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SELECTION OF IT TOOLS IN SHIPPING

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Abstract

As the technology improves, the advanced IT tools are put into practice on the ships to manage the navigation and tracking of ships in the high seas. During Ocean passage these IT tools provide day to day information of the vessel to the shipping company and concerned Maritime Administration. The daily data collection is performed by sensors or dedicated computer systems. The actual recording of the information of tracking the ship is connected to main server at shipping company and to other concerned maritime departments. This paper presents how all these systems provides data related to ship's communications, navigation and tracking during high seas and piracy areas. The information is useful in investigating the ship operation, which is helpful in avoiding operational errors. The application of each Information tool used for proper and effective communication results into effective navigation of the ships. The paper identifies the IT tools and shipping activities. The selection of proper information tools for carrying out activities on a ship is a multiple criteria problem and an attempt is made in this paper to solve the problem with the help of Analytical Hierarchy Process (AHP).

Key words: AHP, IT Tools, Shipping Activities.

1. INTRODUCTION

Nowadays almost all ships are having sophisticated tools used for dealing with information related to navigation and tracking. For effectively managing information, IT tool is considered the heart of maritime business activity. The data's from these equipments provides a very detailed understanding of events leading up to any query pertaining to operational and economical scenario. All these IT tools are centrally connected to computers and store digital evidence. All the standard steps of collection, preservation, examination are applied to the analysis when in need. To analyze the best role of IT tools on ships for navigation and tracking is done by pair wise comparison of 'AHP' method of prioritizing the preference issues in navigational, safety and economical factor. As the technology is improving day by day specially in Maritime sector, extensive use of IT tools has been found in the management of Operational, Navigation and Environment issue. Choice of communication network on ship depends on the nature of the group's tasks and the extent to which group members need to communicate with each other to achieve overall goal. Hence shipping companies are providing equitable access to information data to shipping services, administration and concerned maritime fraternity. In this paper, it has been discussed how IT tools helps in the ship's communications, navigation and tracking during high seas and piracy areas. The information is useful in investigating the ship operation, which is helpful in avoiding operational errors. The application of each Information tool used for proper and effective communication results into effective navigation of the ships. The paper identifies the IT tools and analyzes how they are used effectively in carrying out shipping activities. The selection of proper information tools for carrying out activities on a ship is a multiple criteria problem for the management of a shipping company and an attempt is made in this paper to solve the problem with the help of Analytical Hierarchy Process (AHP).

2. PAST WORK

Dong (2016), and Byrd, (2003), have emphasized to the greater information processing capability achieved through better use of IT in electronic commerce which enable significant price benefit to the supply chain. Hong, et al, (2010) explored in detail the link between IT systems and outsourcing of logistics activities. William, et al, (2002), analysed the electronic supply chain and its impact on the current and future structure of strategic alliances, partnership and logistics leadership. Agarwal et al, (2003, 2006, 2007) analyzed the robust multi-attribute for decision-making technique which integrates various criteria and enablers on decisive application of IT in the system. Win-Bin See, (2007) analyzed the detail of Information technology network security risk assessment and management framework which can be used for shipping companies for multi criteria decision. Velmurugan, et al, 2011 and Pietro, et al, (2012) selected the suitable method for analysis of IT adoption and 3PLs' performance. Suitable e- business and supply chain integration is analyzed by Alan, (2008). Roh,. et al, (2007) analysed the model of a port logistics process, using the structured analysis and design technique and indicating the stability of such relationship to contribute in design and development, and to make investment.

3. AHP FRAMEWORK

AHP is suitable, when there is a gap of adequate quantitative information on Navigation and Operation information from the ship to the shipping company. This makes researcher to depend on the experts experience and knowledgeable, whose opinions needs to be incorporated in the decision-making. A generic decision-making problem is consists of the following activities:

- Understanding the problem of use of IT on the ship and in the Shipping Company.
- Organising various available criteria on the Ships and the Shipping Company.
- Assessing various available criteria.
- Evaluating alternatives on the basis of the assessed criteria.
- Ranking the all assessed alternatives.
- Incorporating the judgements of multiple maritime experts.

The problem of use of IT tools on ships and with Shipping

Company can be abstracted as how to derive importance for a set of activities (Table I) in maritime sector according to their impact on the situation and the objective of the decisions to be made.

Table I: List of Shipping Activities

A	Communication
B	Accessibility
C	Duplication of paper work
D	Authenticity
E	Legal Aspects
F	Control
G	Updation of Information

IT Tools, for carrying out shipping activities, identified by the experts for developing the AHP framework are:

1. Electronic Data Interchange (EDI),
2. Internet on ship,
3. Global Positioning System (GPS),
4. Automatic Identification System (AIS),
5. Long Range Identification and Tracking (LRIT) and
6. Voyage Data Recorder (VDR).

These tools are widely used for tracking of the ship and cargo and were chosen for collecting the pair wise comparison of preference use in maritime sector. The result of Eigen values of other six criteria's of Table III are shown in the Table IV as rows of the concerned research IT equipments.

3.1 Formation of Hierarchy Structure

The problem is decomposed into a hierarchy of goal and alternatives. Structuring the decision problem as a hierarchy is fundamental to the process of the AHP and its indication to a relationship between elements of one level with those of the level immediately below. The AHP helps in breaking the problem into a hierarchy of sub sections, and then these can be easily analysed and subjectively evaluated. The subjective evaluations are converted into numerical values and processed to rank each alternative on a numerical scale and used for evaluation. This relationship percolates down to the lowest levels of the hierarchy and in this manner every element is connected to every other one, at least in an indirect manner the hierarchy is to work down from the Result till possible and then proceed up from the alternatives until the levels of the two processes are correlated in such a way as to make comparisons possible. The decision hierarchy is formulated by breaking down the problem into a hierarchy of decision elements and given in figure 1

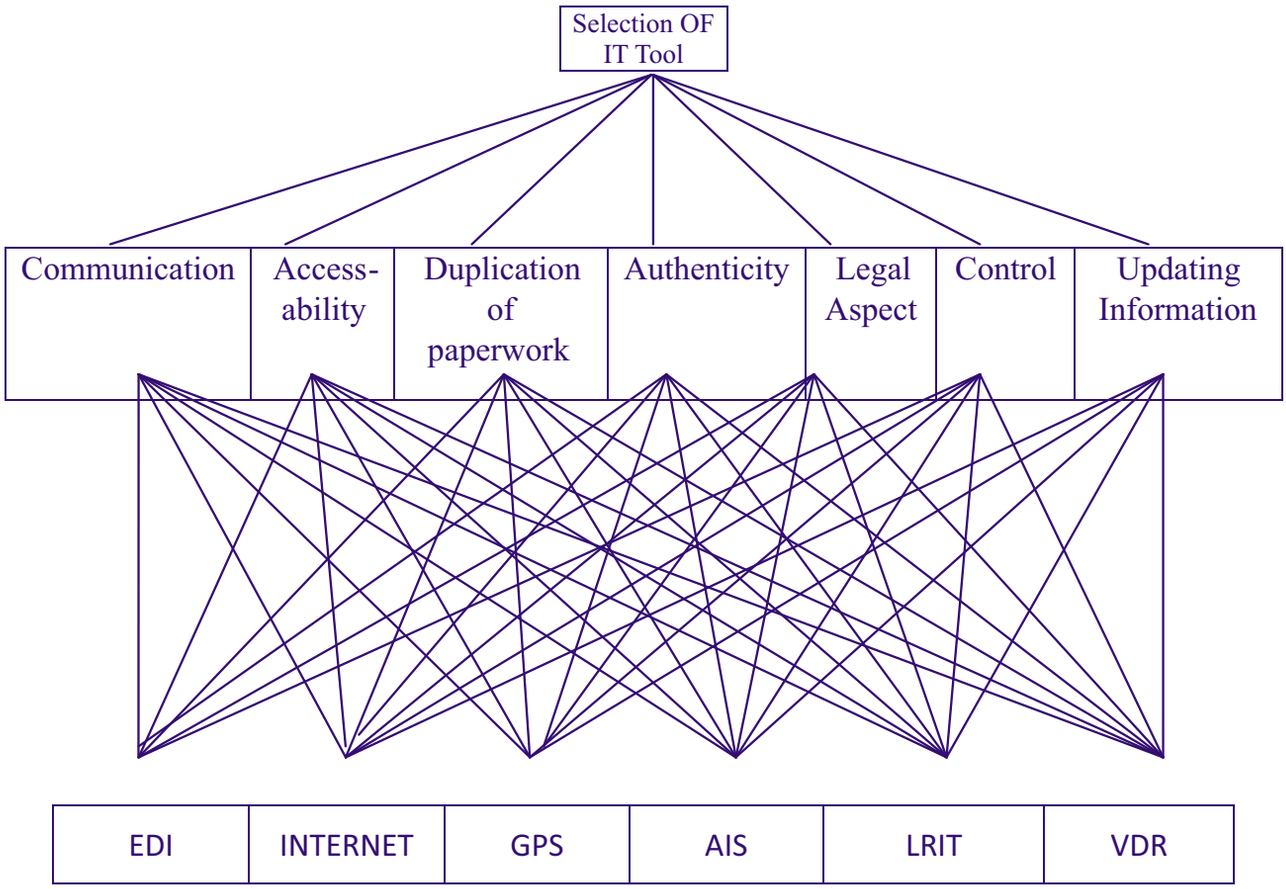

Figure 3.1: AHP Framework for IT Tool Selection in Maritime Sector

At the top of the figure 1 is the objective of the problem being studied and analysed. The leaf nodes are the alternatives to be compared. In between these two levels there are various criteria for the selection of the IT Tools. When comparing elements at each level a decision-maker has just to compare with respect to the contribution of the lower-level elements to the upper-level one.

3.2: Pair Wise Comparison

Data are collected from ships staff corresponding to the hierarchic structure, in the Pair wise comparison of alternatives on a qualitative scale. With reference to Table I, choices can be compared as equal, marginally strong, strong, very strong, and extremely strong (Saaty 1980, 2001).

Table I: Saaty' Scale for Pair wise Comparison.

Pair wise Comparison of Choices	Numerical Values
Equal	1
Marginally strong	3
Strong	5
Very strong	7
Extremely strong	9
Intermediate values to reflect fuzzy inputs	2,4,6,8
Reflecting dominance of second alternative Reciprocals compared with the first	Reciprocal

The rating of each alternative is multiplied by the weights of the sub-criteria and aggregated to get local ratings with respect to each criterion. The local ratings are then multiplied by the weights of the criteria and aggregated to get global ratings. The AHP produces weight values for each alternative based on the judged importance of one alternative over another with respect to a common criterion. AHP is used as a tool for systematically analyzing the opinions of expert belonging to diverse fields in this step.. The nominal-ratio scale of 1 to 9 (Saaty, 1980) is adopted for pair wise comparison of the IT equipments applied on ships.

Researcher conducted a pair wise comparison of the six equipments, and ranked them based on the seven criteria. The results of pair wise comparisons are filled in positive reciprocal matrices to calculate the Eigen vector (E- Vector) and Eigen value (Table II to Table IV). Seven activities were considered while developing AHP framework for prioritization of IT tools. Eigen value for IT tools for Communication (A) is shown in Table II. Eigen Value for IT Tools for other shipping activities are computed and presented in second row of the final judgement Table IV. Table III shows the comparison of shipping activities. For example value for Communication (A) is computed as A3+A3+A2. Total value for A comes as 8 (3+3+2). The value in the last column is obtained by dividing the 8 by the total sum. In this case it is 0.1269.

Table II: Comparison of IT Tools under Activity Communication

Communication	EDI	Internet	GPS	AIS	LRIT	VDR	E. Vector
EDI	1	0.125	0.333	0.5	0.333	0.25	0.035
Internet	8	1	8	9	7	5	0.481
GPS	3	0.125	1	6	8	9	0.244
AIS	2	0.111	0.167	1	3	4	0.094
LRIT	3	0.143	0.125	0.333	1	4	0.081
VDR	4	0.2	0.111	0.25	0.25	1	0.065

Table III: Decision Matrix for Shipping Activities

	B	C	D	E	F	G		Score
A	A3	A3	D3	A2	F3	G3	8	0.1269
	B	B3	D3	B3	F2	G3	6	0.0952
		C	D2	C2	C3	C1	6	0.0952
			D	D3	D2	G3	24	0.3809
				E	E2	G2	2	0.0317
					F	F1	6	0.0952
						G	11	0.1746
							63	1

Table IV: Final Judgemental Matrix

IT Tools	Activity	A	B	C	D	E	F	G	E. Vector
	Weight	0.1269	0.0952	0.0952	0.3809	0.0317	0.0952	0.1746	
Internet		0.4815	0.3248	0.4014	0.2777	0.2706	0.2404	0.3700	0.332
GPS		0.2443	0.2547	0.2916	0.2088	0.1972	0.2048	0.2642	0.234
EDI		0.0354	0.1187	0.0372	0.2534	0.2222	0.2732	0.0299	0.154
AIS		0.0936	0.1083	0.0993	0.0837	0.1174	0.0749	0.1507	0.101
VDR		0.0649	0.0919	0.0625	0.1224	0.0807	0.1283	0.0634	0.095
LRIT		0.0804	0.1016	0.1079	0.0539	0.1118	0.0784	0.1217	0.083

The consistency ratio is obtained to filter out the inconsistent judgments, when the value of the Consistency Index (C.I.) is greater than 0.1. In the present paper, all the judgments are found to be consistent and accepted for analysis.

4. RESULT AND ANALYSIS

The value of Eigen vector for Internet on ships in the final judgmental matrix comes as highest as 0.332 followed by GPS (0.234) and EDI (0.154). The highest value for Internet indicates that for shipping companies, Internet is considered to be the most important IT tool among the six IT tools for data collection pertaining to navigation and for tracking of the ship in high seas. Internet is directly linked with satellites and online information is readily available. Shipping lines especially cruise lines are aligning themselves with IT companies that specialized in maritime communications that either own their satellites or rent such large amounts of bandwidth to bring prices down. Internet is now widely used for other maritime activities like voyage instructions, machinery condition, and repair status of equipment and progress of voyage. Even though use of internet on ship is costly but a good communication is the fundamental backbone of any business entity to survive, growth and to improve the quality of life and shipping business. This is also one way of motivating the Officers and Crew to stay with the company for a longer period without having to go on career-hopping spree during their leave period. By doing so, the company achieves a higher retention rate for the pool of highly qualified, trained and reliable marine officer and crew.

5. CONCLUSION

In this paper, AHP framework has been developed to prioritize the IT tools for carrying out the various shipping activities. Use of IT tools by the shipping company for making decision for navigation, commercial and security of ship, cargo and personnel in complex environments is increasing. From the AHP framework, it has been found that Internet is the most important IT tool among the six IT tools for data collection pertaining to navigation and for tracking of the ship in high seas. Other IT tools such as GPS, EDI, AIS, VDR and LRIT have been rated after Internet. The interpretation of the result from AHP framework is not easy as other IT tools depends on Internet. In the present research only six IT Tools have been considered. There are several shipping activities which are performed with the help of these IT Tools. The result obtained by the AHP framework hence cannot be generalized

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