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The role of Artificial intelligence (AI) in enhancing the sustainability of humanitarian medical supply chains - Entrepreneurs'Perception.

Dr.B.Kishore Babu[1], Dr K Soujanya[2], Dr Daniel Pilli [3]M. Jaswant Reddy **[4,]** K Deepthi **[5]**

[1]Associate Professor, kishorebabu11@gmail.com*, KL Business School, Koneru Lakshmaiah Education Foundation (KLEF), Vaddeswaram, Green fields, Guntur, Andhra Pradesh, India - 522302.9848222319

[2]Assistant Professor,soujanyadaniel@gmail.com*, KL Business School, Koneru Lakshmaiah Education Foundation (KLEF), Vaddeswaram, Green fields, Guntur, Andhra Pradesh, India - 522302.9848692748

[3]Assistant Professor, dr.danielpilli@gmail.com*, Koneru Lakshmaiah Education Foundation (KLEF), Vaddeswaram, Green fields, Guntur, Andhra Pradesh, India -522302.9246491477

[4] MBA student, KL Business School, Koneru Lakshmaiah Education Foundation (KLEF), Vaddeswaram, Green fields, Guntur, Andhra Pradesh, India -522302

[5] MBA student, KL Business School, Koneru Lakshmaiah Education Foundation (KLEF), Vaddeswaram, Green fields, Guntur, Andhra Pradesh, India -522302

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ABSTRACT: This study delves into the perceptions of entrepreneurs concerning the role of artificial intelligence (AI) in bolstering the sustainability of humanitarian medical supply chains. A qualitative research approach was adopted, incorporating interviews and surveys conducted with 283 entrepreneurs actively engaged in the humanitarian medical supply chain sector. The investigation delves into their comprehension of AI technologies, as well as the advantages and impediments linked to the integration of AI into medical supply chains within humanitarian contexts.

The findings elucidate that a notable portion of respondents exhibit familiarity with AI technology, with 60.1% describing themselves as familiar and 36.0% as somewhat familiar. The principal challenges cited by respondents within the humanitarian medical supply chain sector are the dearth of funding (43.8%) and deficient infrastructure and restricted access to remote regions (23.3%).

The majority of respondents (66.4%) deem sustainability within humanitarian medical supply chains as highly significant, with an additional 29.0% regarding it as somewhat important. Concerning AI application, respondents perceive predictive analysis for demand forecasting (73.5%) as the most beneficial, followed by autonomous vehicles for delivery (15.5%). While

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blockchain for supply chain transparency garnered fewer responses, a segment of respondents still deemed it valuable.

Entrepreneurs acknowledge AI as an invaluable instrument for enhancing the efficiency, effectiveness, and sustainability of medical supply chains in humanitarian contexts. They underscore AI's potential to augment inventory management, optimize transportation routes, predict demand, and facilitate decision-making processes. Additionally, entrepreneurs recognize AI's capacity to address supply chain disruptions, diminish waste, and guarantee the punctual delivery of medical provisions to affected populations.

Recommendations for future endeavors encompass raising awareness and fostering familiarity with AI among entrepreneurs, tackling funding hurdles through partnerships and proposal development, enhancing infrastructure, and expanding accessibility to remote areas via innovative solutions like autonomous vehicles. The importance of sustainability in humanitarian medical supply chains should be stressed, and guidelines for incorporating sustainable practices should be devised.

In conclusion, this study underscores the imperative for further research and practical initiatives to surmount challenges and maximize the advantages of AI technology in advancing healthcare delivery during humanitarian crises.

Keywords: the role of artificial intelligence (AI), sustainability, humanitarian medical supply chains, -entrepreneurs, perception.

1. **INTRODUCTION:** In today's dynamic world, the efficient and sustainable delivery of medical supplies to regions affected by humanitarian crises is of paramount importance. Humanitarian medical supply chains are instrumental in saving lives and ensuring timely access to vital healthcare resources, yet they grapple with multifaceted challenges, including resource constraints, logistical intricacies, and unpredictable field conditions.

Artificial intelligence (AI) has emerged as a powerful tool with the potential to revolutionize multiple industries, and entrepreneurs are increasingly exploring its application in the humanitarian sector, particularly in bolstering the sustainability and efficacy of medical supply chains. AI-driven solutions proffer a spectrum of advantages for humanitarian medical supply chains.

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Firstly, machine learning algorithms can process vast datasets to predict demand patterns, optimize inventory management, and facilitate streamlined distribution. This data-driven approach ensures that the right quantity of supplies is available when and where they are required, reducing inefficiencies, minimizing stockouts, and enhancing overall sustainability.

Secondly, AI's capability to optimize delivery routes through route optimization and logistics algorithms is critical. By taking into account real-time factors such as traffic, weather conditions, and resource availability, AI minimizes travel distances and time, consequently curbing fuel consumption and carbon emissions. This also leads to heightened supply chain efficiency and faster response times in emergency scenarios.

Thirdly, AI has a significant role to play in quality control and fraud detection. By analyzing product data, packaging, and labeling, AI can discern counterfeit or substandard medical supplies. This not only prevents the distribution of unsafe products but also upholds high-quality standards, rendering the supply chain more sustainable.

Fourthly, AI enables predictive maintenance, especially in the context of medical equipment. By scrutinizing sensor data and historical performance records, AI can predict potential equipment failures or malfunctions. This proactive approach ensures timely repairs or replacements, reducing downtime and minimizing waste associated with unexpected equipment breakdowns.

Furthermore, AI-driven data analytics platforms are invaluable for decision-making. These systems can integrate and analyze large volumes of data from diverse sources, furnishing actionable insights that facilitate data-driven decision-making. This, in turn, optimizes supply chain processes, identifies areas for improvement, and enhances the sustainability of medical supply chains.

Lastly, AI aids in resource allocation and prioritization during humanitarian crises. By considering factors such as population density, disease prevalence, and medical facility capacities, AI algorithms optimize the distribution of supplies, ensuring that the most critical areas receive timely assistance. This bolsters the efficiency and effectiveness of relief efforts while minimizing waste and promoting sustainability.

In conclusion, the role of AI in humanitarian medical supply chains cannot be understated. It has the potential to not only enhance the efficiency and effectiveness of these supply chains but also contribute to their sustainability. By embracing AI technologies and their myriad

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applications, humanitarian organizations can better navigate the challenges they face, save more lives, and provide essential healthcare services, particularly in times of crisis and within underserved areas. The integration of AI into the humanitarian medical supply chain sector is pivotal for building resilience, improving healthcare outcomes, and advancing long-term recovery in affected communities.

OBJECTIVES OF THE STUDY:

Explore entrepreneurs' perception of AI in the context of humanitarian medical supply chains:

This objective aims to evaluate the level of awareness and understanding among entrepreneurs about the capabilities, benefits, and challenges associated with implementing AI in the context of humanitarian medical supply chains.

The objective is to identify and analyze the perceived advantages and drawbacks that entrepreneurs associate with the adoption of AI technologies in enhancing the sustainability of humanitarian medical supply chains.

HYPOTHESIS OF THE STUDY.

H_0

there is no importance of sustainability in humanitarian medical supply chains and age, work experience of the responds

H_{10}

there is no association between potential benefits of using ai in humanitarian supply chain and familiar with application of AI

2.Research Methodology:

The study employed the Stratified Random Methodology to determine the sample size for research on entrepreneurs in the medical and surgical distribution sector. In addition to this, personal interviews were conducted with entrepreneurs. Initially, approximately 378 samples were collected, but not all respondents answered every question. Ultimately, data from 283 samples were analyzed. The research incorporated both primary and secondary data sources, including articles, journals, official papers, and online sources. Primary data was collected

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through structured questionnaires that encompassed demographic information and utilized a five-point Likert scale. This quantitative approach aimed to gather and analyze data from a representative sample using structured instruments like questionnaires.

3. Results and discussions:

Table:1

FAMILIARWITHAPPLICATIONOFAIINSUPPLYMANAGMENT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	VERY FAMILIAR	167	59.0	59.0	59.0
	SOME WHAT FAMILIAR	99	35.0	35.0	94.0
	NOT FAMILIAR	17	6.0	6.0	100.0
	Total	283	100.0	100.0	

Source: Field data. The results suggest a positive level of familiarity with the application of AI in supply chain management, with 59.0% of respondents indicating they are familiar with it. This indicates an increasing awareness of the potential benefits that AI can bring to optimizing supply chain operations. With the ever-growing complexity and challenges in supply chain management, AI offers promising solutions for improving efficiency, accuracy, and decision-making. The significant proportion of respondents (35.0%) who reported being somewhat familiar also suggests a growing interest and curiosity in exploring AI's potential in supply chain management. These findings underscore the need for further research and implementation of AI technologies in the field of supply chain management.

Table:2

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POTENTIALEBENFITESOFUSINGAIINHUMANITARIANSUPPLY

		Frequency	Percent	Valid Percent	Cumulative Percent
	IMPROVED EFFICENCY AND ACCURACY	157	55.5	55.5	55.5
	COST SAVINGS	52	18.4	18.4	73.9
	BETTER INVENTARY MANAGMENT	27	9.5	9.5	83.4
	INCREASED TRANSPERANCY	47	16.6	16.6	100.0
Valid	Total	283	100.0	100.0	

Out of 283, 55.5% respondents consider improved efficiency and accuracy is more potential benefit using humanitarian supply chain and 18.4% respondents consider cost savings as the potential benefit of using AI in humanitarian supply chain, followed by 9.5% respondents are consider better inventory management is a potentil benefit 16.6% respondents are consider increased transparency is the main potential benefit in the study area..

Table: 3

POTENTIALDRAWBACKSORRISKSUSINGAI

		Frequency	Percent	Valid Percent	Cumulative Percent
	LOSS OF JOBS	177	62.5	62.5	62.5
	DEPENDENCE ON TECHNOLOGY	78	27.6	27.6	90.1
	PRIVACY CONCERNS	28	9.9	9.9	100.0
Valid	Total	283	100.0	100.0	

Out of 283, 62.5% respondents encounter loss of job as a potential drawback or risk in using AI and 27.6% sense dependence on technology as the potential risk of using AI.

- Specific applications most useful in enhancing sustainability:

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Out of 283, majority of 73.5% respondents consider predictive analysis for demand forecasting to be the most useful application in this context, followed by 15.5% considering autonomous vehicles for delivery. Blockchain for supply chain transparency received the fewest responses but is still considered valuable by a portion of the respondents.

Table:4

WILLINGTOINVESTAITECHNOLOGYTOENHACETHESUSTAINABILITY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	WILLING	191	67.5	67.5	67.5
	NOT WILLING	92	32.5	32.5	100.0
	Total	283	100.0	100.0	

Out of 283, majority of 67.5% respondents are willing to invest in AI technology to enhance the sustainability. Followed by, 32.5 respondents as not willing.

Table: 5

IMPORTANCEGOVTSUPPORTINPROMOTINGUSEOFAI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	VERY IMPORTANT	187	66.1	66.1	66.1
	SOME WHAT IMPORTANT	73	25.8	25.8	91.9
	NOT IMPORTANT	23	8.1	8.1	100.0
	Total	283	100.0	100.0	

Out of 283, majority 66.1% respondents believe that government support is very important in promoting use of AI, followed by 25.8% of the respondents consider it somewhat important.

Inferential statistics:

CORRELATION BETWEEN FAMILIAR WITH APPLICATION AND WILLING TO INVEST, DECISION OF INVEST

Table:6

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Crosstab

Count

		WILLINGTOINVESTAITECHNOLOGYTOENHACETHESUSTAINABILITY		Total
		WILLING	NOT WILLING	
FAMILIARWITHAPPLICATIONOFAIINSUPPLYMANAGMENT	VERY FAMILIAR	140	27	167
	SOME WHAT FAMILIAR	49	50	99
	NOT FAMILIAR	2	15	17
Total		191	92	283

The given data presents a correlation analysis between familiarity with an application and the willingness to invest in AI technology to enhance sustainability. The correlation values suggest a positive relationship between familiarity with the application and the willingness to invest. In the first crosstab, which examines the correlation between familiarity with the application and the willingness to invest, we can observe that individuals who are very familiar with the application are more likely to be willing to invest compared to those who are not familiar. The count indicates that out of 167 individuals who are very familiar with the application, 140 are willing to invest, while only 27 are not willing. Similarly, for individuals who are somewhat familiar with the application, 49 are willing to invest compared to 50 who are not willing. Overall, there is a positive association between familiarity with the application and the willingness to invest,

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.456	.052	8.599	.000[c]
Ordinal by Ordinal	Spearman Correlation	.445	.054	8.333	.000[c]
N of Valid Cases		283			

The symmetric measures, such as Pearson's R and Spearman correlation, further confirm the positive correlation. Both measures indicate a positive relationship, with Pearson's R at 0.456 and Spearman correlation at 0.445. The p- values (approx. Sig.)

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associated with both measures are statistically significant ($p < 0.001$), suggesting that the observed correlation is unlikely to have occurred by chance.

Crosstab

Count

		FACTORSINFLUENCEYOURDECISIONTOINVEST				Total
		COST	COMPLEXITY OF IMPLEMENTATION	AVAILABILITY OF SKILLED LABOUR	POTENTIAL BENEFITS	
FAMILIARWITHAPPLICATIONOFAIINSUPPLYMANAGMENT	VERY FAMILIAR	125	9	26	7	167
	SOME WHAT FAMILIAR	24	33	30	12	99
	NOT FAMILIAR	0	6	3	8	17
Total		149	48	59	27	283

In the second crosstab, the analysis expands to examine the factors influencing the decision to invest in AI technology. The factors considered are cost, complexity of implementation, availability of skilled labour, and potential benefits. Again, familiarity with the application shows a positive correlation with the decision to invest. Individuals who are very familiar with the application are more likely to consider factors such as cost, complexity, availability of skilled labour, and potential benefits when making their investment decision.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.471	.051	8.944	.000[c]
Ordinal by Ordinal	Spearman Correlation	.499	.051	9.648	.000[c]
N of Valid Cases		283			

The correlation measures in this crosstab further support the positive relationship between familiarity and investment decision. Pearson's R is calculated as 0.471, and Spearman correlation as 0.499, both of which are positive and statistically significant ($p < 0.001$).

In conclusion, the data suggests that there is a positive correlation between familiarity with the application and the willingness to invest in AI technology for enhancing sustainability. This implies that individuals who are more familiar with the application are more likely to be willing to invest and consider various factors in their investment decision-making process. Based on the correlation value there exist

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positive correlation between familiarity about AI technology and willing to invest, decision about investment.

HYPOTHESIS TESTING BETWEEN IMPORTANCES OF SUSTAINABILITY IN HUMANITARIAN MEDICAL SUPPLY CHAINS AND AGE, WORK EXPERIENCE OF THE RESPONDS

Table: 7

WORKEXPERIENCE * IMPORTANCEOFSUSTAINABILITYINJUMANITARIANMEDICAL Crosstabulation

Count

		IMPORTANCEOFSUSTAINABILITYINJUMANITARIANMEDICAL			Total
		VERY IMPORTANT	SOME WHAT IMPORTANT	NOT IMPORTANT	
WORKEXPERIENCE	1-3	91	45	9	145
	3-6	82	37	4	123
	6-10	15	0	0	15
Total		188	82	13	283

The given data presents a hypothesis test between the importance of sustainability in humanitarian medical supply chains and the age and work experience of the respondents. The table shows the cross-tabulation of work experience and the importance of sustainability, as well as age and the importance of sustainability.

For the work experience analysis:

The rows represent different ranges of work experience (1-3 years, 3-6 years, and 6-10 years).

The columns represent the importance of sustainability in humanitarian medical supply chains (Very Important, Somewhat Important, Not Important).

The count in each cell represents the number of respondents falling into that category

CHI SQUARE TESTS:

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	Value	df	Asymp. Sig. (2sided)
Pearson Chi-Square	9.443[a]	4	.051
Likelihood Ratio	14.106	4	.007
N of Valid Cases	283		

Chi-square tests were conducted to determine the relationship between the variables.

In the work experience analysis, the chi-square test yielded a p-value of 0.051 (Pearson Chi-Square) and 0.007 (Likelihood Ratio), which suggests a marginal or weak statistical significance. This indicates that there may be some association between work experience and the importance of sustainability in humanitarian medical supply chains.

Table: 8

AGE * IMPORTANCEOFSUSTAINABILITYINJUMANITARIANMEDICAL
Crosstabulation Count

		IMPORTANCEOFSUSTAINABILITYINJUMANITARIANMEDICAL			Total
		VERY IMPORTANT	SOME WHAT IMPORTANT	NOT IMPORTANT	
AGE	20-30	82	41	1	124
	30-40	37	18	0	55
	40-50	45	19	12	76
	50-60	24	4	0	28
Total		188	82	13	283

For the age analysis:

The rows represent different age ranges (20-30, 30-40, 40-50, 50-60).

The columns represent the importance of sustainability in humanitarian medical supply chains (Very Important, Somewhat Important, Not Important).

The count in each cell represents the number of respondents falling into that category.

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In the age analysis, the chi-square test resulted in a p-value of 0.000 (Pearson Chi-Square) and 0.000 (Likelihood Ratio), indicating strong statistical significance. This implies that there is a significant relationship between age and the importance of sustainability in humanitarian medical supply chains.

In conclusion, based on the significant p-values in both the work experience and age analyses, it can be inferred that opinions regarding the importance of sustainability in humanitarian medical supply chains are dependent on the age and work experience of the respondents. Based on the significant values in both the cases opinions are dependent on age and experience of the respondents.

ASSOCIATION BETWEEN POTENTIAL BENFITS OF USING AI IN HUMANITARIAN SUPPLY CHAIN AND FAMILIAR WITH APPLICATION OF AI

Table:9

LEVELOFFAMILIARITYWITHAITECHNOLOGY * POTENTIALEBENFITESOFUSINGAIINHUMANITARIANSUPPLY Crosstabulation

Count

		POTENTIALEBENFITESOFUSINGAIINHUMANITARIANSUPPLY				Total
		IMPROVED EFFICENCY AND ACCURACY	COST SAVINGS	BETTER INVENTARY MANAGMENT	INCREASED TRANSPERANCY	
LEVELOFFAMILIARITYWITHAITECHNOLOGY	VERY FAMILIAR	128	17	8	17	170
	SOME WHAT FAMILIAR	29	34	9	30	102
	NOT FAMILIAR	0	1	10	0	11
Total		157	52	27	47	283

The given data presents the association between the potential benefits of using AI in humanitarian supply chains and the level of familiarity with AI technology. The table shows the cross-tabulation of familiarity with AI technology and the perceived potential benefits.

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The rows represent different levels of familiarity with AI technology (Very Familiar, Somewhat Familiar, Not Familiar), and the columns represent the potential benefits of using AI in humanitarian supply chains (Improved Efficiency and Accuracy, Cost Savings, Better Inventory Management, Increased Transparency). The count in each cell represents the number of respondents falling into that category.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.586	.000
N of Valid Cases		283	

A contingency coefficient was calculated to measure the strength of association between the variables. The contingency coefficient value is 0.586, and the associated p-value is 0.000, indicating a strong positive association.

Based on this analysis, we can interpret that there is a significant positive association between the level of familiarity with AI technology and the perceived potential benefits of using AI in humanitarian supply chains. This means that as the level of familiarity with AI technology increases, respondents are more likely to recognize and acknowledge the potential benefits of AI in terms of improved efficiency and accuracy, cost savings, better inventory management, and increased transparency in humanitarian supply chains.

Based on the contingency value there exist positive association between level of familiarity with AI technology and opinions regarding potential benefits

Findings: The study's findings illuminate several critical aspects of AI technology in humanitarian medical supply chain management. A majority of respondents (60.1%) demonstrated familiarity with AI, indicating its increasing recognition. Primary challenges included a lack of funding (43.8%) and limited infrastructure in remote areas (23.3%). Significantly, 66.4% emphasized the importance of sustainability in humanitarian medical efforts, with 59.0% familiar with AI's supply chain applications. Benefits included enhanced efficiency (55.5%) and accuracy (18.4%), while concerns revolved around job loss (62.5%) and technology dependence (27.6%). The study revealed positive correlations between familiarity with AI and willingness to invest in AI technology, offering insights into promoting sustainable AI adoption in the humanitarian sector.

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4. CONCLUSION:

In conclusion, the findings of the study shed light on the perceptions and preferences of entrepreneurs regarding the role of artificial intelligence (AI) in enhancing the sustainability of humanitarian medical supply chains. The majority of respondents expressed familiarity with AI technology, indicating a potential knowledge base to build upon. However, challenges such as lack of funding, inadequate infrastructure, and limited access to remote areas were identified as significant hurdles.

The study also highlighted the importance of sustainability in humanitarian medical supply chains, with a majority of respondents recognizing its significance. Predictive analysis for demand forecasting emerged as the most valuable application of AI, followed by autonomous vehicles for delivery. While blockchain for supply chain transparency received fewer responses, it still garnered recognition from a portion of the respondents.

Based on these findings, several suggestions can be made. Efforts should focus on increasing awareness and familiarity with AI among entrepreneurs, as well as addressing funding challenges through collaborations and proposal development. Improving infrastructure and expanding access to remote areas should be prioritized, considering innovative solutions such as autonomous vehicles. The significance of sustainability in humanitarian medical supply chains should be emphasized, and guidelines for incorporating sustainable practices should be developed. Additionally, there is potential for further exploration of predictive analysis and autonomous vehicles, while blockchain technology should be promoted and its benefits communicated more effectively.

By considering these suggestions and taking appropriate actions, entrepreneurs and stakeholders can enhance their understanding of AI, overcome challenges, prioritize sustainability, and leverage AI technologies to improve the efficiency, effectiveness, and sustainability of humanitarian medical supply chains. Ultimately, this can lead to better healthcare access, optimized resource utilization, and improved outcomes for those in need.

Entrepreneurs perceive AI as a critical enabler for enhancing the sustainability of humanitarian medical supply chains. AI has the potential to optimize inventory management, streamline logistics, and improve forecasting accuracy, ultimately leading to increased efficiency, reduced waste, and better resource allocation. By automating repetitive tasks, AI frees up human resources to focus on critical decision-making and strategic planning. Furthermore, AI-powered analytics can identify patterns, trends, and risks, enabling proactive

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interventions and timely response to emergencies. Overall, entrepreneurs recognize AI as a powerful tool for driving sustainability and resilience in humanitarian medical supply chains, improving the delivery of essential healthcare services to vulnerable populations

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