrated in Table 3, which details which articles fall under which themes and Fig. 3 portrays the evolution of various subjects' popularity.

TABLE III
DSS SYSTEM GROUPED BY TOPICS

Associated DSS topic	Document
Disease management	[48] ; [59]; [45]
Scheduling and planning	[51]; [40]; [60]; [33]; [52]; [61]; [55]; [56]; [22]; [44]; [62];
Harvest regulations	[47]; [31]; [44]
Sustainability	[63]; [34];[36]; [19]; [38]; [56]; [44]; [64]
Catch optimization	[28]; [29]; **[6]**; [65]; [39]; [54]; [42]; [13];
Management decisions	[49]; [47]; [43]; [42]; [57];

Given the growing public awareness of the problem of global overfishing in recent years, fisheries and DSS in aquaculture may be an indicator of political influence inclinations, particularly when combined with an interest in monetary terms. As a result, we are unsurprised by the rise in popularity of efficiency and sustainability, as these are universal concerns that span numerous industries.

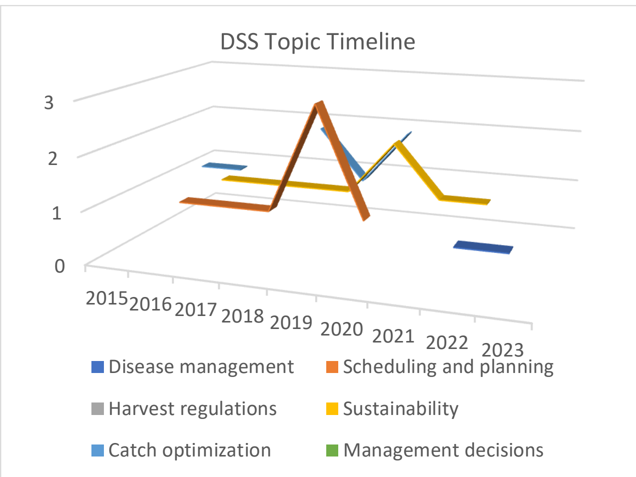

Fig. 4 DSS topics timeline

Finally, we could see that the research analysis in Table 4, which can be figured out in Fig. 4, has a more significant commonality than the research analysis presented in Table 3 (as previously stated). As a result, more studies claim to impact more subjects than studies that use various methods/types of DSS.

3) (RQ-3) Is there already a DSS model for the fishing industry that provides real-time analytics?

In light of the few relevant papers identified during the research process, only one paper [51] satisfied all requirements for a complete real-time fisheries DSS. In contrast, three other papers [32], [34], [40] contain a real-time component. Sustainable development was highlighted as a significant subject in RQ-2, which corresponded to the problem of global overfishing. Føre et al. [51] describe points of reference for fisheries management that give quantitative indications for system-level applications. It argues that making reference points for making quality judgments is backed by historical data and real-time data to achieve their objective efficiently. Therefore, it is necessary to facilitate real-time data critical for fisheries DSSs concerned with the regulation or long-term sustainability of fishing. A recent study [51] demonstrates that real-time data and analytics are conceivable, although for restricted circumstances.

4) (RQ-4) Does the DSS model in Fisheries use machine learning techniques that are applied to the data collected?

An essential characteristic is the degree to which a decision support system accurately portrays the actual condition of the choice issue. It is possible to degrade the output quality by utilizing obsolete models or input data (e.g., model parameters). We have outlined the applications of machine learning and the data used to train machine learning in Table 4. In this context, machine learning is the automatic modeling of phenomena (for example, for predictions, as in [40]) based on data.

TABLE IV
STUDIES USING MACHINE LEARNING

Sub Domain	
Fisheries	[29]; [63]; [34]; [33]; [66]**;**[22]**;** [57]**;** [13]
Aquaculture	[48]; [47]; [6]; [50]; [51]; [54]; [59]

Table 4 shows that just six articles include any machine learning as a significant component of their overall contribution, a minimal number. Further into Aquaculture, there are e seven types of research (46.67 percent) that use machine learning techniques. On the other hand, Fisheries has eight articles (53.33 percent) that use machine learning as a critical contribution to discipline. Data must be made available in Fisheries due to operational needs (e.g., video monitoring in aquaculture). It is unquestionably detrimental for DSS scientists to avoid utilizing these resources for model development and prediction. Future DSS research in this sector should strongly emphasize this particular area of study.

B. Discussion

This article provides the results of a thorough mapping study conducted to establish a sound theoretical framework for DSS research in fisheries by examining current research. From the first semester of 2016 through the first semester of 2021, five years were examined for the mapping study, and 27 articles were generated that matched the research objectives, including criteria for inclusion and exclusion, among other things. The results were validated by three authors who were not involved in the initial screening but conducted a randomized test to eliminate the possibility of missing relevant papers during the search phase. They were not involved in the initial screening but conducted the randomized test. Because no essential articles were discovered during the validation process, we think these 27 papers correctly represent the current level of research and activity in the DSS for fisheries.

1) Critics of the DSS for fisheries

Most of the systems discovered throughout the study include an overview of the systems and their approach. While the collections' papers do not give a comprehensive picture of DSS practice, they provide a broad overview of the problem domain and a wealth of expertise in the subject area. These findings can give anyone considering developing a new DSS in the fisheries domain some valuable insights into the most appropriate methodologies for designing DSS based on the target domain and an inkling of the options within that domain DSS design.

In addition to providing numerous valuable and relevant sources of information, the mapping study's findings inform the reader of a wealth of information that can be used to design or develop DSS for fisheries and various other purposes. A high-level abstraction of vast volumes of data is used to aid management decision-making in fisheries. The system generates a certified forecast based on predictive models to enhance the chance of achieving ideal results. There are various challenges in developing a system that runs simulations and applies consistent data from the most recent data set [67]. System administrators must first ensure that compatible connections to numerous data sources are maintained to manage data. The system is then responsible for completing its analysis within the time constraints set by the administrator. These duties are frequently in conflict since no downtime is assumed to be required to accomplish system deadline responsibilities, and changing data might invalidate the analytic process. At the same time, it is being carried out in real-time.

2) Proposed framework in the DSS for fisheries

Unlike other industries, fisheries, in our opinion, do not require real-time management systems, and value enhancement is frequently assigned a low priority due to the higher costs, both in terms of complexity and monetary value. Mapping studies have revealed a scarcity of fisheries decision support systems that consider a wide range of parameters over a vast geographic region and the species that inhabit that area. Because of the system's complexity, it is unlikely that anybody has attempted to combine these elements with real-time analytics before (e.g., [33]).

In Fig. 5, there are many overlapping articles on the Topic of DSS. This is understandable because whatever method is applied, all aim to achieve productivity and certainty in the future. In addition, interest in the DSS combination method with spatial data has begun to develop, and research is now evolving toward an integrated Spatial Decision Support System.

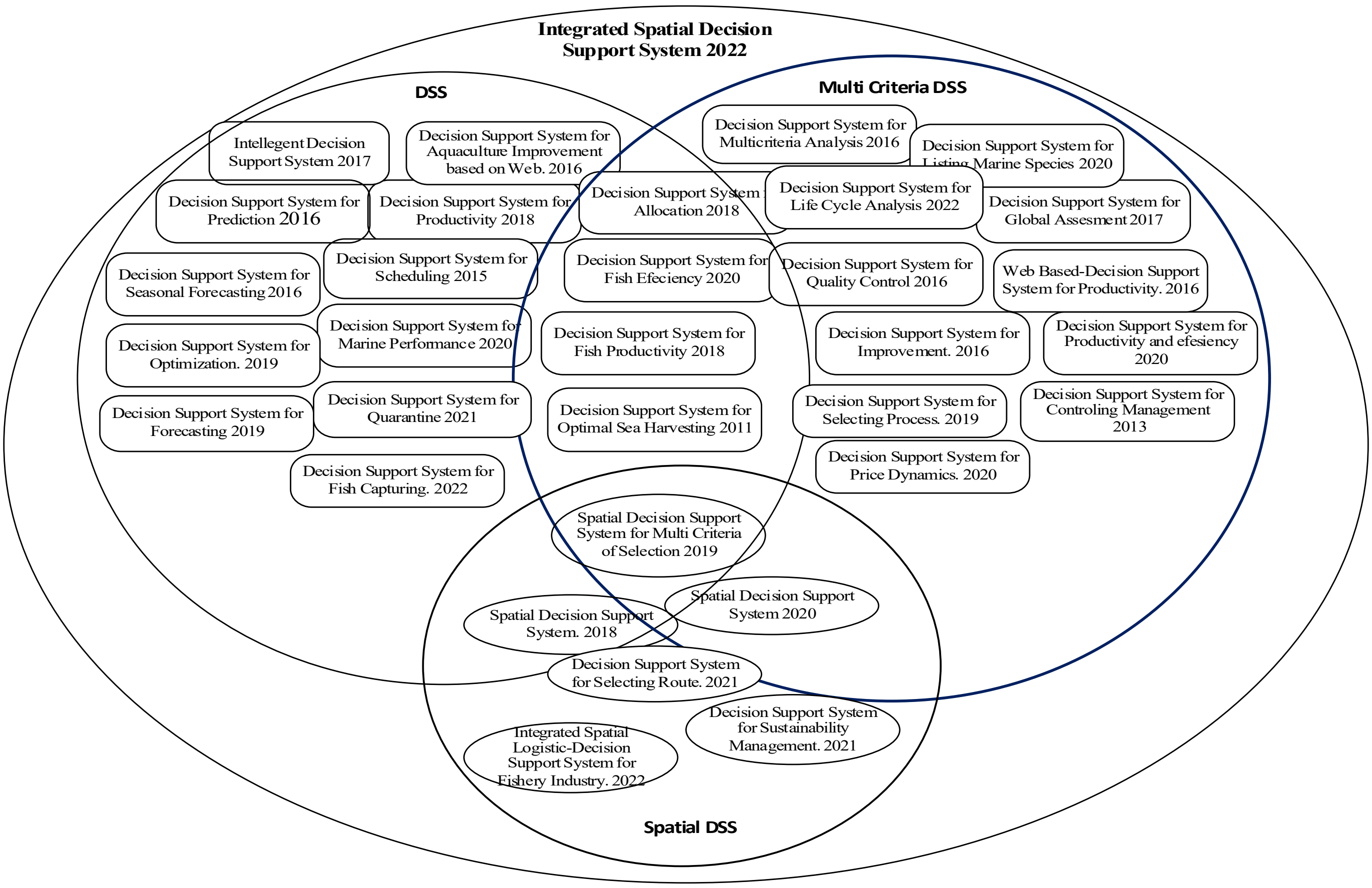

Fig. 5 Aggregation and integration DSS in fishery and aquaculture

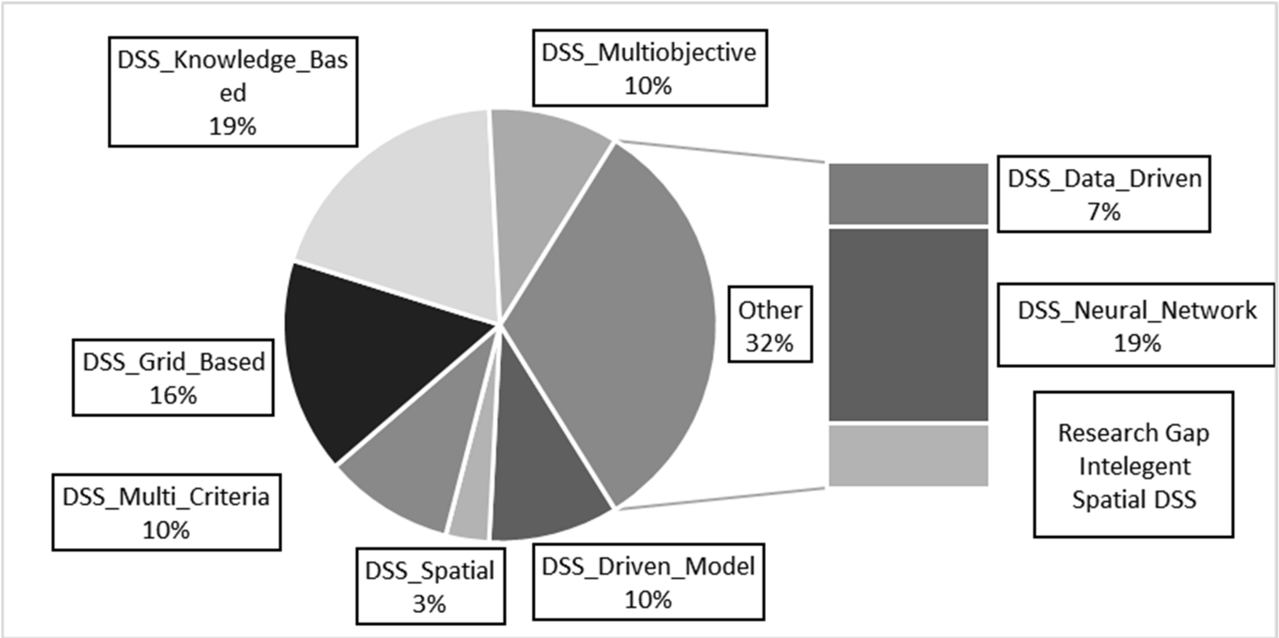

Fig. 6 Research Gap

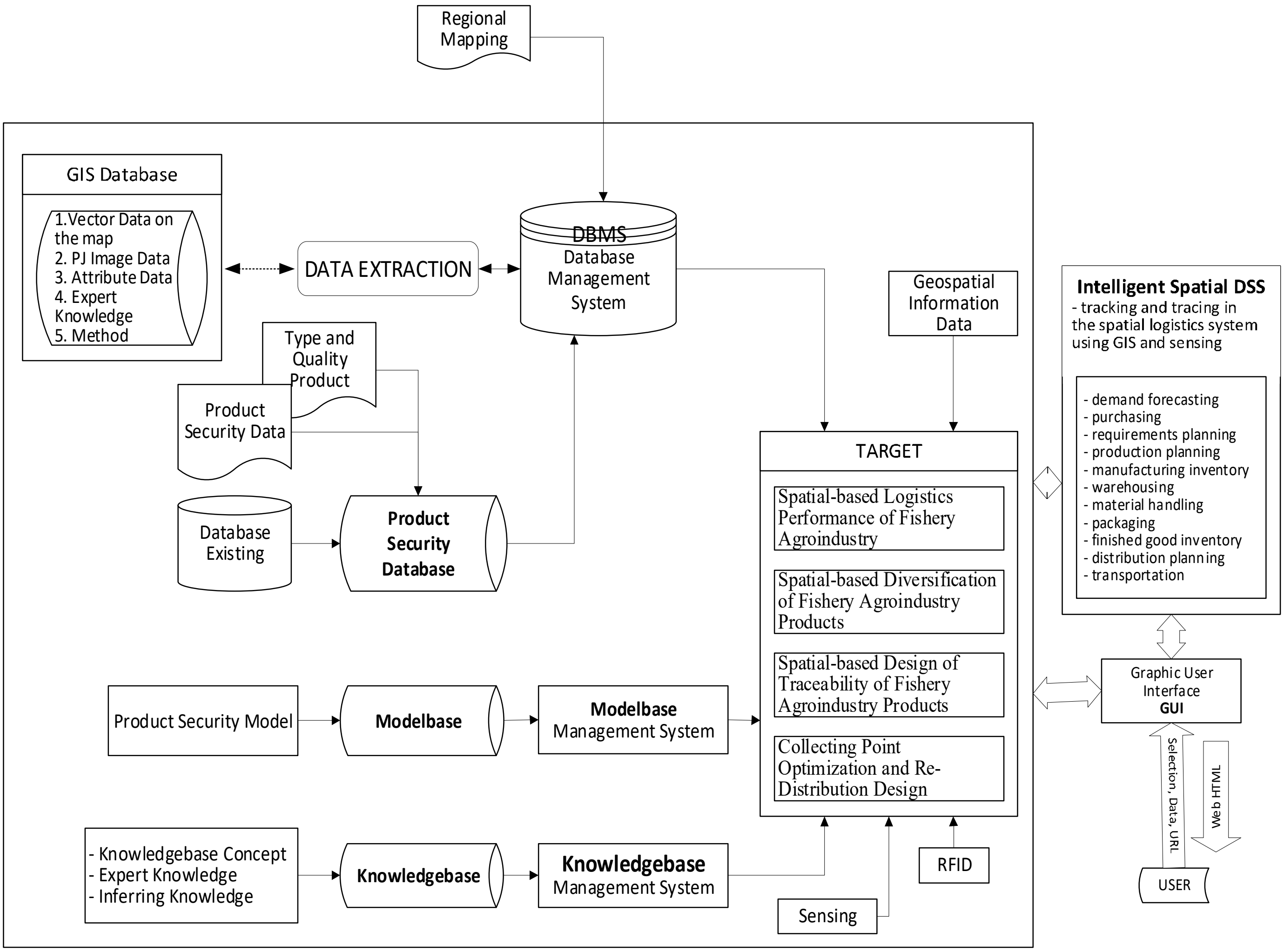

Fig. 7 A conceptual architecture for designing intelligent spatial logistics systems.

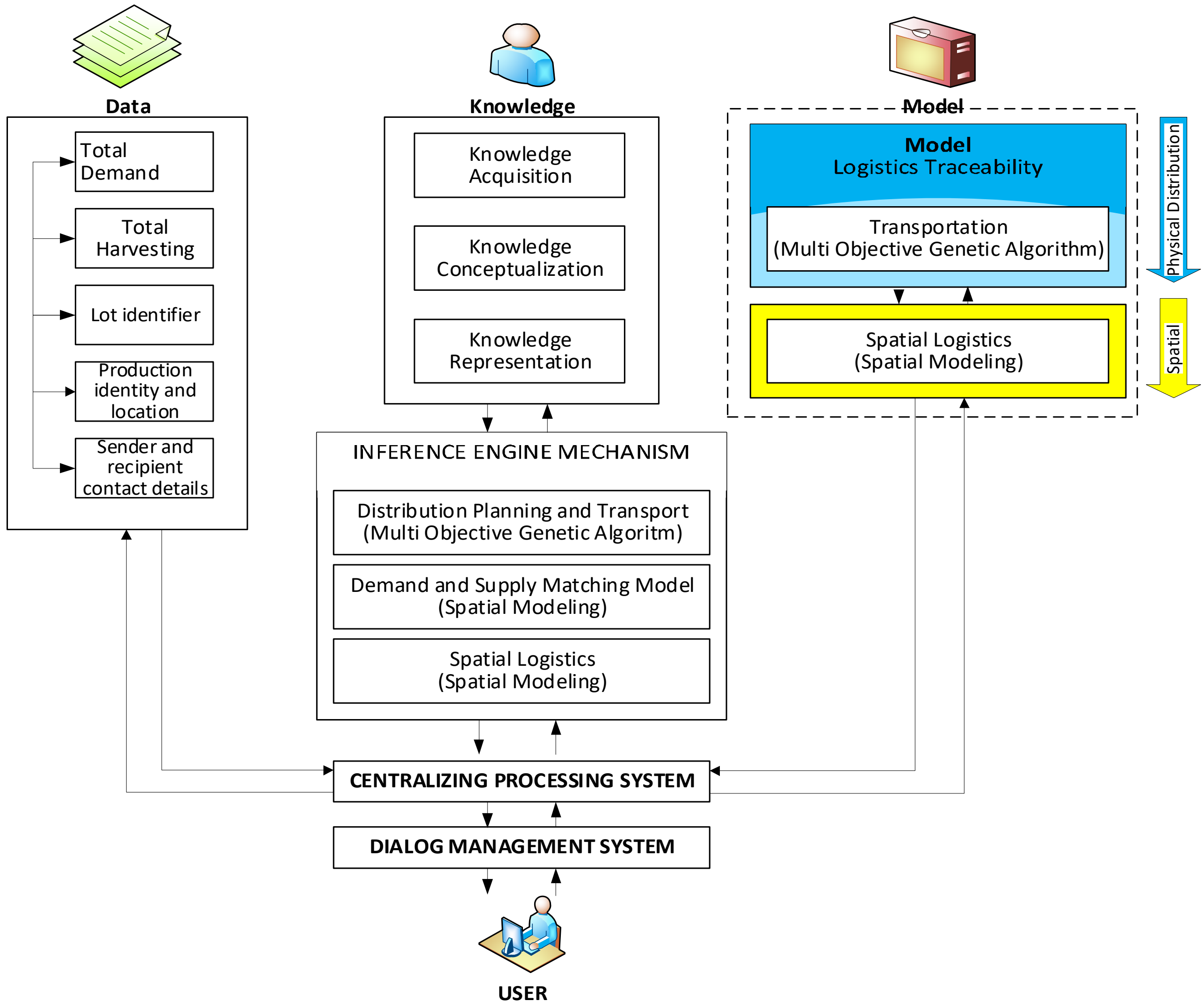

Fig. 8 Spatial-IDSS configuration

As demonstrated by Keshtkar [52], developing decision support systems for fisheries is a challenging undertaking, and it is challenging to apply theory to real-world situations to resolve all the elements that impact decisions that can be associated. Referring to the findings of this study, most fisheries DSS take into account just a small number of criteria, as indicated in Table 2. The exceptions include situations in which the discussion spans a wide variety of subjects [47], [49], [51]; nevertheless, some of the topics that were discussed are frequently closely connected, such as optimization and productivity.

Indeed, making a poor choice will set off a domino effect to incorporate decision-making into an Intelligent DSS prototype [68]. Thus, We create and construct an Intelligent Spatial DSS (ISL-DSS) by configuring database systems (DBMS), models, and level of knowledge after grouping and categorization, aggregating, and comparing with prior research' articles [69]. Management, or extensive data management, is the process of organizing, administering, and governing massive volumes of structured and unstructured data. Comprehensive data management guarantees that data is of high quality and is easily accessible for commercial needs, such as business intelligence and big data analysis applications [70] [71].

The decision support system's fundamental structure should contain a database, a data warehouse management module, data mining tools, a knowledge base, and a knowledge discovery module [69], [72]. It has been established that the decision support system suggests quasi and some unstructured decisions. The decision-maker controls the data in a man-machine conversation which progresses the choice [72]. The upcoming upgrade will create a single application interface for acquiring data from such sensing devices, enabling the easy and rapid acquisition of required data sets from various remote sensing device sources [73].

Based on the mapping of the types of DSS used in Fishery, it is clear that there is still a scarcity of research on intelligent DSS, accounting for only about 3% of all DSS types discussed in the article. Additionally, the possibility of identifying research gaps increases when combined with geographic information technology or spatial data. It is summarized in Fig. 6.

3) Future research agenda

The future agenda for developing Decision Support Systems (DSS) in the fisheries industry is focused on integrating new technologies, using big data and predictive analytics, and implementing sustainable practices.

DSS in the fisheries industry are expected to integrate new technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and Cloud Computing to improve the efficiency and accuracy of decision-making. AI can be used to analyze large amounts of data and provide real-time recommendations for fisheries managers, while IoT can help collect and transmit data from fishing vessels and other sources. Cloud Computing can provide a secure and scalable platform for storing and processing large amounts of data.

DSS in the fisheries industry are increasingly relying on big data and predictive analytics to improve their accuracy and reliability. By analyzing large amounts of data from various sources, DSS can identify patterns and trends in fish populations and the marine environment, allowing for more accurate predictions and better decision-making.

The development of DSS in the fisheries industry is closely linked to the goal of promoting sustainability. As such, DSS are expected to incorporate sustainable practices into their design and implementation, such as using data to set fishing quotas and implementing fishing practices that minimize the impact on the marine ecosystem.

Overall, the future agenda for the development of DSS in the fisheries industry is focused on integrating new technologies, using big data and predictive analytics, and promoting sustainable practices to ensure the long-term viability of the industry and the communities that depend on it.

We developed a new logistic model that entails a spatial and logistical traceability model incorporating spatial data with GIS-based tracing. For GIS databases and food security, this model employs a relational database management system (DBMS) that employs RFID, GIS, and Google maps. ISL—DSS was built in the spatial logistics system employing GIS and control sensing, including database management systems, model bases, and knowledge bases, as shown in Fig. 7.

Spatial-IDSS (Spatial Intelligent Decision Support System) can be configured as a web-based platform that integrates spatial data, analytical tools, and decision support models. The system can incorporate various sources of data, including remote sensing imagery, GPS data, and geographic information systems (GIS) data. The analytical tools in Spatial-IDSS can include statistical and machine learning algorithms and spatial analysis techniques such as interpolation, clustering, and network analysis. Decision support models can include optimization, simulation, and multi-criteria decision-making models.

The Spatial-IDSS configuration can also include features such as real-time data updates, user-friendly interfaces, and the ability to visualize data and results in different formats, such as maps, charts, and tables. The system can be customized to address specific decision-making needs in various applications, including fisheries management, environmental monitoring, and disaster response planning.

Data configuration, knowledge, model base, inference engine, central processing system, and dialog management system are all illustrated in Fig. 8. When configuring a Spatial-IDSS (Spatial Intelligent Decision Support System), several factors should be considered to ensure that it is effective in providing decision support. These factors include:

- Data sources: The system should be able to integrate spatial and non-spatial data from various sources, such as remote sensing imagery, GPS data, and GIS data.
- Analytical tools: The system should incorporate various analytical tools, including statistical and machine learning algorithms, and spatial analysis techniques such as interpolation, clustering, and network analysis.
- Decision support models: The system should include decision support models that enable users to make informed decisions, such as optimization models, simulation models, and multi-criteria decision-making models.
- Real-time data updates: The system should provide real-time data updates to enable users to make timely decisions based on current information.
- User interface: The system should have a user-friendly interface allowing users to easily access and interact with the data, models, and analytical tools.
- Visualization tools: The system should have visualization tools that allow users to visualize data and results in different formats, such as maps, charts, and tables.
- Customization: The system should be customizable to meet the specific needs of different applications, such as fisheries management, environmental monitoring, and disaster response planning

Considering these factors can help ensure that the Spatial-IDSS configuration effectively provides decision support and meets users' needs.

IV. Conclusion

According to our findings, most publications that assess and record their technique do so under a set of criteria. Researchers have discovered that a small study has been done on DSS in fisheries, and there has been no empirical evaluation of these systems due to systematic mapping investigations. Additionally, this study expressed concern about the lack of well-documented multicriteria DSS systems for fisheries, a source of the problem. Meanwhile, this study's findings revealed that many components for smaller DSS systems are well documented. Despite the fact that DSS research intends to improve management decision-making, DSS publications should be anchored in high-quality judgment and decision-making research. This study's findings can be used as a foundation for future research and development, particularly when combined with previous research and knowledge on managing heterogeneous and related data systems with the help of geographic information.

Despite its current limitations, it is important to mention that DSS has a longstanding experience of academic and professional accomplishment. Spatial analysis and DSS systems are becoming an essential aspect of the majority of managers' jobs. DSS scholars have made significant contributions to information systems theory in the areas of evolutionary system development, artificial intelligence integration into business systems, and management information behaviors. Whereas extracting large datasets is a difficult task, it has the potential to provide effective solutions for various sectors.

The research's findings have implications for the development of a new logistical traceability model that incorporates spatial data with GIS-based tracing in the future. This model uses a relational database management system (DBMS) that makes use of Google maps, RFID, and GIS databases for food security. ISL—DSS, which incorporates database management systems, model bases, and knowledge bases, was developed using GIS and control sensing in the spatial logistics system.

Additionally, including spatial data in the dataset complicates the approach. The primary challenges addressed in this research were integrating spatial data with other data sources, dealing with large datasets throughout the proposed approach's various phases, and visualizing the results interactively. For anyone developing a multicriteria decision support system of fisheries, the findings of our systematic mapping study may be of interest.

Decision Support Systems (DSS) can bring numerous benefits and opportunities to the fisheries industry, including improved decision-making, increased profitability, and enhanced sustainability.

- Improved decision-making: DSS provides fisheries managers with accurate and timely information on fish populations, fishing practices, and the broader marine ecosystem, allowing for more informed decision-making. By using DSS, fisheries managers can make better decisions about fishing quotas, habitat protection, and other management strategies.
- Increased profitability: DSS can also help increase profitability in the fisheries industry by optimizing fishing practices and reducing waste. Using data to determine the optimal fishing quotas, fishermen can reduce costs and increase profits. Additionally, fisheries can improve their reputation and attract more customers by reducing waste and minimizing the impact on the marine environment.
- Enhanced sustainability: The use of DSS can help promote sustainability in the fisheries industry by providing fisheries managers with the information they need to make decisions that protect fish populations and the broader marine ecosystem. By using data to set fishing quotas and implement sustainable fishing practices, DSS can help ensure the long-term viability of the industry and the communities that depend on it.
- Improved communication: DSS can also facilitate communication between stakeholders in the fisheries industry, including fishermen, scientists, and policymakers. By providing a platform for sharing information and collaborating on management strategies, DSS can help build trust and promote cooperation among stakeholders.

In conclusion, Decision Support Systems (DSS) have the potential to revolutionize the fisheries industry by improving decision-making, increasing profitability, promoting sustainability, and enhancing communication among stakeholders. The integration of new technologies, such as AI, IoT, and cloud computing, and the use of big data and predictive analytics, are expected to further enhance the capabilities of DSS in the industry.

Continued investment in developing DSS in the fisheries industry is crucial to ensure the long-term viability of the industry and the communities that depend on it. By improving the efficiency and sustainability of the fisheries industry, DSS can help ensure that it continues to provide an important source of food and income for communities around the world. Therefore, it is important to recognize the significant benefits that DSS can bring to the fisheries industry and to continue to invest in their development to ensure that the industry remains sustainable and profitable in the years to come.

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