JOURNAL OF MARITIME RESEARCH

Vol XXII. No. II (2025) pp 36–47

ISSN: 1697-4840, www.jmr.unican.es

Maritime digital innovation analyzed through mixed method approaches: exploring the sequential design in seaport research

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ARTICLE INFO

Article history:
Received 28 Jun 2024;
in revised from 05 May 2024;
accepted 24 Jul 2024.

Keywords:
Mixed Methods, Regional Growth, Seaport Research, Exploratory Sequential Design.

ABSTRACT

This research addresses the knowledge gap in seaport studies by investigating the use of digital mixed-methods approaches. The study employs bibliometric analysis to identify trends and research gaps in maritime digital innovation, and an exploratory sequential design to explore the potential of digital innovation in seaport research. Results reveal a lack of mixed-methods approaches in this field, with quantitative methods being dominant. Only three papers from 2011 to 2022 utilized mixed methods in seaport research. Additionally, there is limited popularity of qualitative and mixed-methods research in regional growth studies. The findings highlight the need to adapt digital innovation in mixed-methods research while preserving human interaction for comprehensive outcomes.

1. Introduction.

The application of a mixed-methods design in a research study is believed to enhance the study's validity. This assertion is based on the utilization of multiple methods in exploring the research problem from diverse perspectives. By focusing on a single procedure, the accuracy of the data collected is significantly improved (Kumar, 2019; Jeevan et al., 2020). This approach provides researchers with the opportunity to integrate qualitative and quantitative techniques in the data collection, perspectives, analysis, and inference processes. Consequently, the scope and depth of knowledge gained from the research project are broadened, while the corroboration of the findings is strengthened (Johnson & Onwuegbuzie, 2004).

Creswell and Clark (2017) posit that the mixed methods design can be categorized into four primary types: triangulation, embedded, explanatory, and exploratory sequential design. The triangulation design involves the concurrent collection of qualitative and quantitative data, which are later integrated to address the research problem based on the outcomes (Jick, 1979). Tashakkori and Teddlie (2003) assert that the embedded design entails the simultaneous collection of qualitative and quantitative data, with one type of data reinforcing the other. In contrast, the explanatory sequential design comprises the collection of quantitative data first, followed by qualitative data to elaborate on the quantitative findings. Meanwhile, the exploratory sequential design involves gathering qualitative data initially to explore and understand the phenomenon being studied. Subsequently, quantitative data is collected to uncover the relationships between the variables identified in the qualitative phase (Creswell & Clark, 2017).

Research methodology in logistics domain is important to explore and examine important as well as interesting agenda in this particular segment. According to Jeevan et al. (2019), quantitative based research domain has become attractive among

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the researchers because this particular approach provides precise or practicable inference from a scientific perspective. This is contradicting with qualitative approach whereby the findings are more abstract and challenging to be generalized. In the meantime, the quantitative design is unable to explore fundamental ideas in any research stream due to the strict protocols in this specific design. In order to overcome the limitation from both streams, the mixed methods design have been proposed to provide a comprehensive outcome for the proposed research questions.

This paper clarifies the process of the mixed method which specifically focusing on exploratory sequential design. Firstly, a bibliometric analysis has been conducted to identify the gap on the mixed methods application in regional growth. From this, we will understand the usage of this specific method on regional growth research. After identifying the gap, the exploratory mixed methods design will be employed to explore and validate the outcome from the respondents.

2. Mixed Methods: An exploratory sequential design.

Mixed methods define as '*actively invites participants in dialogue and involving multiple ways of seeing and hearing, multiple ways of making sense of the social world and multiple standpoints on what is important and to be valued and cherished* (Green, 2007, pp20). This definition has been evolved and Creswell and Clark (2018) have come out with a new description for this method. They define this approach as '*collects and analyses both qualitative and quantitative data rigorously in response to research objectives, integrates the two forms of data and results, organize these procedures in specific research design that provide the logical procedure to conduct the research and frames the procedure within theory and philosophy*. Both of these definitions indicate that the direct involvement of participant is crucial to meet the research aim by giving equal important to both approaches through collects, integrate, organize and frame the outcome accordingly.

An exploratory sequential design is a specific type of mixed methods research that involves collecting and analyzing qualitative data in the first phase of the study, and then using that data to inform the collection and analysis of quantitative data in the second phase (Harrison et al., 2020; Hirose & Creswell, 2023). This approach is particularly useful when the research topic is relatively unexplored and there is not a clear understanding of the phenomenon under investigation (Subedi, 2016). In the exploratory sequential design, the qualitative phase typically involves collecting data through methods such as interviews, focus groups, or observations. The goal of this phase is to develop a deeper understanding of the research topic, explore potential hypotheses, and identify any unexpected findings or patterns (Casula et al., 2021). The qualitative data collected in this phase are then analyzed using techniques such as thematic analysis or grounded theory to identify themes, patterns, and relationships (Morgan & Nica, 2020; Rattray et al., 2023).

Based on the findings from the qualitative phase, the researcher then designs the quantitative phase of the study. This may involve developing a survey or questionnaire to collect data from a larger sample of participants, or using other quantitative methods such as experiments or statistical analysis. The goal of the quantitative phase is to confirm or refute the hypotheses generated in the qualitative phase, and to provide a more generalizable understanding of the research topic (Mulisa, 2022). The exploratory sequential design is particularly useful when the research question is complex and there is not a clear understanding of the phenomenon under investigation (Maarouf, 2019; Parey & Kutscher, 2023). By using qualitative data to develop a deeper understanding of the topic and identify potential hypotheses, researchers can design the quantitative phase of the study to provide a more robust analysis. This approach also allows for flexibility in the research process, as unexpected findings or patterns from the qualitative phase can inform the design of the quantitative phase.

Thus, mixed methods research is a valuable approach that combines both qualitative and quantitative data collection and analysis methods. The exploratory sequential design is one specific type of mixed methods research that is particularly useful for exploring complex research questions when there is not a clear understanding of the phenomenon under investigation. By involving participants in the research process and using both qualitative and quantitative data, researchers can develop a more comprehensive and nuanced understanding of the research topic. Overall, mixed methods research offers a powerful tool for conducting research that is both rigorous and flexible.

3. Bibliometric analysis: the ground for mixed methods research.

Bibliographic analysis is a research methodology that involves analyzing academic publications to gain insights into the patterns and trends of research in a specific field or topic (Munim et al., 2020; Jeevan et al., 2022). This analysis relies on bibliographic data, such as citation data, to examine the relationships among authors, publications, and sources (Donthu et al., 2021). One of the primary goals of bibliographic analysis is to identify the most significant publications, authors, and sources in a particular field or topic (Hyland & Jiang, 2021). Researchers can use this information to identify key trends and ideas, track the development of research over time, and inform future research directions (Autsadee et al., 2023; Donthu et al., 2021).

Besides, bibliographic analysis is a valuable tool for assessing the impact of individual publications or authors, and for evaluating the quality and relevance of academic journals (Pranckutė, 2021). This method is particularly useful for identifying emerging trends or underdeveloped areas of research (Autsadee et al., 2024). To conduct a bibliometric analysis, researchers use a range of statistical techniques, including frequency analysis, citation analysis, and network analysis (Donthu et al., 2021). These techniques help to identify patterns and relationships between publications, authors, and sources, enabling researchers to gain insights into the structure and dynamics of a specific field or topic.

In addition, bibliometric analysis is a research methodology that involves the use of statistical techniques to analyze

and interpret large sets of data, such as citation data or publication data. The aim of this method is to provide objective and quantitative measures of various aspects of scholarly research, such as the impact of individual publications, the prominence of individual authors or institutions, or the trends in research over time. One of the key advantages of bibliometric analysis is its ability to provide reliable and valid results (Sudirman et al., 2023). As the analysis is based on objective data rather than subjective opinions or judgments, it can help to reduce bias in the research outcomes. This is particularly important in fields where subjective judgments or biases could impact the research results, such as in the social sciences or humanities (Dominko & Verbič, 2019).

Furthermore, the results of bibliometric analysis are generalizable to the broader population of publications or authors in a given field. This means that researchers can draw broader conclusions about the patterns and trends of research in a particular field or topic, which can inform future research directions. However, it's important to note that bibliometric analysis has some limitations. For instance, it may not capture all relevant publications or authors, particularly if some publications or authors are not indexed in the databases used for the analysis (Saab et al., 2019). Additionally, bibliometric analysis alone cannot fully capture the qualitative aspects of scholarly research, such as the originality or creativity of a particular work (Shambe et al., 2023). Therefore, researchers must use caution in interpreting the results of bibliometric analysis and should supplement it with other forms of data analysis to gain a more comprehensive understanding of the research landscape.

In summary, bibliometric analysis is a valuable research methodology that can provide reliable and valid results and help to reduce bias in research outcomes. Despite its limitations, it is a useful tool for gaining insights into the patterns and trends of scholarly research in a given field or topic. For this reason, we used data from the established Scopus database to conduct our bibliometric analysis. This database was selected to maintain the quality of our reviewed studies and to ensure that the results remained of high quality and were transferable and generalizable to other contexts (Chen & Liu, 2020). The process of bibliometric analysis is divided into five major steps as below:

3.1. First steps (Defining keyword).

To ensure that the research topic was adequately covered, the main keywords were used are seaport, regional growth, qualitative, quantitative and mixed method. The term "AND NOT" were included to eliminate the redundancy or the repetition of the journals. The list of keywords below (Table 1) was used extensively throughout the data collection process in Scopus data based on Shaffril et al. (2018).

3.2. Second steps (Pre-requisite setting).

To further refine the results, and increase the quality and misinterpretation of the results, four criteria has been included as below:

- Database type: Scopus.
- Time Frame: 25 September 2011 to 25^{th} September 2021.
- Subject Area: Social Science; Business, Management and Accounting; Multidisciplinary.
- Document Type: Journal Articles.
- Language: English.

3.3. Third steps (Final results).

The final results that were extracted from bibliometric analysis shown in the Table 2.

3.4. Fourth steps (Data analysis).

The results of bibliometric analysis in this paper determine the top ten authors with highest citations (Jeevan et al., 2022). The additional details of the authors like the source tittle, document published were included. Moreover, the main the objective of the paper is to compare the Malaysia and global view to prove that the there is a gap in the literature that should be addressed. Table 3 and 4 shows the summary on methodological approach in seaport and regional growth research based on Scopus data from 2011-2021. In general, the outcome from the bibliometric analysis can utilized to justify the methodological lacuna of the research. This section can be expanded to justify the research gap in any higher degree researches.

4. Malaysian seaports and regional growth researches: current methodological gap.

Table 3 summaries the results of seaports and regional growth researches from the bibliometric analysis. For example, 22 papers were identified in Scopus database which indicates the application of qualitative method in global and Malaysian seaport researches. In contrast, 11 papers were found which employs quantitative approach in global seaport research and no papers were detected employing quantitative design in Malaysian seaport research between this time frame. Moreover, only 3 papers were detected employing mixed methods design in global and Malaysian seaport research. This table also indicates that the application of mixed methods is still at juvenile stage compared to other two dominant approaches. This new stream needs to be embraced in the research agenda of maritime logistics to transfer and generalize the outcome of the research.

In a general perspective, only 3 papers which have employed mixed methods approach throughout 2011-2022. Although researchers have the autonomy to choose an appropriate research methodology to address their research aim, it is critical for emerging scholars to consider diversifying or proposing novel approaches to address their research questions in their theses or academic articles. Frequently, researchers rely on a limited number of research methodologies to answer their research questions without exploring alternative approaches that may be equally or more effective. This indicates a pressing need for emerging researchers to explore and propose new methods to answer their research questions, thereby introducing diversity in research methodologies and potentially discovering

Table 1: The list of keywords.

No	List of keywords
1.	*"Seaport" AND "Qualitative" AND NOT "Quantitative" AND NOT "Mixed Method"*
2.	*"Seaport" AND "Quantitative" AND NOT "Qualitative" AND NOT "Mixed Method"*
3.	*"Seaport" AND "Mixed Method" AND NOT "Qualitative" AND NOT "Quantitative"*
4.	*"Regional growth" AND "Qualitative" AND NOT "Quantitative" AND NOT "Mixed Method"*
5.	*"Regional growth" AND "Quantitative" AND NOT "Qualitative" AND NOT "Mixed Method"*
6.	*"Regional growth" AND "Mixed Method" AND NOT "Qualitative" AND NOT "Quantitative"*
7.	*"Seaport" AND "Qualitative" AND "Malaysia" AND NOT "Quantitative" AND NOT "Mixed Method"*
8.	*"Seaport" AND "Quantitative" AND "Malaysia" AND NOT "Qualitative" AND NOT "Mixed Method"*
9.	*"Seaport" AND "Mixed Method" AND "Malaysia" AND NOT "Qualitative" AND NOT "Quantitative"*
10.	*"Regional growth" AND "Qualitative" AND "Malaysia" AND NOT "Quantitative" AND NOT "Mixed Method"*
11.	*"Regional growth" AND "Quantitative" AND "Malaysia" AND NOT "Qualitative" AND NOT "Mixed Method"*
12.	*"Regional growth" AND "Mixed Method" AND "Malaysia" AND NOT "Qualitative" AND NOT "Quantitative"*

Source: Authors.

Table 2: The outcome of from the Scopus database.

No.	List of keywords	Journals
1.	"Seaport" AND "Qualitative" AND NOT "Quantitative" AND NOT "Mixed Method"	27 Journals
2.	"Seaport" AND "Quantitative" AND NOT "Qualitative" AND NOT "Mixed Method"	12 Journals
3.	"Seaport" AND "Mixed Method" AND NOT "Qualitative" AND NOT "Quantitative"	5 Journals
4.	"Regional growth" AND "Qualitative" AND NOT "Quantitative" AND NOT "Mixed Method"	2 Journals
5.	"Regional growth" AND "Quantitative" AND NOT "Qualitative" AND NOT "Mixed Method"	0 Journal
6.	"Regional growth" AND "Mixed Method" AND NOT "Qualitative" AND NOT "Quantitative"	2 Journals
7.	"Seaport" AND "Qualitative" AND "Malaysia" AND NOT "Quantitative" AND NOT "Mixed Method"	204 Journals
8.	"Seaport" AND "Quantitative" AND "Malaysia" AND NOT "Qualitative" AND NOT "Mixed Method"	1 Journal
9.	"Seaport" AND "Mixed Method" AND "Malaysia" AND NOT "Qualitative" AND NOT "Quantitative"	123 Journals
10.	"Regional growth" AND "Qualitative" AND "Malaysia" AND NOT "Quantitative" AND NOT "Mixed Method"	1 Journal
11.	"Regional growth" AND "Quantitative" AND "Malaysia" AND NOT "Qualitative" AND NOT "Mixed Method"	22 Journals
12.	"Regional growth" AND "Mixed Method" AND "Malaysia" AND NOT "Qualitative" AND NOT "Quantitative"	0 Journal
13	**Total Journals**	**399 papers**

Source: Authors.

novel approaches that are better suited to their research questions.

Practically, this means that emerging researchers must not constrain themselves to the most frequently used research methodologies. Instead, they must investigate and propose new methods that may provide new insights or perspectives on their research questions. They must also be able to justify why their proposed methodology is the most appropriate to answer their research question, taking into consideration its strengths and limitations. By promoting diversity in research methodologies, researchers can potentially uncover new knowledge and advance their respective fields. Therefore, it is critical for emerging researchers to take the initiative and propose novel methodologies that could bring about new insights and advance knowledge in their respective fields.

Apart from that, Table 4 indicates the summary of regional growth research papers based on Scopus data from 2011-2021. In this research perspective, quantitative research has dominated as main approach in regional growth research which consists of 12 papers from the global point of view and 6 papers from Malaysian views and a total of 18 papers. Secondly, the qualitative and mixed methods research papers which related to regional growth were 20 papers respectively. The field of regional growth studies in Malaysia presents a research gap that warrants investigation. Despite existing studies on regional growth in Malaysia, none have utilized mixed methods as a research approach. A mixed methods approach, however, presents a more comprehensive and nuanced understanding of the factors that contribute to regional growth in Malaysia.

By incorporating both quantitative and qualitative data, researchers can gain a completer and more accurate picture of the region's economic indicators, as well as insights from local business owners and community members. Consequently, it can be argued that there is a critical need for researchers to adopt mixed methods in their studies on regional growth in Malaysia. Such an approach would enable a more informed policy formulation and interventions for sustainable regional growth (See Table 4).

5. Qualitative phase & data analysis.

Grounded theory is a systematic qualitative research methodology that was adopted in this research because of its suitability for investigating the seaport system and its relationship with regional growth. The primary objective of the research was to understand the perceptions, attitudes, and actions of seaports, dry port operators, transport operators, and policymakers in a specific context, with respect to the two secondary research questions identified. The grounded theory approach facilitates the integration of multiple data sources and analytical perspectives to solve complex real-world problems, with the goal of developing generalizations based on comparative analysis across social situations (Corbin & Strauss, 2008). The use of this approach in this research ensured that data from various stakeholders were effectively integrated, and a systematic approach for addressing the secondary research questions was developed.

The qualitative phase of the mixed-methods research employed a non-probability sampling technique that employed varying sample sizes based on the research question and unit of analysis. Specifically, the qualitative phase utilized the non-probability sampling technique and convenience sampling (Teddlie & Yu, 2007), a method that identifies and selects eligible participants willing to take part in the interview process (Klassen et al., 2012). The response rate for the 15 participants was 100 percent, with a total interview time of 2,190 minutes or 36.5 hours. The mean time spent per participant was 146 minutes or 2.43 hours, with the interview duration ranging from 90 to 210 minutes. About 70 percent of the interview participants had more than 10 years of working experience, ranging from 11 to 21 years, while the remaining 30 percent had less than a decade of experience. These findings suggest that most of the participants had significant experience and could provide valuable insights for the study, thereby increasing the generalizability of the results to other regions.

5.1. Summary of qualitative findings.

The qualitative data analysis conducted through face-to-face interviews with 15 participants revealed several key findings (see Table 5). The participants defined regional development as comprising sustainable economic growth, geo-economic evolution, and infrastructure development. The analysis also highlighted several patterns of regional development in peninsular Malaysia, including imbalances in multimodal transportation options, infrastructure planning, regional economic planning, and economic growth.

The participants emphasized the significant role of seaports in regional development, as they create opportunities for economic investment, generate employment, and integrate inland and coastal maritime activities. To ensure sustainable regional development, it is crucial to focus on maritime support services hubs, maritime tourism, offshore sectors, and regional connectivity. Besides, the study identified Kuantan Port, Tok Bali Port, and Kemaman Port as having substantial potential to drive regional development in the east coast of Malaysia.

However, there are several challenges that may hinder the regional development process in the east coast. These challenges include the lack of attractiveness of the maritime sectors in the region, inadequate regional development policies, and geographical and geopolitical factors. The participants suggested that implementing a regional investment plan and focusing on the development of seaports and industrial parks could enhance the regional development strategy in the east coast.

Furthermore, the participants identified existing opportunities that can be leveraged to accelerate the regional development plan. These opportunities include infrastructure development, the availability of maritime industrial parks, and diversification of maritime services. By capitalizing on these opportunities, rapid infrastructure development, socio-economic progress, and increased maritime tourism activities can be achieved for the benefit of the entire region. This, in turn, could lead to various effects on seaport development, such as transforming seaports into maritime gateways, establishing seaport-centric logistics, and developing seaports as transportation hubs along

Table 3: Summary on seaport research papers based on Scopus data from 2011-2021.

Number	Author	Citation	Documents	Methodology	Global or Malaysian view	Source title	Total
1.	Roso. V	68	2	Qualitative	Global	Journal of Transport Geography & Maritime Economics and Logistics	14 qualitative papers on seaport research from global perspective
2.	Andersson. D	54	1	Qualitative	Global	Journal of Transport Geography	
3.	Bask. A	54	1	Qualitative	Global	Journal of Transport Geography	
4.	Hämäläinen E.	54	1	Qualitative	Global	Journal of Transport Geography	
5.	Dutra. A	46	2	Qualitative	Global	International Journal of Productivity and Performance Management & Maritime Economics and Logistics	
6.	Ensslin. I.	46	2	Qualitative	Global	Maritime Economics and Logistics & International Journal of Productivity and Performance Management	
7.	Ensslin S.	46	2	Qualitative	Global	International Journal of Productivity and Performance Management &Maritime Economics and Logistics	
8.	Fillol A.	35	1	Qualitative	Global	International Journal of Productivity and Performance Management	
9.	Ripoll-feliu V.	35	1	Qualitative	Global	International Journal of Productivity and Performance Management	
10.	Islam S.	35	1	Qualitative	Global	Business Process Management Journal	
11.	Beleya P.	2	1	Qualitative	Malaysia	International Journal of Supply Chain Management	8 qualitative papers on seaport research from Malaysian perspective
12.	Dei giudeice M.	2	1	Qualitative	Malaysia	Maritime Policy and Management	
13.	Di vaio A.	2	1	Qualitative	Malaysia	Maritime Policy and Management	
14.	Ding W.	2	1	Qualitative	Malaysia	International Journal of Supply Chain Management	
15.	Hassan R.	2	1	Qualitative	Malaysia	Maritime Policy and Management	
16.	Palladino R.	2	1	Qualitative	Malaysia	Maritime Policy and Management	
17.	Tan J.	2	1	Qualitative	Malaysia	International Journal of Supply Chain Management	
18.	Veerappan G	2	1	Qualitative	Malaysia	International Journal of Supply Chain Management	
19.	Beresford A.	112	1	Quantitative	Global	Transportation Research Part A: Policy and Practice	11 quantitative papers on seaport research from global perspective No quantitative papers on seaport research from Malaysian perspective
20.	Kwak D.	112	1	Quantitative	Global	Transportation Research Part A: Policy and Practice	
21.	Pettit S.	112	1	Quantitative	Global	Transportation Research Part A: Policy and Practice	
22.	Woo S.	112	1	Quantitative	Global	Transportation Research Part A: Policy and Practice	
23.	Yang Z.	90	2	Quantitative	Global	Maritime Policy and Management &Transportation Research Part A: Policy and Practice	
24.	Alyami H.	46	1	Quantitative	Global	Maritime Policy and Management	
25.	Bonsall S.	46	1	Quantitative	Global	Maritime Policy and Management	
26.	Lee W.	46	1	Quantitative	Global	Maritime Policy and Management	
27.	Riahi R.	46	1	Quantitative	Global	Maritime Policy and Management	
28.	Wang J.	46	1	Quantitative	Global	Maritime Policy and Management	
29.	Evers N.	1	1	Mixed Method	Global	Maritime Business Review	1 mixed methods paper on seaport research from global perspective
30.	Jeevan J.	4	2	Mixed Method	Malaysia	Australian Journal of Maritime and Ocean Affairs & Transactions on Maritime Science	2 mixed methods papers on seaport research from Malaysian perspective

Source: Authors.

the east coast. Thus, addressing the challenges and utilizing the available opportunities in the east coast region can contribute to the overall regional development and transform the seaports into strategic drivers of economic growth and connectivity.

6. Quantitative phase & data analysis

The present study employed an exploratory mixed-methods design to investigate the concept of regional growth on the east coast, with a focus on identifying the key variables in the seaport system that serve as the foundation for the regional growth strategy. To confirm the qualitative findings, exploratory factor analysis (EFA) was used during the quantitative phase, and the qualitative results were evaluated again to ensure alignment with each variable in the research questions. The use of the exploratory mixed-methods design was deemed essential to the success of this research. Additionally, a list-based stratified sampling technique was utilized for the online survey to categorize seaport stakeholders into homogeneous subgroups, which improved the statistical efficiency of the sample compared to a simple random sampling method (Collins et al., 2007; Fricker, 2008). This technique is particularly well-suited for surveying respondents whose organizations are dispersed across a wide geographical area (Cooper & Schindler, 2014).

According to Creswell (2008), the list-based stratified sampling method is effective in collecting adequate data for the analysis of multiple subpopulations. This technique has been demonstrated to be useful in investigating the characteristics, perspectives, and positions of a particular population on specific issues. Simsek and Veiga (2001) state that the list-based stratified sampling technique provides greater control over the samples, reducing the occurrence of fake identities commonly encountered in online surveys. According to Bethlehem and Biffignandi (2011), the list-based stratified sampling technique is more precise than simple random sampling as it allows for tracking the availability of respondents and generates a higher number of representatives in each stratum.

Questionnaires were distributed to 260 Malaysian seaports and their respective stakeholders consisting of freight forwarders, haulers, shipping lines, shippers and rail operators. A total of 120 responses were received, achieving a response rate of 46.2 per cent. This response rate is higher than 33 per cent which is the minimum indicator for the acceptance rate for an online survey (Nulty, 2008). A total of 51 (42.5 per cent) responses were received from the freight forwarders, 11 (9.2per cent) from the haulers and 14 (11.7 per cent) from the shipping lines. Moreover, 20 (16.7 per cent) responses were received from the shippers, 8 (6.7 per cent) from the rail operators and 16 (13.3 per

Table 4: Summary regional growth research papers based on Scopus data from 2011-2021.

Number	Author	Citation	Documents	Methodology	Global or Malaysian view	Source title	Total
1.	Garcilazo E.	150	1	Qualitative	Global	Regional Studies	10 qualitative papers on regional development research from global perspective No qualitative papers on regional development research from Malaysian perspective
2.	Rodriguez-pose A.	150	1	Qualitative	Global	Regional Studies	
3.	Bagautdinova N.	98	1	Qualitative	Global	World Applied Sciences Journal	
4.	Gafurovi I.	98	1	Qualitative	Global	World Applied Sciences Journal	
5.	Kalenskaya N.	98	1	Qualitative	Global	World Applied Sciences Journal	
6.	Novenkova A.	98	1	Qualitative	Global	World Applied Sciences Journal	
7.	Everett S.	59	1	Qualitative	Global	Journal of Sustainable Tourism	
8.	Slocum S.	59	1	Qualitative	Global	Journal of Sustainable Tourism	
9.	Preuss l.	54	1	Qualitative	Global	Entrepreneurship and Regional Development	
10.	Passiante G.	53	1	Qualitative	Global	International Journal of Knowledge-Based Development	
11.	Bouwer l.	81	1	Quantitative	Global	Global Environmental Change	12 quantitative papers on regional development research from global perspective
12.	Dosio A.	81	1	Quantitative	Global	Global Environmental Change	
13.	Lavalle C.	81	1	Quantitative	Global	Global Environmental Change	
14.	Lung T.	81	1	Quantitative	Global	Global Environmental Change	
15.	Muda I.	79	2	Quantitative	Global	International Journal of Applied Business and Economic Research & International Journal of Scientific and Technology Research	
16.	Sadalia I.	79	2	Quantitative	Global	International Journal of Applied Business and Economic Research & International Journal of Scientific and Technology Research	
17.	Dharsuky A.	77	1	Quantitative	Global	International Journal of Applied Business and Economic Research	
18.	Siregar H	77	1	Quantitative	Global	International Journal of Applied Business and Economic Research	
19.	Kay A.	57	1	Quantitative	Global	Environment and Planning C: Government and Policy	
20.	Miller C.	57	1	Quantitative	Global	Environment and Planning C: Government and Policy	
21.	Au-young-oliveira M.	0	1	Quantitative	Malaysia	Sustainability (Switzerland)	6 quantitative papers on regional development research from Malaysian perspective
22.	Santos V.	0	1	Quantitative	Malaysia	Sustainability (Switzerland)	
23.	Sousa B.	0	1	Quantitative	Malaysia	Sustainability (Switzerland)	
24.	Veleri M.	0	1	Quantitative	Malaysia	Sustainability (Switzerland)	
25.	Veloso C.	0	1	Quantitative	Malaysia	Sustainability (Switzerland)	
26.	Walter C.	0	1	Quantitative	Malaysia	Sustainability (Switzerland)	
27.	Jarvis J.	27	1	Mixed Method	Global	Tourism Management	10 mixed methods papers on regional development research from global perspective No mixed methods papers on regional development research from Malaysian perspective
28.	Peel V.	27	1	Mixed Method	Global	Tourism Management	
29.	Del-aguila-obra A.	24	1	Mixed Method	Global	Technological Forecasting and Social Change	
30.	Fuster E.	24	1	Mixed Method	Global	Technological Forecasting and Social Change	
31.	Lockett N.	24	1	Mixed Method	Global	Technological Forecasting and Social Change	
32.	Padilla-melendez A.	24	1	Mixed Method	Global	Technological Forecasting and Social Change	
33.	Carstensen T.	23	1	Mixed Method	Global	Geografisk Tidsskrift - Danish Journal of Geography	
34.	Fertner C.	23	1	Mixed Method	Global	Geografisk Tidsskrift - Danish Journal of Geography	
35.	Groth N.	23	1	Mixed Method	Global	Geografisk Tidsskrift - Danish Journal of Geography	
36.	Herslund l.	23	1	Mixed Method	Global	Geografisk Tidsskrift - Danish Journal of Geography	

Source: Authors.

cent) from the seaports. Based on the response rate, shippers had the highest response rate of 100 per cent, while the haulers group had the lowest of 18.3 per cent.

6.1. Summary of quantitative findings.

The quantitative phase of this research utilized exploratory factor analysis (EFA) to analyze the survey data collected as shown in Table 6. The data was subjected to various procedures to ensure data suitability and validate assumptions. The main objectives of this phase were to examine the impact of seaports on regional development and vice versa, as well as to propose appropriate strategies for enhancing seaport development to further stimulate regional development in the east coast of Peninsular Malaysia.

The EFA results revealed two primary impacts of seaports on regional development: geo-economic development and social development. The geo-economic development component encompassed factors such as seaport-centric logistics, transportation hub functions, maritime gateway status, socio-economic development indicators, production volume, infrastructure development, infrastructure quality, and maritime tourism activities. Additionally, seaports were found to possess significant potential for improving social development in the east coast region. This includes enhancing average wealth, quality of life, community services, regional development planning strategies and tools, urban development competitiveness, governance, reducing unemployment rates, and creating more employment opportunities.

On the other hand, the study examined the impact of regional development on seaport growth. The findings revealed that regional development positively influences seaport dynamism, particularly in areas such as infrastructure development, the establishment of seaport-centric logistics, enhanced socio - economic development within the seaport, transformation of the seaport into a maritime gateway, and stimulation of maritime-based tourism activities in the east coast of Peninsular Malaysia. Additionally, the findings suggest that the regional development occurring in the east coast of Malaysia presents a high potential for the development of transportation hubs.

To foster seaport growth in the east coast of Peninsular Malaysia, three strategies have been proposed: maritime sustainable strategy, seaport integration strategy, and administrative strategy. The maritime sustainable strategy requires consideration of variables such as developing a macroeconomic view of regional development, assessing urban development competitiveness and governance, analyzing existing regional institutions and future prospects, embedding the strategy within its organizational, economic, and social context, establishing clear mechanisms for information delivery, preparing phased key investments and actions, critically assessing land development and management policies, and establishing a widely-shared vision for the region's future development.

The seaport integration strategy emphasizes boosting the regional investment plan, developing seaports and industrial parks,

Table 5: Summary of findings in qualitative phase.

Questions	Themes	Percentage of responses
A_1. How the regional development is defined in Malaysia?	Infrastructure development	27
	Geo-economic evolution	33
	Sustainable economic growth	47
A_2. Why there are huge differences between the east coast and west coast of peninsular Malaysian in regional development?	Imbalance in economic growth	13
	Imbalance infrastructure plan	20
	Imbalance in regional economic plan	20
	Disparity in multimodal options	33
A_3. How do seaport influence regional development in the east coast?	Integrating inland and coastal maritime activities	20
	Opportunity for economic investment	33
	Initiating employability	33
A_4. Besides seaports, who/what can contribute to regional development in the east coast?	Regional connectivity	13
	Offshore sectors	20
	Maritime tourism	27
	Maritime support services hub	40
B_1. Which seaports in east coast Malaysia might have a great potential to boost regional development in east coast Malaysia?	Kuantan port	27
	Tok Bali port	27
	Kemaman port	33
B_2. What do you think are the major challenges facing by seaports to boost regional development in the east coast?	Adequate regional development policy	20
	Geographical factor	20
	Geopolitical factors	20
	Poor attractiveness of maritime sectors in this region	53
B_3. Based on the challenges mentioned in B2, what do you think are the best strategies taken by seaports for improving regional development in east coast Malaysia?	Seaport and industrial park development	47
	Boosting regional investment plan	60
B_4. What are the opportunities of seaports in east coast Malaysia for further development?	Maritime service diversifications	27
	Availability of maritime industrial park	33
	Prospect infrastructure development	40
C_1. What are the impacts of seaports on regional development in east coast Malaysia?	Maritime tourism activity	27
	Socio economic development	33
	Infrastructure development	40
C_2. On the other way, what are the impacts of regional development on seaports?	Transportation hub	20
	Maritime gateway	40
	Seaport centric logistics	40

Source: Authors.

Table 6: Summary of findings in quantitative phase.

Section B, C and D	Outcome from EFA		Rotated component matrix	No. of items and Cronbach Alpha
Impacts of seaports on regional development	Geo-economic development	B_1. Infrastructure development	0.698	8 (0.922)
		B_2. Socio-economic development	0.736	
		B_3. Maritime tourism activity	0.572	
		B_4. Maritime gateway	0.813	
		B_5. Transportation hub	0.826	
		B_6. Seaport centric logistics	0.840	
		B_7. Infrastructure quality	0.664	
		B_9. Production volume	0.708	
	Social development	B_8. Community services	0.741	7 (0.907)
		B_{10}. Low unemployment rate	0.678	
		B_{11}. Growing numbers of jobs	0.622	
		B_{12}. Average wealth	0.843	
		B_{13}. Quality of life	0.783	
		B_{18}. Urban development competitiveness and governance	0.717	
		B_{20}. Upgrading regional development planning strategies and tools	0.730	
Impact of regional development on seaports growth	Seaport dynamic	C_1. Maritime getaway	0.815	5 (0.839)
		C_3. Seaport centric logistics	0.865	
		C_4. Infrastructure development	0.878	
		C_5. Socio-economic development	0.856	
		C_6. Maritime tourism activity	0.512	
	Maritime logistics hub	C_2. Transportation hub	0.965	1 (0.944)
Strategy for seaports development	Maritime sustainable strategy	D_3. Establishes a widely-shared vision for the future development of the region	0.799	8 (0.958)
		D_5. Identifies clear mechanisms for information delivery	0.820	
		D_6. Prepare phases and sequences key investments and actions	0.872	
		D_8. Strategy should be embedded in its organizational, economic and social context	0.879	
		D_9. Developing macroeconomic view of regional development	0.887	
		D_{10}. Critical assessment of land development and management policy	0.829	
		D_{11}. Assessment and reformulation of regional industrial development strategy	0.871	
		D_{12}. Assessment of urban development competitiveness and governance; analysis of existing regional institutions and future prospects	0.879	
	Seaport integration strategy	D_1. Boosting regional investment plan	0.834	3 (0.789)
		D_2. Seaport and industrial park development	0.819	
		D_4. Engages stakeholders in an open and productive manner during preparation of the strategy	0.776	
	Administrative strategy	D_7. Establish a simple but effective framework for monitoring	0.985	1 (0.985)

Source: Authors.

and engaging stakeholders in an open and productive manner during the strategy's preparation. The administrative strategy focuses on establishing an effective framework for monitoring the symbiotic relationship between seaport and regional development.

The findings from both the qualitative and quantitative phases indicate that the seaport system in the east coast of Peninsular Malaysia possesses significant potential to stimulate regional development in the region. Furthermore, there are available opportunities that can be utilized to enhance regional development. The implication of the interplay between seaport and regional development offers a means to reduce the economic imbalance between the east and west coasts of Peninsular Malaysia.

7. Bias management procedures.

For bias analysis, the Common Method Bias (CMB) is required to ensure the findings through EFA are free from unfairness. Common Method Bias (CMB) refers to a type of measurement bias that arises when a single source or method is used to measure multiple variables in a study, creating a spurious relationship between those variables (Kock et al., 2021). This phenomenon can distort research outcomes and lead to erroneous conclusions. For instance, survey instruments that are employed to measure both independent and dependent variables may yield biased responses due to the similarity of measurement methods, resulting in inflated relationships between variables (Lee et al., 2022). To address this issue, researchers can utilize techniques such as Harman's single-factor test or the marker variable approach to ensure that the findings obtained through Exploratory Factor Analysis (EFA) are free from CMB (Jordan & Troth, 2020).

Harman's single-factor test is a technique used to assess the presence and magnitude of CMB in a study's data (Aguirre-Urreta & Hu, 2019). This technique involves conducting a factor analysis on all items in the study, including those that are theoretically unrelated to each other (Malhotra et al., 2006). If a single factor accounts for a substantial proportion of the variance in the data, it indicates the presence of CMB. Conversely, if multiple factors emerge, it suggests that the responses are not solely influenced by the measurement method. The marker variable approach is another technique that researchers can use to identify the degree of CMB in their data (Bozionelos & Simmering, 2022). This method involves including a marker variable in the survey that is not related to the other variables but is measured using the same method.

By examining the correlation between the marker variable and the other variables, researchers can assess the extent to which CMB is present in the data (Farooq et al., 2022). By employing techniques such as Harman's single-factor test and the marker variable approach, researchers can control for CMB, increase the reliability and validity of their findings, and minimize the risk of drawing inaccurate or misleading conclusions (Kock et al., 2021). Therefore, addressing CMB is a crucial aspect of research methodology, particularly when utilizing EFA.

In this research, the CMB was conducted through Harman single factor analysis using the EFA, where all 38 variables loaded into a single factor. In any analysis, a newly introduced common latent factor explaining more than 50 per cent of the variance indicates the presence of bias in the result (Eichhorn, 2014). In this research, the Common Method Variance (CMV) value was 46.722 per cent which reflects the absence of bias in the findings (see Table 7).

Table 7: Summary of findings in quantitative phase.

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	per cent of variance	Cumulative per cent	Total	per cent of variance	Cumulative per cent
1.	18.220	47.947	47.947	17.754	**46.722***	46.722
2.	3.322	8.742	56.668			
3.	1.726	4.541	61.229			
4…	1.427	3.754	64.984			

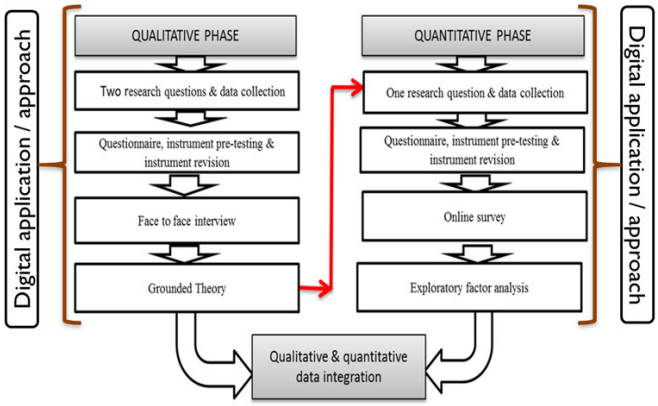
Note: *CMB value: 46.722 per cent

Source: Authors.

8. Data mixing in mixed methods.

Most of the researchers assume that the mixing procedures in mixed methods are proven by combining several methodologies in a single piece of research. This concept is obviously contradicted with the original concept of mixed methods design (Jeevan et al. 2019). Furthermore, the mixing procedure in exploratory mixed methods design is not occurred at the end of research but it happens at the beginning of the research especially during the development of qualitative and quantitative research questions. According to Tashakkori and Teddlie (2003), the combinations of both types research questions facilitates the interpretation procedure of the outcome. Data mixing is important for comparing, consolidating, infusing, building and embedding of both results (qualitative and quantitative) to develop a new outcome through a significant clarifications and understandings (Teddlie & Tashakkori, 2006). For example, in this case, which employs exploratory sequential design, the mixing was made and connections were established during the selection of participants for the quantitative follow-up analysis based on qualitative results. Conversely, the connection has been established before the interpretation procedure and this evidenced that the mixed methods approach has been implemented thoroughly during the research process. Figure 1 indicates the flow and the data mixing stage in mixed method research.

Figure 1: Summary of findings in quantitative phase.



Source: Authors.

9. Incorporating digital innovation in exploratory mixed method design.

The involvement of digital application has become a substantial agenda in research especially after the introduction of 4^{th} industrial revolution (IR 4.0) and the emergence of global pandemic. Basically, the exploratory mixed method will start with qualitative phase and ended with quantitative phase. In general, the emergence of IR 4.0 assists many aspects in research. For example, many of the interview sessions have been conducted via online and this situation reducing the time, cost and protecting the interviewers and interviewees from Covid 19. However, from a deeper perspective, while conducting the interview sessions via online several issues have been encountered. For example, some of the interviewees facing poor internet connections. This situation preventing the interviewer to grasp the meaning or the explanations for the proposed questions. Moreover, the interviewers also difficult to observe the body language of the participants while explaining the content of their ideas. The body language of the participants needs to be observed the ensure the significance level for the proposed answers for each question during the sessions.

These technological limitations distracting the interview sessions and might affecting the validity of the answer. Further, these invalid answers will be carried forward to the quantitative phase which eventually affecting the generalization of the output. In that case, the digital innovation needs to be utilized effectively by providing a clear guidance to the participants. For example, the participants can be informed to be in specific location which has optimum internet access to ease the interview procedure. In this case, the communication skills need to polish among the researchers to convince the participants to be at the appropriate venue at the right time. In that case, the token of appreciation can be provided to encourage the participants to be involve in the session effectively.

During the quantitative phase, the digital innovation playing the major role to assist the researcher to collect the information from the respondents. For example, a link has been created and share it to the respondents via various social media platforms. During the pandemic, the social media has been utilized to support the researchers for the data collections. In order to ensure the validity of the result, the sampling frame has been utilized as fundamental guideline during the questionnaire disseminations.

According to Gonzalez et al. (2019), the maritime sector has been accepting the dynamic of digitalization in the different area. Since the digital application have been implemented in seaport and shipping sectors such as; "autonomous vehicles and robotics; artificial intelligence (AI); Big Data; virtual reality, augmented and mixed reality; Internet of Things; the cloud and edge computing; digital security; 3D printing and additive engineering hence, the different and advance approaches are required to collect the information to ensure the data can be collected successfully. In addition, in the era of social distance has become a norm in the society, the technological advancement needs to be utilized to ease the data collection procedure especially from the qualitative research perspective. Teti et al. (2020) agree that researchers are required to explore a new research norm to prevent them from any disruptions while conducting the research.

Predicated to the current restrictions, digital applications have been carried out to ease the data collection procedure especially for interview sessions. Several approaches such as video based online interview (Lobe et al. 2020), virtual ethnography and email (Fritz and Vandermause, 2018), telephone interview (Johnson et al, 2019), instant message interviews (Chen and Neo, 2019) and electronic forums (Schiek and Ullrich, 2019) have become idol tools for researchers to garner the qualitative data from the respondents. In contrast, those application might assist the researcher to gain the answer for the proposed questions however, the detail observation on their body language, their face reactions towards the proposed questions will be neglected and this might affect the interpretations during the transcript development. According to Easterby et al. (2018) the trust from the respondents to be involved in the research is crucial to harvest optimum data related to the research questions. However, the involvement of these tools or additional devices as a transitional medium will prevent to gain the full trust from them. According to Hatch (2001), natural setting is important for information gathering by actual talking directly face-to-face with respondents and watching them behave and act within their context. Therefore, the involvement of the respondents in face-to-face interview session is necessary. It can be done through a round table discussion to validate the transcriptions which have collected through the assistance of digital applications.

Conclusions.

The findings of this paper reveal a scarcity of research employing a mixed methods approach in the domain of seaport and regional development between 2011 and 2022, with only three papers identified. Additionally, a total of 22 papers utilizing qualitative methods were found in the Scopus database, reflecting the use of qualitative approaches in global and Malaysian seaport research. In contrast, only 11 papers employing a quantitative approach were identified in global seaport research, and no papers were found using quantitative designs in Malaysian seaport research during this time period. These findings serve as a significant motivation to explore mixed methods research in seaport and regional development, particularly by incorporating digital applications.

Moreover, this research demonstrates innovation in the design of mixed methods research by integrating both qualitative and quantitative approaches to comprehensively address the research objectives and validate the generalizability of the research findings. The application of mixed methods designs in maritime-related research has been rare and often not clearly stated. Therefore, this paper adopts an exploratory sequential design as part of its mixed methods methodology, integrating qualitative and quantitative phases within a single research study focusing on seaports and regional development. The results also highlight the necessity of incorporating digital tools during the mixed methods research process. However, it is emphasized that the human touch remains crucial in preserving the outcomes of both qualitative and quantitative phases to ensure the trustworthiness of the results obtained through this specific method.

In summary, this research underscores the potential benefits of mixed methods designs in logistics-based research and emphasizes the need for their increased utilization and deeper understanding of their effective use. By encouraging innovative applications of mixed methods, researchers can enhance the significance of research outcomes and develop new approaches to address global challenges in seaport-based research.

References.

Aguirre-Urreta, M. I., & Hu, J. (2019). Detecting common method bias: Performance of the Harman's single-factor test. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, *50*(2), 45-70.

Autsadee, Y., Jeevan, J., Mohd Salleh, N. H., & Othman, M. R. (2024). Digital wind of changes: navigating competitiveness in the maritime sector through the transformation in human resource development. *Maritime Business Review*.

Autsadee, Y., Jeevan, J., Othman, M. R. B., & Salleh, N. H. M. (2023). Evolution and Current trends of Human resource development in the maritime industry through performance analysis and science mapping procedures. *Journal of Maritime Research*, *20*(2), 148-161.

Bethlehem, J., & Biffignandi, S. (2011). *Handbook of web surveys* (Vol. 567). John Wiley & Sons.

Bozionelos, N., & Simmering, M. J. (2022). Methodological threat or myth? Evaluating the current state of evidence on common method variance in human resource management research. *Human Resource Management Journal*, *32*(1), 194-215.

Casula, M., Rangarajan, N., & Shields, P. (2021). The potential of working hypotheses for deductive exploratory research. *Quality & Quantity*, *55*(5), 1703-1725.

Chen, J., & Neo, P. (2019). Texting the waters: An assessment of focus groups conducted via the WhatsApp smartphone messaging application. *Methodological Innovations, 12*(3).

Chen, S. Y., & Liu, S. Y. (2020). Developing students' action competence for a sustainable future: A review of educational research. *Sustainability (Switzerland), 12*(4).

Collins, K. M. T., Onwuegbuzie, A. J. & Jiao, Q. G. (2007). A mixed method investigation of mixed methods sampling design in social and health science research. *Journal of Mixed Method Research, 1*(3), 267-294.

Cooper, D. R. & Schindler, P. S. (2014). *Business research methods*, 12th Edn., McGraw Hill International Edition, New York.

Corbin, J. & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory,* 3rd Edn., SAGE publication, United Kingdom.

Creswell, J. W. & Clark, L. P. (2017). *Designing and conducting mixed methods research*, 3rd Edn, Thousand Oaks, Calif.: SAGE publication, USA.

Creswell, J. W. (2008). *Educational research: Planning, conducting and evaluating quantitative and qualitative research,* 3rd Edn, Kevin M. Davis, New Jersey.

Dominko, M., & Verbič, M. (2019). The economics of subjective well-being: A bibliometric analysis. *Journal of Happiness Studies*, *20*(6), 1973-1994.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285-296.

Easterby, S. M., Thorpe, R. & Jackson, P. R. 2008,Management Research,3rd edn, SAGE publication, London.

Eichhorn, B. R. (2014). *Common method variance techniques*. Cleveland State University, Department of Operations and Supply Chain Management. Cleveland, OH: SAS Institute Inc.

Farooq, R., Zhang, Z., Talwar, S., & Dhir, A. (2022). Do green human resource management and self-efficacy facilitate green creativity? A study of luxury hotels and resorts. *Journal of Sustainable Tourism*, *30*(4), 824-845.

Fricker, R. D. (2008). *Sampling methods for web and e-mail survey*. SAGE publication, London.

Fritz, R. L., & Vandermause, R. (2018). Data collection via in-depth email interviewing: Lessons from the field. Qualitative Health Research, 28(10), 1640–1649.

Greene, J. C. (2007). Mixed methods in social inquiry. John Wiley & Sons.

Harrison, R. L., Reilly, T. M., & Creswell, J. W. (2020). Methodological rigor in mixed methods: An application in management studies. *Journal of Mixed Methods Research*, *14*(4), 473-495.

Hatch, T. 2001, 'Incoherence in the system: Three perspectives on the implementation of multiple initiatives in one district.', American Journal of Education, vol. 2, no. 3, pp. 407-437.

Hirose, M., & Creswell, J. W. (2023). Applying core quality criteria of mixed methods research to an empirical study. *Journal of Mixed Methods Research*, *17*(1), 12-28.

Hyland, K., & Jiang, F. K. (2021). A bibliometric study of EAP research: Who is doing what, where and when?. *Journal of English for Academic Purposes*, *49*, 100929.

Jeevan, J., Bandara, Y.M., Mohd Salleh, N.H., Ngah, A.H. and Hanafiah, R., (2019). A Procedure of Implementing Exploratry Mixed Method Research in Dry Ports Management. *Transactions on Maritime Science*, *8*(02), pp.157-170.

Jeevan, J., Mohd Salleh, N. H., Mohd Zaideen, I. M., Othman, M. R., Menhat, M. N. S., & Divine Caesar, L. (2020). Application of geoeconomics in seaport operations: a theoretical proposal for post Covid-19 recovery strategy. Australian Journal of Maritime & Ocean Affairs, 12(4), 217-242.

Jeevan, J., Selvaduray, M., Mohd Salleh, N. H., Ngah, A. H., & Zailani, S. (2022). Evolution of Industrial Revolution 4.0 in seaport system: An interpretation from a bibliometric analysis. *Australian Journal of Maritime & Ocean Affairs, 14*(4), 229-250.

Jick, T. D. (1979). Qualitative and quantitative methods: Triangulation in action. *Journal of Administrative Science, 24* (4), 602-611.

Johnson, D. R., Scheitle, C. P., & Ecklund, E. H. (2019). Beyond the in-person interview? How interview quality varies across inperson, telephone, and Skype interviews. Social Science Computer Review.

Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Journal of Educational Researcher, 33*(7), 14-26.

Jordan, P. J., & Troth, A. C. (2020). Common method bias in applied settings: The dilemma of researching in organizations. *Australian Journal of Management*, *45*(1), 3-14.

Klassen, A. C., Creswell, J., Plano Clark, V. L., Smith, K. C. & Meissner, H. I. (2012). Best practices in mixed methods for quality of life research. *Quality of Life Research, 21*(3), 377-80.

Kock, F., Berbekova, A., & Assaf, A. G. (2021). Understanding and managing the threat of common method bias: Detection, prevention and control. *Tourism Management*, *86*, 104-330.

Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners*. Sage Publications Limited.

Lee, S. H., Kang, H. J., & Lee, S. Y. (2022). The Influence of Board Diversity and Board Conflict on Performance in Consumer Cooperatives in South Korea. *Journal of Entrepreneurial and Organizational Diversity*, *11*(1), 55-81.

Maarouf, H. (2019). Pragmatism as a supportive paradigm for the mixed research approach: Conceptualizing the ontological, epistemological, and axiological stances of pragmatism. *International Business Research*, *12*(9), 1-12.

Malhotra, N. K., Patil, A., & Kim, S. S. (2007). Bias breakdown. *Marketing Research*, *19*(1).

Morgan, D. L., & Nica, A. (2020). Iterative thematic inquiry: A new method for analyzing qualitative data. *International Journal of Qualitative Methods*, *19*, 1609406920955118.

Mulisa, F. (2022). When Does a Researcher Choose a Quantitative, Qualitative, or Mixed Research Approach?. *Interchange*, *53*(1), 113-131.

Munim, Z. H., M. Dushenko, V. J. Jimenez, M. H. Shakil, and M. Imset. 2020. "Big Data and Artificial Intelligence in the Maritime Industry: A Bibliometric Review and Future Research Directions." Maritime Policy & Management 47 (5): 577–597.

Nulty, D. D. (2008). The adequacy of response rates to online and paper surveys: what can be done? *Assessment and evaluation in higher education, 33*(3), 301-314.

Parey, B., & Kutscher, E. (2023). Operationalizing and Expanding the Rigorous Mixed Methods Framework for Systematic Reviews: The Case of Inclusive Education. *Journal of Mixed Methods Research*, 15586898231175192.

Pranckutė, R. (2021). Web of Science (WoS) and Scopus: The titans of bibliographic information in today's academic world. *Publications*, *9*(1), 12.

Rattray, N. A., Miech, E. J., True, G., Natividad, D., Laws, B., Frankel, R. M., & Kukla, M. (2023). Modeling contingency in veteran community reintegration: a mixed methods approach. *Journal of Mixed Methods Research*, *17*(1), 70-92.

Saab, M., Dartus, J., Erivan, R., Reina, N., Ollivier, M., & Devos, P. (2019). Publication output of French orthopedic and trauma surgeons: Quantitative and qualitative bibliometric analysis of their scientific production in orthopedics and other medical fields. *Orthopaedics & Traumatology: Surgery & Research*, *105*(8), 1439-1446.

Sanchez-Gonzalez, P.L.; Díaz-Gutiérrez, D.; Leo, T.J.; Núñez-Rivas, L.R. Toward Digitalization of Maritime Transport? Sensors 2019, 19, 926.

Schiek, D., & Ullrich, C. G. (2019). Using web forums for qualitative inquiries: Empirical findings on the conditions and techniques for asynchronous online group discussions. The Qualitative Report, 24(13), 14.

Shambe, I., Thomas, K., Bradley, J., Marchant, T., Weiss, H. A., & Webb, E. L. (2023). Bibliometric analysis of authorship patterns in publications from a research group at the London School of Hygiene & Tropical Medicine, 2016–2020. *BMJ global health*, *8*(2), e011053.

Simsek, Z. & Veiga, J. F. (2001). A primer on internet organizational surveys. *Organizational Research Method, 4*(3), 218-235.

Subedi, D. (2016). Explanatory sequential mixed method design as the third research community of knowledge claim. *American Journal of Educational Research*, *4*(7), 570-577.

Sudirman, S., Hakim, A., & Hamidi, H. (2023). Performance Assessment Comprehensively Based on Project Learning Related to Critical Thinking: A Bibliometric Analysis. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 171-179.

Tashakkori, A. & Teddlie, C. (2003). Issues and dilemmas in teaching research methods courses in social and behavioral sciences: US perspective. *International Journal of Social Research Methodology, 6*(1), 61-77.

Teddlie, C. & Tasshakori, A. (2006). A general typology of research designs featuring mixed methods. *Research in the Schools, 13*(1), 12-28.

Teddlie, C. & Yu, F. (2007). Mixed methods sampling a typology with examples. *Journal of Mixed Methods Research, 1*(1), 77-100.

Teti, M., Schatz, E., & Liebenberg, L. (2020). Methods in the time of COVID-19: The vital role of qualitative inquiries. *International Journal of Qualitative Methods, 19*, 1-5.