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Factors of Digital Transformation in the Maritime Transport Sector

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Abstract: This paper aims to present the model of factors which influence the digital transformation in maritime transport sector. The preliminary model is based on a literature review and interviews conducted to identify the relevant factors influencing the digital transformation of stakeholders operating in the maritime transport sector. In order to test the model, the survey was conducted on the sample of Croatian administrative (port authorities, ministry, harbormaster's offices, etc.) and commercial stakeholders (freight forwarders, agents, terminal operators, etc.) operating in maritime transport sector. The collected data was analyzed using the partial least squares structural equation modeling (PLS-SEM) approach. The research has shown that organizational, technological, and environmental (TOE) factors affect the digitalization of the organizations in the maritime transport sector. As a result of digitalization, changes in business models are visible: organizations in maritime transport sector generate additional revenue from new sources, provide new services, and introduce new sales channels.

Keywords: digital transformation; maritime transport sector; seaports; TOE factors; PLS-SEM

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1. Introduction

An increasing number of practitioners and scholars are exploring the possibilities offered by digital technologies and digital transformation [1–8]. Digital transformation has increased consumer expectations and disrupted markets while at the same time putting pressure on traditional companies and traditional business models [9]. Digital transformation refers not only to the implementation of new technologies but also to shaping digital strategies and digital culture and creating a new business model [10–13].

The carriers, seaports, and shippers involved in maritime transport chains [14] have become increasingly dependent on information and communication technologies [15]. Digital transformation may positively affect the maritime transport chain in terms of optimized cargo handling, improved business processes, and minimized environmental impacts [16]. Furthermore, the digitalization of seaport business processes may enhance sea–land supply chain performance [17,18]. Despite numerous benefits, digital transformation in the maritime transport sector lags other transport sectors [19].

The research problem can be observed as follows: A significant number of heterogeneous stakeholders operate in the maritime transport sector, often using incompatible information systems [20,21], the costs of establishing information interoperability are very high [3,22,23], there is a lack of awareness of the positive effects of digital technologies [24], laws and regulations often allow only paper data exchange [25], and cooperation among stakeholders operating in the maritime transport sector is at an insufficient level [23]. Despite these obstacles, there is an urgent need to move ahead and seize the opportunities of digital transformation in the maritime transport sector. Therefore, it is important to understand the current role and situation of digitalization, as well as factors that influence organizations in the maritime transport sector on their digital transformation journey.

This research follows up on the literature review "Digital transformation in the maritime transport sector" [26], in which drivers, success factors, and barriers related to digital transformation were identified. Based on that, we developed the preliminary research model and designed a survey that we administered among 94 enterprises in the maritime transport sector in Croatia. We used PLS-SEM statistical analyses to identify the reliability of the factors of digital transformation in the maritime transport sector. Influencing factors were grouped into technological, organizational, and environmental factors (TOE factors) and factors related to changes in a business model. The latter are included in the research as numerous authors connect digital transformation with reshaping business models. This research aimed to develop and validate a model of the influencing factors on digital transformation in the maritime transport sector, which will help stakeholders to better understand the digital transformation phenomenon and shape more successful digital transformation strategies. In this respect, the results can be used to support decision makers in their digital transformation endeavors.

2. Literature Review

Digitalization refers to the implementation of digital technologies [27] or business process automation [28] to enhance business productivity and sustainability [29]. Digital technologies are only one aspect of digital transformation. It refers to the implementation of digital technologies in order to innovate business models, the success of which depends on actively reshaping business strategies [29,30], adequate digital skills [31], digital culture, etc. [3,13].

Fruth and Teuteberg [32] established that automation and digitalization in maritime logistics are constantly progressing and affecting changes in business models. Bălan (2020) [33] recognized the disruptive impact of advanced information and communications technologies (ICTs) on maritime transport and supply chains. The importance of digitalization has been also recognized by the European Union, which encourages paperless procedures regarding custom processes, freight documents, and documents between cargo owners and contract carriers [34].

Heilig et al. [35] identified three generations of digital transformation in seaports, namely, transformation to paperless procedures, transformation to automated procedures, and transformation to smart procedures. Heilig et al. [29] analyzed the development and the state of the art of digital transformation at the seaport level and identified current opportunities and barriers related to digital transformation.

El Hilali et al. [36] analysed digital transformation in a sustainability context, using a PLS approach. According to the results, "customers, data and innovation", as drivers that companies should work on during a digital transformation, significantly affect companies' efforts to reach sustainability.

As already mentioned, the preliminary research model is based on the literature review "Digital transformation in the maritime transport sector" [26]. In that study, factors were grouped according to the technology organization environment (TOE) framework [37,38]. Technology refers to the acceptance and implementation of modern digital technologies and innovations, along with their safety and interoperability. Organization refers to organizational resources, organizational structure, and communication among employees within an organization. The external environment affects the activities of the organization and its growth. The TOE framework is frequently used in this kind of research, and according to [37], the adoption of innovations is clearly affected by the technological, organizational, and environmental contexts within an organization. In order to adapt the findings and conclusions of the aforementioned paper to this research, we made several changes; for example, success factors and barriers were converted into influencing factors.

Furthermore, to enhance the preliminary research model, the authors identified the scope of changes caused by digitalization and digital transformation, which were defined as changes in a business model. It is important to design a business model to capture value from innovation [39].

In order to validate the preliminary research model as a next step, the authors interviewed six experts in the maritime transport sector. Regarding the interviews with experts, the authors considered different types of stakeholders (administrative and commercial) in order to make the results more relevant. To conduct the quantitative analysis, the authors defined the constructs. The constructs and respective measurement items (factors) are presented in Table 1. The abbreviation ST stands for success technological factors, SO for success organizational factors, and SE for success environmental factors. The abbreviation D stands for digitalization and BM for changes in a business model.

Table 1. Constructs and items.

Constructs	Items	Sources
Technological factors	ST1: The organization implements measures to improve information security	[21,26,32,40–47]
	ST2: ICT systems within the organization are interconnected	[21,26,48–51]
	ST3: The organization has connected its own ICT systems with systems operated by other commercial or administrative stakeholders	
	ST4: The organization uses standards for electronic data interchange (e.g., EDIFACT, XML, etc.)	[21,26,48]
	ST5: The organization has available funds for the implementation of new digital technologies	[3,23,26,43,45,52,53]
	ST6: The organization systematically manages the risks of the implementation of new digital technologies (for example, risks related to the quality of project implementation by the contractor)	[26,45,52]
	ST7: The organization has hired new IT experts, i.e., expanded IT departments in order to accelerate the digital transformation	[26,54] + Interview
	ST8: The existing technology in the organization allows for the upgrade of modern digital technologies	[55]
	ST9: The use of modern digital technologies opens up new business opportunities	[55]
	ST10: The organization regularly invests in modern technologies to develop its business and services	[3,26,43,52,55]
	ST11: The organization has provided prerequisites for interoperability with external information systems, i.e., with systems managed by other stakeholders (for example, by sharing the interface specification to which external systems can be connected)	Interview
Organizational factors	SO1: The organization has a clearly communicated vision toward all employees in the context of digital transformation	[26,31,53,56–68]
	SO2: Managers are motivated when it comes to the digital transformation of the organization (for example, encouraging the adoption of digital technologies)	[26,69–72]
	SO3: The organization has sufficient financial resources to introduce new digital technologies	[3,26,43,52] + Interview

Table 1. *Cont.*

Constructs	Items	Sources
Organizational factors	SO4: The organization has sufficient human resources to introduce new digital technologies	[26,45,52,53,55,69,72–75] + Interview
	SO5: Managers possess sufficient digital skills needed to digitally transform an organization	
	SO6: Employees possess sufficient digital skills for the digital transformation of the organization	
	SO7: The organization invests in employee knowledge in the context of digitalization and digital transformation	[24,26,30,40,44,46,53,54,56,58,61,63,64,66,71,76–85]
	SO8: The organization conducts the continuous training of employees in the field of digitalization and digital transformation	Interview
	SO9: There is an awareness in the organization of how digital transformation can affect the business of the organization	[24,26,81,86,87]
	SO10: Employees actively share knowledge and information among themselves within the organization as a result of digitization and digital transformation	Interview
	SO11: The organization has introduced new leadership roles to improve digitalization and digital transformation (for example, business process manager)	[26,54] + Interview
	SO12: The organization is actively developing digital transformation strategies	[9,12,26,29,30,35,42,46,47,49,52–54,56–58,60–65,68,70–74,76,77,81,82,84,85,87–100]
	SO13: Employees in the organization have the opportunity to participate in the development or adaptation of digital technologies	Interview
Environmental factors	SE1: The organization feels the pressure of competition on business due to digitalization and digital transformation of competition (digital transformation can significantly disrupt existing markets and recombine existing products and services)	[3,9,12,23,24,26,32,35,42,47,49,54,55,57,64,65,70–72,74,79,81,84,87,89,90,92,93,95,96,99,101–106]
	SE2: The organization feels the pressure of business partners and other relevant stakeholders on the business (due to the emergence of new technologies, the expectations of business partners may increase)	[9,12,23,24,26,40,42,45,51,52,54–57,61–66,69–72,74,79,84,86,89,101,103–105,107,108]
	SE3: The business of the organization is tightly regulated or subject to special legal regulations	[3,21,26,55,89,109]
	SE4: The organization cooperates with research institutions in the development of new digital solutions (startups, faculties, etc.)	Interview
	SE5: There is the compliance of the organization with standards (for example, ISO standards) and conventions	[55]
	SE6: The organization conducts socially responsible business with the help of digitalization and digital transformation	Interview

Table 1. *Cont.*

Constructs	Items	Sources
Digitalization	D1: The organization cooperates with new partners with the aim of developing new digital solutions	[55,101]
	D2: The organization has digitalized internal business processes	[3,55]
	D3: The organization has digitalized external business processes	[29,30,35,36,110–115]
Changes in business model	BM1: The organization generates additional revenue from new sources as a result of the implementation of digital technologies	[30,55,114,116]
	BM2: The organization has entered new markets as a result of digitalization and digital transformation	[55,101]
	BM3: The organization provides new services as a result of digitalization and digital transformation	[11,12,30,35,36,55,80,101,110–112,114,115,117–120]
	BM4: The organization has introduced new sales channels as a result of digitalization and digital transformation	Interview
	BM5: The organization has introduced new ways of charging for services as a result of digitalization and digital transformation	[30,55,114,116]

3. Methodology

The methodology combines qualitative and quantitative approaches [55,116,121]. Based on an extensive literature review [26], digital transformation influencing factors were identified and clustered using the TOE framework. These factors influence the level of digitalization in enterprises and are reflected in business models changes. To confirm the relevance of the influencing factors, interviews with six experts from different organizations were conducted, and a preliminary research model was designed. The authors interviewed the managers of the following organizations: the ministry of transport, shipping and logistic companies, a port authority and the enterprise that focuses on digitalization of stakeholders operating in maritime transport sector. After that, the authors designed the questionnaire and conducted a survey of 262 Croatian stakeholders to validate the research model. Figure 1 shows the research steps and outcomes.

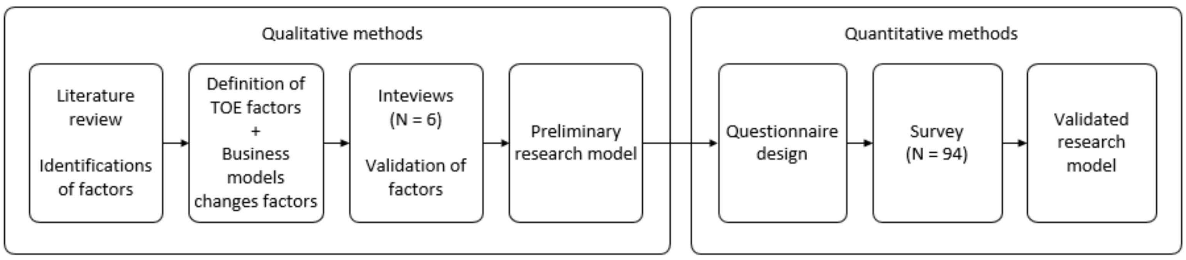

Figure 1. The research steps.

Based on the extensive literature review and interviews with experts, the following hypotheses were formulated:

Hypothesis 1 (H1). *Organizational factors have a positive impact on technological factors.*

Hypothesis 2 (H2). *Technological factors have a positive impact on digitalization.*

Hypothesis 3 (H3). *Environmental factors have a positive impact on digitalization.*

Hypothesis 4 (H4). *Digitalization has a positive impact on changes in a business model.*

The preliminary research model of digital transformation in the maritime transport sector is shown in Figure 2.

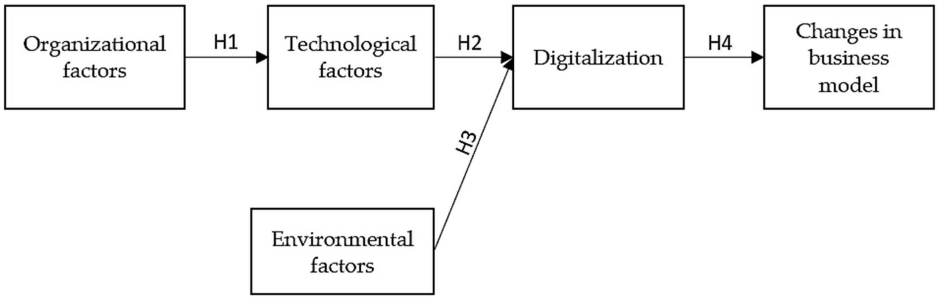

Figure 2. The preliminary model of digital transformation in the maritime transport sector.

The authors designed a questionnaire and collected quantitative data on factors influencing the digital transformation of stakeholders operating in the maritime transport sector through an online survey. A five-point Likert type scale (1—totally disagree, 5—totally agree) was used to measure the level of agreement with given statements on the questionnaire. For data analyses, the partial least squares structural equation modeling (PLS–SEM) method was used to test the model, using SmartPLS 3.3.9 (SmartPLS GmbH, Bönningstedt, Germany).

The authors contacted 262 Croatian stakeholders listed in relevant national databases, both commercial (freight forwarders, agents, terminal operators, etc.) and administrative (port authorities, harbour master offices, and the relevant ministries). Since seaports are an important link in the transport chain [122], and the connection of the seaport with the hinterland contributes to the competitiveness of the seaport and influences its development [123,124], the authors also considered rail and road carriers that are involved in the maritime transport chain. Experts who had leading positions within the organization and who had experience in the field of digital transformation responded to the surveys (one person from each organization). The complete set of data was collected in 2022 from 94 organizations in Croatia.

4. Results

4.1. Descriptive Statistics

Out of the total of 262 invited enterprises, we received 122 responses. We took into account only fully completed surveys, 94 of them. Out of 94 respondents, 35.11% were administrative stakeholders, and 64.89% were commercial stakeholders. Table 2 shows the types and percentages of the different stakeholders.

Table 2. Types and percentages of stakeholders.

Group of Stakeholders	Type of Stakeholders	Percentage
Administrative stakeholders	Public bodies and administrative stakeholders	35.11%
Commercial stakeholders	Shipping companies	17.02%
	Freight forwarders and logistics operators	14.89%
	Maritime brokers	11.70%
	Port operators and terminal operators	7.45%
	Other	7.45%
	Maritime port agents	3.19%
	Road carriers	2.12%
	Railway carriers	1.06%

Among the commercial stakeholders, we received the largest number of responses from shipping companies, followed by freight forwarders and logistics operators. The category "other" includes: crewing (manning) agencies, the maritime training center for maritime education, and vessel management

4.2. Measurement Model Evaluation

In the first part of the PLS–SEM analysis, we tested the measurement model. We evaluated composite reliability and convergent validity and the reliability of measurement model indicators, and then we assessed discriminant validity and evaluated the composite model.

4.2.1. Evaluating Composite Reliability and Convergent Validity of Measurement Model

First, to measure the composite reliability of the measurement model, we calculated Cronbach's alpha, Dijkstra–Henseler rho_A, and composite reliability as shown in Table 3.

Table 3. Construct Reliability and Validity.

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Changes in business model	0.883	0.900	0.927	0.809
Digitalization	0.802	0.807	0.884	0.719
Environmental factors	0.766	0.841	0.863	0.679
Organizational factors	0.842	0.847	0.894	0.678
Technological factors	0.816	0.820	0.879	0.646

All composite reliability values are measured in the interval from 0 to 1, where 1 means a complete reliability estimate. The measure of composite reliability (rho) is higher than Cronbach's alpha, which is recommended because rho estimates are usually closer to true reliability. Cronbach's alpha as rho has an acceptance limit of 0.7, and a match above 0.8 means good composite reliability. Table 3 shows that Cronbach's alphas for the latent variables are between 0.766 and 0.883, and rho is between 0.807 and 0.900. In recent years, Dijkstra–Henseler rho_A [121] has become increasingly popular. Dijkstra–Henseler rho_a above 0.707 is considered appropriate, meaning that the latent variable explains more than 50% of the variance in a construct [121]. Table 3 shows that all rho_A are above 0.707, indicating a reliable construct.

"Convergent validity is the extent to which the indicators belonging to one latent variable actually measure the same construct" and is estimated based on average variance extracted (AVE) [121]. As a composite reliability metric, AVE is between 0 and 1, where 1 represents a complete convergence estimate [125]. "An AVE larger than 0.5 has been suggested to provide empirical evidence for convergent validity, as the corresponding latent variable explains more than half of the variance in the belonging indicators" [121]. As shown in Table 3, the AVEs for all latent variables are between 0.646 and 0.809, which is appropriate and indicates convergent validity.

4.2.2. Evaluating the Reliability of Measurement Model Indicators

An assessment of the reliability of the indicator can be given based on factor loadings, where a factor loading above 0.707 is considered acceptable.

In the original measurement model, there were 38 indicators that we gradually eliminated. In each iteration, we eliminated one factor with the lowest factor loading. We continued this process until we came up with indicators with factor loadings above 0.707. It means that "more than 50% of the variance in a single indicator can be explained by the corresponding latent variable" [121].

4.2.3. Assessment of Discriminant Validity of a Measurement Model

"Discriminant validity entails that, two latent variables that are meant to represent two different theoretical concepts are statistically sufficiently different." To obtain empirical evidence for discriminant validity, the heterotrait–monotrait (HTMT) ratio should be considered [121]. The HTMT should be lower than 0.85 (stricter threshold) or 0.90 (more lenient threshold) or significantly smaller than 1". The HTMTs for the latent variables are shown in Table 4. No HTMT is higher than the strict criterion, 0.85, so HTMT indicates the discriminant validity of the measurement model.

Table 4. HTMT values.

	Changes in Business Model	Digitalization	Environmental Factors	Organizational Factors	Technological Factors
Changes in business model					
Digitalization	0.581				
Environmental factors	0.190	0.786			
Organizational factors	0.366	0.580	0.523		
Technological factors	0.369	0.781	0.705	0.713	

4.2.4. Evaluating Composite Model

To provide an estimate of the composite model, we focus on estimating multicollinearity, weights, and composite loadings [121]. Multicollinearity occurs when two independent variables have a high correlation, which increases standard errors and test unreliability, and when there are difficulties in assessing the importance of variables depending on each other [125]. As a rule, problems with multicollinearity occur when the variance inflation factor (VIF) is above 4.0, or above 5.0 following the less stringent criterion [121,125].

Problems with multicollinearity can occur at both the measurement level and the structural model level [125], so SmartPLS separates VIF into inner VIFs for the measurement model and outer VIFs for the structural model. Table 5 shows the inner VIFs for the measurement model.

Table 5. The inner VIFs.

	Changes in Business Model	Digitalization	Environmental Factors	Organizational Factors	Technological Factors
Changes in a business model					
Digitalization	1.000				
Environmental factors		1.482			
Organizational factors					1.000
Technological factors		1.482			

All values are much lower than 4 (the maximum inner VIF is 1.482), which is why we do not expect problems related to multicollinearity. Table 6 shows the outer VIFs for the measurement model as well as the weights and loadings.

All VIFs are lower than 4 (the maximum outer VIF is 2.905), which is why we do not expect problems related to multicollinearity in the structural model.

"While weights show the relative contribution of an indicator to its construct, composite loadings represent the correlation between the indicator and the corresponding emergent variable; a loading shows the absolute contribution of an indicator to its construct" [121]. If there is an indicator of a latent variable with a significantly smaller loading than other indicators, then it is necessary to assess whether it is appropriate to exclude that indicator. The validity of the indicator must also be taken into account. In the event of a change in the validity, we may choose to keep an indicator with a lower weight. As can be seen from Table 6, within the structural model, indicators of latent variables are similarly weighted/loaded.

Table 6. The outer VIFs, weights, and loadings.

Constructs	VIF	Weight	Loading
BM1	2.905	0.366	0.917
BM3	2.461	0.424	0.912
BM4	2.292	0.319	0.869
D1	1.387	0.371	0.769
D2	2.315	0.415	0.889
D3	2.291	0.393	0.880
SE3	1.444	0.287	0.730
SE5	1.610	0.383	0.820
SE6	1.892	0.523	0.911
SO4	1.743	0.295	0.793
SO7	2.157	0.337	0.856
SO8	2.158	0.306	0.841
SO9	1.851	0.275	0.803
ST10	1.927	0.341	0.829
ST2	1.638	0.294	0.787
ST6	1.486	0.299	0.746
ST8	2.107	0.310	0.848

4.3. Structural Model Evaluation

After completing evaluations of the measurement and composite models, according to which we consider the measured properties of the research model to be appropriate, we can proceed with the assessment of the structural model [121,125]. In the assessment of structural models, we focus on estimates of model fit as well as estimates of path coefficients, their importance, effect sizes (f^2), and coefficients of determination (R^2) [121].

First, it was necessary "to evaluate the overall fit of the estimated model through the bootstrap-based test of overall model fit and the Standardized Root Mean Square Residual (SRMR) as a measure of approximate fit to obtain empirical evidence for the proposed theory" [121]. For each iteration of the following steps, we used SRMR, the squared Euclidean distance (d_{ULS}), and geodesic distance (d_G) to verify that the model corresponds to a saturated structural model [121] (see Table 7).

Table 7. Model fit.

	Saturated Model	Estimated Model
SRMR	0.080	0.106
d_{ULS}	0.972	1.725
d_G	0.508	0.571

An SRMR below 0.08 (or in a more conservative version below 0.10) indicates acceptable model fit [121,126]. Based on the considered data, the SRMR coefficient is 0.08, which is still acceptable.

The values of d_{ULS} and d_G by themselves have no value for assessing the suitability of the model. The adjusted Bollen–Stine bootstrap should be implemented to estimate d_{ULS} and d_G, which in SmartPLS is marked as double, or perfect, bootstrapping. This procedure creates samples based on the distribution of confidence intervals for SRMR, $d_{ULS,}$ and d_G. If d_{ULS} and d_G are within the 95% confidence interval, the model is considered appropriate [126]. The analysis of the research model showed that both values are within the 95% confidence interval.

The structural or internal model consists of latent variables and the relationships (arrows) between them. The weight written on the arrow that directly connects the two latent variables is the standardized regression coefficient. The statistical characteristics of individual paths are checked using a double, or complete, bootstrapping, and for a path to be statistically significant, it must have a *p* value lower than 0.05 [121]. The results of the bootstrapping analysis are shown in Table 8.

Table 8. Path coefficients (bootstrapping).

Relationship	Original Coefficient	Sample Mean	Standard Deviation	T Statistic	*p* Value
Digitalization → Changes in business model	0.491	0.497	0.106	4.653	0.000
Environmental factors → Digitalization	0.414	0.429	0.105	3.939	0.000
Organizational factors → Technological factors	0.597	0.611	0.094	6.376	0.000
Technological factors → Digitalization	0.399	0.386	0.119	3.354	0.001

All *p* values are lower than 0.05, which means that the relationships between the variables are statistically significant. Furthermore, as can be seen from Table 8, all path coefficients are positive. It can be concluded that the hypotheses have been confirmed.

Table 9 shows the explained variance of a dependent construct (R^2) and the magnitude of an effect that is independent of sample size (f^2).

Table 9. Structural model evaluation.

Endogenous Variable	R^2
Changes in business model	0.258
Digitalization	0.535
Technological factors	0.383
Effect Size	f^2
Digitalization → Changes in business model	0.375
Environmental factors → Digitalization	0.272
Organizational factors → Technological factors	0.675
Technological factors → Digitalization	0.250

When phenomena are already quite well understood, one expects a high R^2. When the phenomena are not yet well understood, a lower R^2 is acceptable [121]. These results including the path coefficient and R^2 are presented in Figure 3.

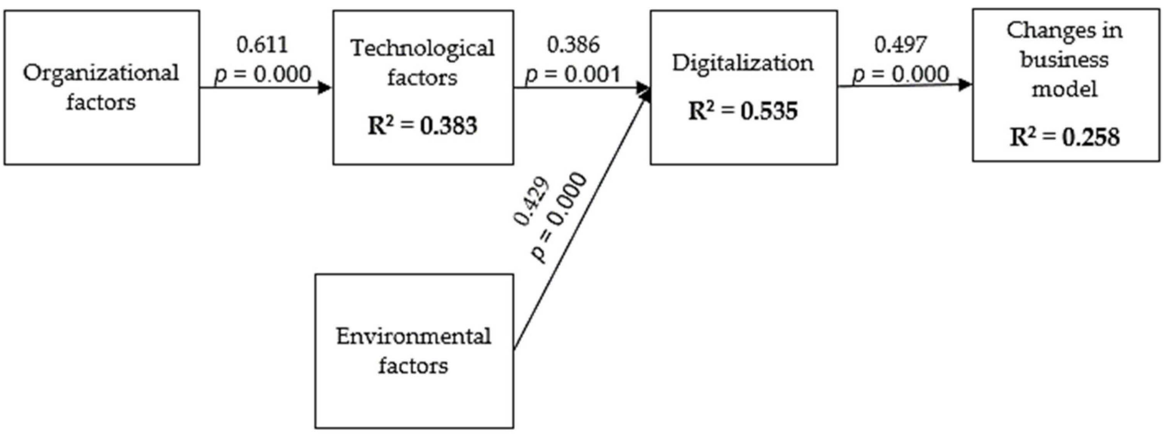

Figure 3. PLS analysis of the research model.

Given that, in our opinion, this is the first such study that evaluates the impacts of factors of digitalization on changes in business models, it is estimated that R^2 = 0.258 is an acceptable value.

Table 9 shows f^2, which indicates the practical relevance of an effect. The magnitude of the effect f^2 is independent of the magnitude of the sample value, and the effect size is considered weak for f^2 between 0.02 and 0.15, medium for f^2 between 0.15 and 0.35, and large for f^2 equal to or larger than 0.35 [121]. Table 9 shows that the structural model contains both medium and large effect sizes. Namely, in the structural model, the effect size of linking technological factors and digitalization is the weakest in the whole model (f^2 = 0.250). On the other hand, the effect size of linking organizational factors and technological factors is the strongest (f^2 = 0.675).

5. Discussion and Findings

Based on an assessment of the indicators, several organizational factors were assessed as the most reliable. One of the important organizational factors is the existence of awareness in the organization of how digital transformation can affect the business of the organization. If there is no awareness, the need for investment in employees, new digital technology, etc. will not be recognized, which will ultimately slow down or prevent digital transformation [24]. For this reason, organizational factors represent the base or first step towards digital transformation. Another factor is "the organization has enough human resources to introduce new digital technologies". In order to ensure a sufficient number of human resources, cooperation between the university and the private sector is needed (e.g., by investing in knowledge), which would facilitate the further development and implementation of digital technologies in maritime transport sector [26,127].

One of the factors is "The organization invests in employee knowledge in the context of digitalization and digital transformation". In this respect, changes in the structure as well as the culture of the organization lead employees to take on roles that have traditionally been outside their functions [26]. Therefore, employees in the maritime transport sector should be encouraged by managers to upgrade their knowledge through intern or extern workshops, seminars, etc., which consequently affects organizational agility [128]. However, it is equally important that employee education take place regularly. Therefore, one of the factors the importance of which was recognized by the respondents related to the continuity of training: "The organization conducts continuous training of employees in the field of digitalization and digital transformation (for example, the development of an internal academy with online training and training modules in individual departments)".

Regarding technological factors, three of them were assessed as the most reliable, two of which were "The organization regularly invests in modern technologies to develop its business and services" and "The existing technology in the organization allows the upgrade of modern digital technologies". In this respect, "necessary technical modifications depend on the state of existing technologies used in an organization and must be adapted according to the needs of the organization" [26]. The last technological factor is "The organization systematically manages the risks of the implementation of new digital technologies", which is related to risks regarding, e.g., the quality of project implementation by the contractor.

The external environment may influence the activities of the organization and its growth. In terms of environmental factors, three of them were assessed as the most reliable. One of them is "The business of the organization is tightly regulated or subject to special legal regulations", which is usually related to green transport technologies or technologies that are applied for efficient and safe operation [109]. Another environmental factor is "There is a compliance of the organization with standards (for example, ISO standards) and conventions". For example, "ISO/IEC 38500:2015 provides guiding principles for members of governing bodies of organizations on improved, and acceptable use of information technology within their organizations" [129]. The last environmental factor assessed as most reliable is "the organization conducts socially responsible business with the help of digitalization and digital transformation". For example, in maritime transport, the United Nations 2030 Agenda and Sustainable Development Goal 17 refer to significant regulatory development that triggered a diffusion of corporate social responsibility [130].

In addition to assessing the factors of digital transformation, the stakeholders who participated in our research were asked if their organizations had a formulated digital transformation strategy, and only 27% of organizations provided a positive response.

Furthermore, in 47% of organizations, general managers are responsible for leading the digital transformation. In other organizations, IT department managers, project managers, or digital transformation managers are responsible for digital transformation.

Stakeholders were also asked in which business area the digitalization has brought the most benefits, and the following areas were mentioned: sales, accounting, finance, cost management, procurement, reporting, the official procedures of arrivals and departures of ships, customs formalities, human resource management, and analytics. Furthermore, organizations use the following information technologies (in descending order, based on the number of responses): office programs, e.g., MS Office (93%); information systems for business support (69%); applications for communication with clients (48%); social networks, e.g., LinkedIn (48%); software solutions for business analytics (36%); online sales (14%); blockchain (1%); and other, e.g., geographic information systems (5%). The majority of organizations (60%) answered that they had increased productivity by introducing digitalization and digital transformation.

In addition, stakeholders pointed out the importance of digital transformation when it comes to sustainable business, especially the ecological aspect of sustainability. In this respect, some of them increasingly use green sources and have implemented various solutions in order to lower the harmful impacts of their business (such as fuel flow measuring systems to optimize fuel consumption). One of the stakeholders has also developed a research center that is focused exclusively on development of zero-carbon technologies and solutions.

Our research has shown that organizational, technological, and environmental factors affect the digitalization of organizations in the maritime transport sector. Digitalization includes cooperation between an organization and new partners to develop new digital solutions (including through participation in projects related to digitalization and/or digital transformation) and digitalized internal and external business processes. As a result of digitalization, organizations in the maritime transport sector generate additional revenue from new sources, provide new services, and have introduced new sales channels.

The contribution of this study is twofold. First, the results of the study enrich the body of knowledge in the field of digitalization and digital transformation in the maritime transport sector. The validated model of digital transformation offers other researchers an introduction to the investigated field and may provide a baseline towards future research designs. In this respect, this research offers a better understanding of the influencing factors (technological, organizational, and environmental) that affect the digitalization of organizations operating in the maritime transport sector and how these changes result in changes in business models (the way an organization operates and conducts business). Second, the model with identified influencing factors can help practitioners and decision makers in shaping their digital transformation and digitalization strategies.

6. Conclusions

In the maritime transport sector, stakeholders are at different stages regarding the digital transformation of their business. The motivation for this research stems from the lack of existing research focused on digital transformation in the maritime transport sector. The existing studies do not provide a comprehensive overview of digital transformation in the maritime transport or seaports. In this respect, this research presents a model of influencing factors on digital transformation in the maritime transport sector. For that purpose, the authors, as a first step, conducted a literature review and carried out interviews with six organizations. Based on that, the authors identified 11 technological factors, 13 organizational factors, and 6 environmental factors and defined digitalization through 3 items and changes in business models through 5 items. Furthermore, the authors collected quantitative data on factors influencing the digital transformation of stakeholders operating in the maritime transport sector through a survey methodology. In the first part of the PLS–SEM analysis, testing of the measurement model was performed. The authors evaluated composite reliability and convergent validity and the reliability of measurement model indicators and then assessed discriminant validity and evaluated the composite model. In the assessment of structural models, the authors focused on estimates of model fit, estimates of path coefficients, their importance, effect size (f^2), and coefficient of determination (R^2).

The research has several limitations, which may also serve as future research directions. First, the research findings were based only on a sample of 94 organizations in Croatia. The comparison of these findings with other countries (e.g., countries in which digital transformation leaders operate such as Holland at the Port of Rotterdam) could provide further insights regarding digital transformation in the maritime transport sector. Furthermore, the authors analyzed both commercial and administrative stakeholders. In this respect, further research could include only one group. In order to broaden the scope of the research, additional analysis of the impact of digitalization on the business model may be conducted, for example at the supply chain level. In this respect, virtualization of product supply may be included, which means selling items that are not even owned by the company through the digital integration of inventories (digital marketplaces). Furthermore, traceability and product safety can change the business model based on the securitization of food, etc. This study offers only partial insights into digital transformation, which is a complex and fast-evolving phenomenon.

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References

1. Vujičić, S.; Hasanspahic, N.; Car, M.; Čampara, L. Distributed Ledger Technology as a Tool for Environmental Sustainability in the Shipping Industry. *J. Mar. Sci. Eng.* **2020**, *8*, 366. [CrossRef]
2. Pu, S.; Lam, J.S.L. Blockchain adoptions in the maritime industry: A conceptual framework. *Marit. Policy Manag.* **2021**, *48*, 777–794. [CrossRef]
3. Gausdal, A.H.; Czachorowski, K.V.; Solesvik, M.Z. Applying Blockchain Technology: Evidence from Norwegian Companies. *Sustainability* **2018**, *10*, 1985. [CrossRef]
4. Tijan, E.; Agatić, A.; Hlača, B. The Necessity of Port Community System Implementation in the Croatian Seaports. *Promet Traffic Transportation* **2012**, *24*, 305–315. [CrossRef]
5. Ferretti, M.; Schiavone, F. Internet of Things and business processes redesign in seaports: The case of Hamburg. *Bus. Process Manag. J.* **2016**, *22*, 271–284. [CrossRef]
6. Russo, F.; Musolino, G. The Role of Emerging ICT in the Ports: Increasing Utilities According to Shared Decisions. *Front. Future Transp.* **2021**, *2*, 722812. [CrossRef]
7. Moros-Daza, A.; Amaya-Miera, R.; Paternina-Arboleda, C. Port Community Systems: A Structured Literature Review. *Transp. Res. Part A* **2020**, *133*, 27–46. [CrossRef]
8. Russo, F.; Musolino, G. Quantitative characteristics for port generations: The Italian case study. *Int. J. Transp. Dev. Integr.* **2020**, *4*, 103–112. [CrossRef]
9. Verhoef, P.C.; Broekhuizen, T.; Bart, Y.; Bhattacharya, A.; Dong, J.Q.; Fabian, N.; Haenlein, M. Digital transformation: A multidisciplinary reflection and research agenda. *J. Bus. Res.* **2019**, *122*, 889–901. [CrossRef]
10. Lucas, H.C.; Agarwal, R.; Clemons, E.K.; El Sawy, O.A.; Weber, B. Impactful research on transformational information technology: An opportunity to inform new audiences. MIS Q. Manag. *Inf. Syst.* **2013**, *37*, 371–382.
11. Hausberg, J.P.; Liere-Netheler, K.; Packmohr, S.; Pakura, S. Digital Transformation in Business Research: A systematic literature review and analysis. In Proceedings of the DRUID18 Conference, Copenhagen, Denmark, 11–13 June 2018.

12. Morakanyane, R.; Grace, A.; O'Reilly, P. Conceptualizing Digital Transformation in Business Organizations: A Systematic Review of Literature. In Proceedings of the 30th Bled eConference Digital Transformation—From Connecting Things to Transforming Our Lives, Bled, Slovenia, 18–21 June 2017.
13. Warner, K.S.R.; Wäger, M. Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal. *Long Range Plan.* **2019**, *52*, 326–349. [CrossRef]
14. Talley, W.K. Maritime transport chains: Carrier, port and shipper choice effects. *Int. J. Prod. Econ.* **2014**, *151*, 174–179. [CrossRef]
15. Heering, D. Ensuring Cybersecurity in Shipping: Reference to Estonian Shipowners. *Int. J. Mar. Navig. Saf. Sea Transp.* **2020**, *14*, 271–278. [CrossRef]
16. Babica, V.; Sceulovs, D.; Rustenova, E. Digitalization in Maritime Industry: Prospects and Pitfalls. In *ICTE in Transportation and Logistics 2019. ICTE ToL 2019. Lecture Notes in Intelligent Transportation and Infrastructure*; Ginters, E., Ruiz Estrada, M., Piera Eroles, M., Eds.; Springer: Cham, Switzerland, 2020. [CrossRef]
17. Paulauskas, V.; Filina-Dawidowicz, L.; Paulauskas, D. Ports Digitalization Level Evaluation. *Sensors* **2021**, *21*, 6134. [CrossRef]
18. Di Vaio, A.; Varriale, L. Digitalization in the sea-land supply chain: Experiences from Italy in rethinking the port operations within inter-organizational relationships. *Prod. Plan. Control* **2020**, *31*, 220–232. [CrossRef]
19. Kapidani, N.; Bauk, S.; Davidson, I.E. Digitalization in Developing Maritime Business Environments towards Ensuring Sustainability. *Sustainability* **2020**, *12*, 9235. [CrossRef]
20. Kumar, A.; Sharma, A. Paradigm Shifts from E-Governance to S-Governance. In *The Human Element of Big Data—Issues, Analytics, and Performance*; Tomar, G.S., Chaudhari, N.S., Bhadoria, R.S., Eds.; Taylor and Francis Group: Oxford, UK, 2017; pp. 213–234.
21. Tsakalidis, A.; Gkoumas, K.; Pekár, F. Digital Transformation Supporting Transport Decarbonisation: Technological Developments in EU-Funded Research and Innovation. *Sustainability* **2020**, *12*, 3762. [CrossRef]
22. Disadvantages of Decision Support System. 2010. Available online: http://dsssystem.blogspot.com/2010/01/disadvantages-of-decision-support.html (accessed on 26 November 2021).
23. Acciaro, M.; Sys, C. Innovation in the maritime sector: Aligning strategy with outcomes. Marit. Policy Manag. Flagsh. *J. Int. Shipp. Port Res.* **2020**, *47*, 1045–1063.
24. Boneva, M. Challenges related to the digital transformation of business companies. In Proceedings of the 6th International Conference Innovation Management, Entrepreneurship and Sustainability (IMES 2018), Prague, Czech Republic, 31 May–1 June 2018; pp. 101–114.
25. Jović, M. Digital transformation of Croatian seaports. In Proceedings of the 32nd Bled eConference: Humanizing Technology for a Sustainable Society Conference Proceedings/Doctoral Consortium, Bled, Slovenia, 16–19 June 2019.
26. Tijan, E.; Jović, M.; Aksentijević, S.; Pucihar, A. Digital transformation in the maritime transport sector. Technol. *Forecast. Soc. Change* **2021**, *170*, 120879. [CrossRef]
27. Agatić, A.; Kolanović, I. Improving the seaport service quality by implementing digital technologies. *Sci. J. Marit. Res.* **2020**, *34*, 93–101. [CrossRef]
28. Jović, M.; Tijan, E. Digitalization and Digital Transformation in Maritime Transport. In Proceedings of the 5th My First Conference Proceedings, Rijeka, Croatia, 23 September 2021.
29. Heilig, L.; Lalla-Ruiz, E.; Voß, S. Digital transformation in maritime ports: Analysis and a game theoretic framework. *NETNOMICS Econ. Res. Electron. Netw.* **2017**, *18*, 227–254. [CrossRef]
30. Genzorova, T.; Corejova, T.; Stalmasekova, N. How digital transformation can influence business model, Case study for transport industry. In Proceedings of the Peer-Review under Responsibility of the Scientific Committee of the 13th International Scientific Conference on Sustainable, Modern and Safe Transport (TRANSCOM 2019), Stary Smokovec, Slovakia, 29–31 May 2019.
31. Zeike, S.; Bradbury, K.; Lindert, L.; Pfaf, H. Digital Leadership Skills and Associations with Psychological Well-Being. *Int. J. Environ. Res. Public Health* **2019**, *16*, 2628. [CrossRef] [PubMed]
32. Fruth, M.; Teuteberg, F. Digitization in maritime logistics—What is there and what is missing? *Cogent Bus. Manag.* **2017**, *4*, 1411066. [CrossRef]
33. Bălan, C. The disruptive impact of future advanced ICTson maritime transport: A systematic review. *Supply Chain. Manag. Int. J.* **2020**, *25*, 157–175. [CrossRef]
34. Brunila, O.-P.; Kunnaala-Hyrkki, V.; Inkinen, T. Hindrances in port digitalization? Identifying problems in adoption and implementation. *Eur. Transp. Res. Rev.* **2021**, *13*, 62. [CrossRef]
35. Heilig, L.; Schwarze, S.; Voss, S. An Analysis of Digital Transformation in the History and Future of Modern Ports. In Proceedings of the 50th Hawaii International Conference on System Sciences, Hawaii, HI, USA, 4–7 January 2017.
36. El Hilali, W.; El Manouar, A.; Janati Idrissi, M.A. Reaching sustainability during a digital transformation: A PLS approach. *Int. J. Innov. Sci.* **2020**, *12*, 52–79. [CrossRef]
37. Baker, J. The Technology–Organization–Environment Framework. In *Information Systems Theory. Integrated Series in Information Systems*; Dwivedi, Y., Wade, M., Schneberger, S., Eds.; Springer: New York, NY, USA, 2021; Volume 28. [CrossRef]
38. Gašperlin, B.; Pucihar, A.; Borstnar, M.K. Influencing Factors of Digital Transformation in SMEs. In Proceedings of the 40th International Scientific Conference on Organizational Science Development Values, Competencies and Changes in Organizations, Portoroz, Slovenia, 17–19 March 2021.
39. Cavalcante, S.A. Designing business model change. *Int. J. Innov. Manag.* **2014**, *18*, 1450018. [CrossRef]

40. Legner, C.; Eymann, T.; Hess, T.; Matt, C.; Böhmann, T.; Drews, P.; Mädche, A.; Urbach, N.; Ahlemann, F. Digitalization: Opportunity and Challenge for the Business and Information Systems Engineering Community. *Bus. Inf. Syst. Eng.* **2017**, *59*, 301–308. [CrossRef]
41. Ali, F.A.B.H.; Jali, M.Z. Human-Technology Centric in Cyber Security Maintenance for Digital Transformation Era. In Proceedings of the 1st International Conference on Big Data and Cloud Computing (ICoBiC) 2017, Kuching, Sarawak, Malaysia, 25–27 November 2017.
42. Henriette, E.; Feki, M.; Boughzala, I. Digital Transformation Challenges. In Proceedings of the Mediterranean Conference on Information Systems (MCIS), Paphos, Cyprus, 4–6 September 2016.
43. Digital Transport & Logistics Forum. Towards Paperless Transport within the EU and across Its Borders (Report). 2018. Available online: https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=15358 (accessed on 10 March 2020).
44. Nkuna, N. Understanding the Motives for Digital Transformation in the Container Shipping Sector. The Maritime Commons: Digital Repository of the World Maritime University. 2017. Available online: https://commons.wmu.se/cgi/viewcontent.cgi?article=1597&context=all_dissertations (accessed on 15 March 2022).
45. Agrawal, P.; Narain, R.; Ullah, I. Analysis of barriers in implementation of digital transformation of supply chain using interpretive structural modelling approach. *J. Model. Manag.* **2020**, *15*, 297–317. [CrossRef]
46. Kane, G.C.; Palmer, D.; Phillips, A.N.; Kiron, D.; Buckley, N. Strategy, not Technology, Drives Digital Transformation. *MIT Sloan Manag. Rev.* 2015. Available online: https://sloanreview.mit.edu/projects/strategy-drives-digital-transformation/ (accessed on 15 April 2022).
47. Junge, A.L.; Verhoeven, P.; Reipert, J.; Mansfeld, M. *Pathway of Digital Transformation in Logistics: Best Practice Concepts and Future Developments*; Straube, F., Ed.; Scientific Series Logistics at the Berlin Institute of Technology; Special Edition; Universitätsverlag der TU Berlin: Berlin, Germany, 2019; ISBN 978-3-7983-3094-8.
48. Schumann, C.-A.; Baum, J.; Forkel, E.; Otto, F.; Reuther, K. Digital Transformation and Industry 4.0 as a Complex and Eclectic Change. In Proceedings of the Future Technologies Conference (FTC), Vancouver, BC, Canada, 29–30 November 2017.
49. Korpela, K.; Hallikas, J.; Dahlberg, T. Digital Supply Chain Transformation toward Blockchain Integration. In Proceedings of the Hawaii International Conference on System Sciences, Hawaii, HI, USA, 4–7 January 2017.
50. Iddris, F. Digital Supply Chain: Survey of the Literature. *Int. J. Bus. Res. Manag.* **2018**, *9*, 47–61.
51. Wiedenmann, M.; Größler, A. The impact of digital technologies on operational causes of the bullwhip effect—A literature review. *Procedia CIRP* **2019**, *81*, 552–557. [CrossRef]
52. von Leipzig, T.; Gamp, M.; Manz, D.; Schöttle, K.; Ohlhausen, P.; Oosthuizen, G.; Palm, D.; von Leipzig, K. Initialising customer-orientated digital transformation in enterprises. In Proceedings of the 14th Global Conference on Sustainable Manufacturing, Stellenbosch, South Africa, 3–5 October 2016.
53. Mosconi, E.; Packmohr, S.; De Santa-Eulalia, L.A. Making Digital Transformation Real. In Proceedings of the 52nd Hawaii International Conference on System Sciences, Hawaii, HI, USA, 8–11 January 2019.
54. Vial, G. Understanding digital transformation: A review and a research agenda. *J. Strateg. Inf. Syst.* **2019**, *28*, 118–144. [CrossRef]
55. Vidmar, D. Effects of Information Technologies on Sustainability Performance of Organizations. Ph.D. Thesis, Faculty of Organizational Sciences, University of Maribor, Maribor, Slovenia, 2021.
56. Larjovuori, R.-L.; Bordi, L.; Heikkilä-Tammi, K. Leadership in the digital business transformation. In Proceedings of the 22nd International Academic Mindtrek Conference, Tampere, Finland, 10–11 October 2018; pp. 212–221. [CrossRef]
57. Ismail, M.H.; Khater, M.; Zaki, M. *Digital Business Transformation and Strategy: What Do We Know So Far*; Cambridge Service Alliance: Cambridge, UK, 2017; pp. 1–35.
58. Gupta, S. Organizational Barriers to Digital Transformation. Master's Thesis, KTH Industrial Engineering and Management Industrial Management, Stockholm, Sweden, 2018. Available online: https://www.diva-portal.org/smash/get/diva2:1218220/FULLTEXT01.pdf (accessed on 15 April 2022).
59. Kozak-Holland, M.; Procter, C. The Challenge of Digital Transformation. In *Managing Transformation Projects: Tracing Lessons from the Industrial to the Digital Revolution*; Palgrave, P., Ed.; Palgrave Pivot: London, UK, 2019; pp. 1–11.
60. Holotiuk, F.; Beimborn, D. Critical Success Factors of Digital Business Strategy. In Proceedings of the 13th International Conference on Wirtschaftsinformatik, St. Gallen, Switzerland, 12–15 February 2017; pp. 991–1005. Available online: https://wi2017.ch/images/wi2017-0244.pdf (accessed on 8 August 2020).
61. Carcary, M.; Doherty, E.; Conway, G. A dynamic capability approach to digital transformation—A focus on key foundationalthemes. In Proceedings of the 10th European Conference on Information Systems Management, Evora, Portugal, 8–9 September 2016.
62. Kwon, E.H.; Park, M.J. Critical factors on firm's digital transformation capacity: Empirical evidence from Korea. *Int. J. Appl. Eng. Res.* **2017**, *12*, 12585–12596.
63. Ponsignon, F.; Kleinhans, S.; Bressolles, G. The contribution of quality management to an organisation's digital transformation: A qualitative study. *Total Qual. Manag. Bus. Excell.* **2019**, *30*, S17–S34. [CrossRef]
64. Mugge, P.; Abbu, H.; Michaelis, T.L.; Kwiatkowski, A.; Gudergan, G. Patterns of Digitization a Practical Guide to Digital Transformation. *Res. Manag.* **2020**, *63*, 27–35.

65. Sayabek, Z.; Suieubayeva, S.; Utegenova, A. Digital Transformation in Business. In *Digital Age: Chances, Challenges and Future*; Ashmarina, S.I., Vochozka, M., Mantulenko, V.V., Eds.; Springer Nature: Cham, Switzerland, 2020; Volume 2020, pp. 408–415.
66. Ivančić, L.; Vukšić, V.; Spremić, M. Mastering the Digital Transformation Process: Business Practices and Lessons Learned. *Technol. Innov. Manag. Rev.* **2019**, *9*, 36–50. [CrossRef]
67. Schwertner, K. Digital transformation of business. *Trakia J. Sci.* **2017**, *15*, 388–393. [CrossRef]
68. Sánchez, M.A. A framework to assess organizational readiness for the digital transformation. *Dimens. Empres.* **2017**, *15*, 27–40. [CrossRef]
69. Fuchs, C.; Hess, T. Becoming agile in the digital transformation: The process of a large-scale agile transformation. In Proceedings of the Thirty Ninth International Conference on Information Systems, San Francisco, CA, USA, 13–16 December 2018; Available online: https://aisel.aisnet.org/icis2018/innovation/Presentations/19/ (accessed on 8 August 2020).
70. Teece, D.J.; Linden, G. Business models, value capture, and the digital enterprise. *J. Organ. Des.* **2017**, *6*, 8. [CrossRef]
71. Verina, N.; Titko, J. Digital Transformation: A Conceptual Framework. In Proceedings of the 6th International Scientific Conference on Contemporary Issues in Business, Management and Economic Enginering 2019, Vilnius, Lithuania, 9–10 May 2019; pp. 719–727. [CrossRef]
72. Sehlin, D.; Truedsson, M.; Cronemyr, P. A conceptual cooperative model designed for processes, digitalisation and innovation. *Int. J. Qual. Serv. Sci.* **2019**, *11*, 504–522. [CrossRef]
73. Kane, G.C.; Palmer, D.; Phillips, A.N.; Kiron, D.; Buckley, N. Aligning the Future for Its Digital Organization. *MIT Sloan Manag. Rev. Deloitte Univ. Press*. 2016. Available online: https://www2.deloitte.com/ie/en/pages/public-sector/articles/Allinging-the-organisation-for-digital-future.html (accessed on 8 August 2020).
74. Agushi, G. Understanding the Digital Transformation Approach—A Case of Slovenian Enterprises, Thesis for: Master of Science in International Business. 2019. Available online: https://repozitorij.uni-lj.si/IzpisGradiva.php?id=113619&lang=eng (accessed on 8 August 2020).
75. Munim, Z.H.; Dushenko, M.; Jimenez, V.J.; Shakil, M.H.; Imset, M. Big data and artificial intelligence in the maritime industry: A bibliometric review and future research directions. *Marit. Policy Manag.* **2020**, *47*, 577–597. [CrossRef]
76. Pappas, I.O.; Mikalef, P.; Giannakos, M.N.; Krogstie, J.; Lekakos, G. Big data and business analytics ecosystems: Paving the way towards digital transformation and sustainable societies. *Inf. Syst. E-Bus. Manag.* **2018**, *16*, 479–491. [CrossRef]
77. Kutzner, K.; Schoormann, T.; Knackstedt, R. Digital Transformation in Information Systems Research: A Taxonomy-Based Approach to Structure the Field. 2018. Available online: https://aisel.aisnet.org/ecis2018_rp/56 (accessed on 8 August 2020).
78. Huang, J. Building Intelligence in Digital Transformation. *J. Integr. Des. Process Sci.* **2018**, *21*, 1–4. [CrossRef]
79. Henriette, E.; Feki, M.; Boughzala, I. The Shape of Digital Transformation: A Systematic Literature Review. In Proceedings of the Mediterranean Conference on Information Systems (MCIS), Samos, Greece, 2–5 October 2015; Available online: https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1027&context=mcis2015 (accessed on 8 August 2020).
80. Chinoracky, R.; Corejova, T. Impact of Digital Technologies on Labor Market and the Transport Sector. *Transp. Res. Procedia* **2019**, *40*, 994–1001. [CrossRef]
81. North, K.; Aramburu, N.; Lorenzo, O.J. Promoting digitally enabled growth in SMEs: A framework proposal. *J. Enterp. Inf. Manag.* **2019**, *33*, 238–262. [CrossRef]
82. Schallmo, D.; Williams, C.; Lohse, J. Digital Strategy: Integrated Approach and Generic Options. *Int. J. Innov. Manag.* **2019**, *23*, 1940005. [CrossRef]
83. Junge, A.L. Digital transformation technologies as an enabler for sustainable logistics and supply chain processes—An exploratory framework. *Brazilian J. Oper. Prod. Manag.* **2019**, *16*, 462–472. [CrossRef]
84. Dos Reis, J.C.G.; Amorim, M.; Melao, N. Digital Transformation: A Literature Review and Guidelines for Future Research. In *Trends and Advances in Information Systems and Technologies*; Rocha, Á., Adeli, H., Reis, L.P., Costanzo, S., Eds.; Springer Nature: Cham, Switzerland, 2018; pp. 411–421.
85. Remane, G.; Hanelt, A.; Nickerson, R.C.; Kolbe, L.M. Discovering Digital Business Models in Traditional Industries. *J. Bus. Strategy* **2017**, *38*, 41–51. [CrossRef]
86. Piccinini, E.; Gregory, R.W.; Kolbe, L.M. Changes in the Producer-Consumer Relationship—Towards Digital Tranformation. In Proceedings of the Wirtschaftsinformatik Proceedings, Osnabrueck, Germany, 4–6 March 2015. Available online: https://aisel.aisnet.org/wi2015/109 (accessed on 8 August 2020).
87. Durão, N.; Ferreira, M.J.; Pereira, C.S.; Moreira, F. Current and future state of Portuguese organizations towards digital transformation. *Procedia Comput. Sci.* **2019**, *164*, 25–32. [CrossRef]
88. Kotarba, M. Digital Transformation of Business Models. *Found. Manag.* **2018**, *10*, 123–142. [CrossRef]
89. Osmundsen, K.; Iden, J.; Bygstad, B. Digital Transformation: Drivers, Success Factors, and Implications. In Proceedings of the 12th Mediterranean Conference on Information Systems, Corfu, Greece, 28–30 September 2018.
90. Nwankpa, J.K.; Roumani, Y. IT Capability and Digital Transformation: A Firm Performance Perspective. In Proceedings of the Thirty Seventh International Conference on Information Systems, Dublin, Ireland, 11–14 December 2016.
91. Matt, C.; Hess, T.; Benlian, A. Digital Transformation Strategies. *Bus. Inf. Syst. Eng.* **2015**, *57*, 339–343. [CrossRef]
92. Adner, R.; Puranam, P.; Zhu, F. What Is Different About Digital Strategy? From Quantitative to Qualitative Change. *Strateg. Sci.* **2019**, *4*, 253–261. [CrossRef]

93. Galimova, M.; Gileva, T.; Mukhanova, N.; Krasnuk, L. Selecting the path of the digital transformation of business-models for industrial enterprises. *IOP Conf. Ser. Mater. Sci. Eng.* **2019**, *497*, 012071. [CrossRef]
94. Moreira, F.; Ferreira, M.J.; Seruca, I. Enterprise 4.0—the emerging digital transformed enterprise? *Procedia Comput. Sci.* **2018**, *138*, 525–532. [CrossRef]
95. Sabri, Y.; Micheli, G.J.L.; Nuur, C. Exploring the impact of innovation implementation on supply chain configuration. *J. Eng. Technol. Manag.* **2018**, *49*, 60–75. [CrossRef]
96. Vukšič, V.B.; Ivančić, L.; Vugec, D.S. A Preliminary Literature Review of Digital Transformation Case Studies. In Proceedings of the ICMIT 2018: 20th International Conference on Managing Information Technology, Rome, Italy, 17–18 September 2018.
97. Scholz, R.W.; Czichos, R.; Parycek, P.; Lampoltshammer, T.J. Organizational vulnerability of digital threats: A first validation of an assessment method. *Eur. J. Oper. Res.* **2020**, *282*, 627–643. [CrossRef]
98. Pagani, M.; Pardo, C. The impact of digital technology on relationships in a business network. *Ind. Mark. Manag.* **2017**, *67*, 185–192. [CrossRef]
99. Wang, P.; Mileski, J. Strategic maritime management as a new emerging field in maritime studies. *Marit. Bus. Rev.* **2018**, *3*, 290–313. [CrossRef]
100. Junge, A.L.; Straube, F. Sustainable supply chains—Digital transformation technologies' impact on the social and environmental dimension. *Procedia Manuf.* **2020**, *43*, 736–742. [CrossRef]
101. Jeansson, J.; Bredmar, K. Digital Transformation of SMEs: Capturing Complexity. In Proceedings of the 32nd Bled eConference, Humanizing Technology for a Sustainable Society, Bled, Slovenia, 16–19 June 2019.
102. Cichosz, M. Digitalization and Competitiveness in the Logistics Service Industry. *E-Mentor* **2018**, *5*, 73–82. [CrossRef]
103. Viktorovich, D.A.; Aleksandrovna, P.I. Integrated digital platforms for development of transport and logistics services. In Proceedings of the International Conference on Digital Technologies in Logistics and Infrastructure (ICDTLI 2019), St. Petersburg, Russia, 4–5 April 2019.
104. Hartl, E.; Hess, T. The Role of Cultural Values for Digital Transformation: Insights from a Delphi Study. In Proceedings of the 23rd Americas Conference on Information Systems (AMCIS 2017), Boston, MA, USA, 10–12 August 2017.
105. Caputa, W. The Process of Digital Transformation as a Challenge for Companies. *Zesz. Nauk. Politech. Częstochowskiej. Zarządzanie* **2017**, *27*, 72–84. [CrossRef]
106. Schiavi, G.S.; Behr, A. Emerging technologies and new business models: A review on disruptive business models. *Innov. Manag.* **2018**, *15*, 338–355. [CrossRef]
107. Hausberg, J.P.; Liere-Netheler, K.; Packmohr, S.; Pakura, S.; Vogelsang, K. Research streams on digital transformation from a holistic business perspective: A systematic literature review and citation network analysis. *J. Bus. Econ.* **2019**, *89*, 931–963. [CrossRef]
108. Korchagina, E.; Kalinina, O.; Burova, A.; Ostrovskaya, N. Main Logistics Digitalization Features for Business. 2020. Available online: https://www.e3s-conferences.org/articles/e3sconf/abs/2020/24/e3sconf_tpacee2020_10023/e3sconf_tpacee2020_10023.html (accessed on 8 August 2020).
109. Zaman, I.; Pazouki, K.; Norman, R.; Younessi, S.; Coleman, S. Challenges and Opportunities of Big Data Analytics for Upcoming Regulations and Future Transformation of the Shipping Industry. *Procedia Eng.* **2017**, *194*, 537–544. [CrossRef]
110. Petrikina, J.; Krieger, M.; Schirmer, I.; Stoeckler, N.; Saxe, S.; Baldauf, U. Improving the readiness for change—Addressing information concerns of internal stakeholders in the smartPORT Hamburg. In Proceedings of the Americas Conference on Information Systems (AMCIS), Boston, MA, USA, 10–12 August 2017.
111. Del Giudice, M.; Di Vaio, A.; Hassan, R.; Palladino, R. Digitalization and new technologies for sustainable business models at the ship-port interface: A bibliometric analysis. *Marit. Policy Manag.* **2022**, *49*, 410–446. [CrossRef]
112. Balci, G. Digitalization in Container Shipping Services: Critical Resources for Competitive Advantage. *J. ETA Marit. Sci.* **2021**, *9*, 3–12. [CrossRef]
113. Halpern, N.; Mwesiumo, D.; Suau-Sanchez, P.; Budd, T.; Bråthen, S. Ready for digital transformation? The effect of organisational readiness, innovation, airport size and ownership on digital change at airports. *J. Air Transp. Manag.* **2021**, *90*, 101949. [CrossRef]
114. Gong, C.; Ribiere, V. Developing a unified definition of digital transformation. *Technovation* **2021**, *102*, 102217. [CrossRef]
115. Fitzgerald, M.; Kruschwitz, N.; Bonnet, D.; Welch, M. Embracing Digital Technology a New Strategic Imperative. *MIT Sloan Manag. Rev.* 2013. Available online: https://www.capgemini.com/wp-content/uploads/2017/07/embracing_digital_technology_a_new_strategic_imperative.pdf (accessed on 8 August 2020).
116. Pucihar, A.; Lenart, G.; Borstnar, M.K.; Vidmar, D.; Marolt, M. Drivers and Outcomes of Business Model Innovation—Micro, Small and Medium-Sized Enterprises Perspective. *Sustainability* **2019**, *11*, 344. [CrossRef]
117. Bocayuva, M. Cybersecurity in the European Union port sector in light of the digital transformation and the COVID-19 pandemic. *WMU J. Marit. Aff.* **2021**, *20*, 173–192. [CrossRef]
118. Heuermann, A.; Duin, H.; Gorldt, C.; Thoben, K.-D. Service Ideation and Design for Process Innovations in Future Seaports. In Proceedings of the International ICE Conference on Engineering Technology and Innovation, Madeira Island, Portugal, 27–29 June 2017.
119. Lam, J.S.L.; Wong, H.N. Analysing business models of liner shipping companies. *Int. J. Shipp. Transp. Logist.* **2018**, *10*, 237–256. [CrossRef]

120. Brown, A.; Fishenden, J.; Thompson, M. Organizational Structures and Digital Transformation. In *Digitizing Government. Business in the Digital Economy*; Palgrave Macmillan: London, UK, 2014. [CrossRef]
121. Benitez, J.; Henseler, J.; Castillo, A.; Schuberth, F. How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory IS research. *Inf. Manag.* **2020**, *57*, 103168. [CrossRef]
122. Behdani, B.; Wiegmans, B.; Roso, V.; Haralambides, H. Port-hinterland transport and logistics: Emerging trends and frontier research. *Marit. Econ. Logist.* **2020**, *22*, 1–25. [CrossRef]
123. Notteboom, T.; Rodrigue, J.-P. Port Hinterlands, Regionalization and Corridors. In Port Economics, Management and Policy. Available online: https://porteconomicsmanagement.org/pemp/contents/part2/port-hinterlands-regionalization/ (accessed on 1 June 2022).
124. Wide, P.; Roso, V. Information on Resource Utilisation for Operational Planning in Port Hinterland Transport. *Trans. Marit. Sci.* **2021**, *10*, 477–487. [CrossRef]
125. Garson, G.D. Partial Least Squares: Regression and Structural Equation Models. 2016. Available online: http://www.statisticalassociates.com/pls-sem.htm (accessed on 1 July 2022).
126. SmartPLS. Fit Measures in SmartPLS. Available online: https://www.smartpls.com/documentation/algorithms-and-techniques/model-fit/ (accessed on 1 June 2022).
127. Koga, S. Major Challenges and Solutions for Utilizing Big Data in the Maritime Industry. Available online: https://commons.wmu.se/cgi/viewcontent.cgi?article=1489&context=all_dissertations (accessed on 8 August 2021).
128. Maymand, M.M.; Mollaei, E. The Effect of Business Process Re-Engineering Factors on Organizational Agility Using Path Analysis: Case Study of Ports & Maritime Organization in Iran. *Asian Econ. Financ. Rev.* **2014**, *4*, 1849–1864.
129. ISO. ISO/IEC 38500:2015 Information Technology—Governance of IT for the Organization. 2015. Available online: https://www.iso.org/standard/62816.html (accessed on 1 July 2022).
130. Fasoulis, I.; Kurt, R.E. Determinants to the implementation of corporate social responsibility in the maritime industry: A quantitative study. *J. Int. Marit. Saf. Environ. Aff. Shipp.* **2019**, *3*, 10–20. [CrossRef]