AN INVESTIGATIVE STUDY: IS IOT AN INTELLECTUAL IDEA FOR INDUSTRIES OF 21ST CENTURIES

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Abstract

The study was conducted to investigate the effectiveness of IoT in decision making and increasing the operational efficiency of the business. Further, the study was aimed at identifying the important applications of IoT in Business management. The study adopted a descriptive research design, wherein the data was collected from the 103 managers belonging to 68 large-scale companies from 11 different industry. The data were collected using a structured questionnaire. Through analysis performed it was understood that most of the respondents belong to the age category between 26 – 35 years with 1 – 7 years of experience in the field of IoT technology. According to their opinion, there is no significant difference in opinion among the respondents regarding the effectiveness of IoT during the decision-making process and in business operation management. They collectively agree that IoT is effective during the decision-making process and in business operation management. Also, they state that IoT is highly required for managing large scale business in this 21st century. Further, it was found that there is a significant influence of IoT on the decision-making process and Business Operation Management. Additionally, Easy data storage and retrieval to support decision-making, Reduced workload and complexity, Enhanced operational efficiency, Aids in identifying and correcting errors Immediately and Improvised system monitoring and control are found to be important applications of IoT for business belonging to various industries.

Keywords: IoT, Industry, India

Introduction

The internet of things (IoT) is a network of devices that are embedded with sensors, connectivity, actuators, software, and electronics allowing them to communicate and exchange data. In a nutshell, IoT devices share data over a wired or wireless network(Ferreira, P., Martinho, R., &Domingos, D., 2010).The

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increasing importance of the "Internet of Things" (IoT) stems from the ability to connect people, product, and production processes via a global network. The Internet of Things enables global corporations to become more competitive by sharing specific knowledge and social value over time, influencing company performance and customer relationship management(Delgosha, M. S., Hajiheydari, N., &Talafidaryani, M., 2021). On the one hand, in many sectors such as smart cities, natural environment, agri-food, insurance, and safety security, the IoT utility is changing the way of interpreting business process management within and outside of firms, as well as innovation processes linked to products and services. On the other hand, market competitiveness necessitates the use of intelligent equipment, expert systems, and executive technology(Jayasena, K. P. N., &Madhunamali, Et. al. 2021).

As a result, a new technology management scenario is emerging in which products made up of electrical and mechanical parts evolve into intelligent systems that combine hardware, software, control sensors, data storage, and connectivity in an infinite number of ways. In this regard, the Internet of Things enables modern businesses to share large amounts of data while increasing productivity and lowering marginal costs(Álvarez, A. P., Ordieres-Meré, J., Loreiro, Á. P., & de Marcos, L., 2021). Simultaneously, businesses must understand the potential of IoT to manage business process management, technology strategy, technology forecasting, technology roadmap, and technology management portfolio(Mishra, S., &Tripathi, A. R., 2020). We still know very little about how the Internet of Things is changing the way we interpret business process management both inside and outside of firms, and this topic is becoming increasingly popular in the leading managerial literature. Then, management scholars intend to investigate the impact and role of IoT on business process management in terms of knowledge flow, innovation, and competitiveness(Lei, T., Cai, Z., & Hua, L., 2021). Similarly, management researchers want to know how IoT fosters innovation within organisations and what impact this phenomenon has on business process management and firm competitiveness.

Today, several megatrends are relevant for business process management in modern factories: globalisation, technological evolution, the dynamism of product life cycles, and resource scarcity. Other relevant key factors appear to be the acceleration of innovation cycles and the growing customer demand for individualised mass productions with the highest quality expectations(Yang, X., Cao, D., Chen, J., Xiao, Z., &Daowd, A., 2020). IoT projects and applications in manufacturing, supply chain, supervision, and servicing are emerging within these industrial contexts.In addition to technology revitalization, a major question that arises in all of these projects is the value and benefit that such an application can provide to the user and the entrepreneur. In the manufacturing industry, as well as in industrial applications, the value question is extremely important. Adoption, acceptance, and widespread use of IoT-based applications will be determined by their value(Lee, I., 2019). However,

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because it is based on several features that are heavily application area dependent, this value is difficult to quantify.As a result, IoT adoption propels future research into a variety of areas, including international production systems, market demand and supply, and long-term value creation. So many examples today demonstrate that the main mechanism for generating value from IoT technology is to generate actual and refined data from the real world, thereby optimising technological and business process management based on it(Mishra, A., Jain, H., Biswas, P., Et. al. 2021). Herein this is one such attempt made to investigate the effectiveness of IoT in decision making and increasing the operational efficiency of the business. Further, the study was aimed at identifying the important applications of IoT in Business management.

Review of Literature

The IoT researches and applications are developing the industry sector as well as other economic sectors all over the world by creating value for both consumers and providers on the market(Saravanakumar, R., 2021). Examples of technological revitalization stemming from the use of IoT applications are coming from various domains like optimizing business process flows based on the analysis of big data, optimizing processes based on smart tags and smart objects, as well as the implementation of ad-hoc predictive maintenance applications(Chiu, H. H., & Wang, M. S., 2013). On one hand, technologies revitalized thanks to the IoT applications provide more and more efficient services solutions acquired by different clients; on the other hand, intelligent revitalized applications enhance the efficient companies systems starting from the production perspective(Uchihira, N., Ishimatsu, H., & Inoue, K., 2016). In this context, a relevant change is connected to the governance model applied by a contemporary firm based on IoT applications. Particularly, in the new knowledge economy, innovations included in new revitalized products and processes are likely to become the driving factors and the source of future financial and competitive advantages for each firm(Weinberger, M., Bilgeri, D., &Fleisch, E., 2016). The investigation of IoT applications together with other immaterial assets owned by the firms allows for the interpretation of the synergies generated by dimensions of intellectual capital and retrieved in human capital, relational capital and structural capital(Silva, E. M., &Maló, P., 2014).

The achievement of business process-oriented results for IoT industrial applications will be defined by data management and handling, as well as extracting relevant information and correlating IoT data with other factory information and processes(Remondes, J., &Afonso, C., 2019). The growing number of IoT-related technical contributions demonstrates that technologies are evolving and that there is a learning and application process underpinned by standardisation efforts. Simple installation, standardisation, sturdiness, configuration, and servicing are required to keep IoT systems operational and thus provide value for business process management across all industries(Xiaocong, Q., &Jidong, Z., 2010).From the perspective of business process management, value creation from the application of IoT to technological revitalization is likely to be crucial. In the

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coming years, it will have an increasingly large impact on the use of IoT technologies in the industry. This, however, is a different storey(Schönig, S., Ackermann, L., Jablonski, S., &Ermer, A., 2018).

The Objective of the Study

The study was conducted to investigate the effectiveness of IoT in decision making and increasing the operational efficiency of the business. Further, the study was aimed at identifying the important applications of IoT in Business management.

Methodology

The study adopted a descriptive research design, wherein the data was collected from the 103 managers belonging to 68 large-scale companies from 11 different industry. The data were collected using a structured questionnaire.

Analysis and interpretation

Herein the analysis was carried to identify whether the structured questionnaire with constructs is reliable for futuristic study.

Table No. 1: Reliability Statistics: Application of IoT in various Industries

Reliability Statistics: Application of IoT in various Industries				
Cronbach's Alpha	N of Items			
.832	10			
Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Reduced cost of operation	39.0194	18.784	.686	.798
Enhanced operational efficiency	38.9612	21.077	.476	.821
Improvement in Sales performance	39.0971	20.540	.482	.821
Retaining Customers	39.1165	21.300	.423	.827
Possibility of new product and service innovation	39.0291	19.283	.647	.803
Workload and complexity were reduced	38.9320	23.437	.194	.843
Provides scope for the creation of a brand.	39.1456	18.930	.734	.794
Easy data storage and retrieval to support decision-making	38.8835	22.261	.419	.826
Aids in identifying and correcting errors Immediately	38.9709	21.283	.503	.819
Improvised system monitoring and control	38.9903	19.657	.607	.808

Source: (Primary data)

The estimated Cronbach Alpha value is 0.832 for the construct named ‘Applications of IOT technology’ which is greater than 0.7 [Std. Value]. Therefore, the structured questionnaire with the constructs is reliable for futuristic study.

Herein demographic profile was analysed using simple descriptive statistics.

Table No. 2: Descriptive Statistics – Demographic Profile

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Demographic Profile		Frequency	Percentage
Age	25 Years and Below	19	18.4
	26 - 35 Years	33	32.0
	36 - 45 Years	35	34.0
	Above 45 Years	16	15.5
	Total	103	100.0
Experience	Less than 1 Year	13	12.6
	1 - 3 Years	43	41.7
	4 - 7 Years	32	31.1
	Above 7 Years	15	14.6
	Total	103	100.0

Source: (Primary data)

From the descriptive statistics, it can be interpreted that most of the respondents belong to the age category between 26 – 35 years with 1 – 7 years of experience in the field of IoT technology.

Herein Univariate test was performed to determine the effectiveness of IoT during the decision-making process in business.

Table No. 3: Univariate Test - Effectiveness of Decision Making through IoT

Tests of Between-Subjects Effects					
Dependent Variable: Effectiveness of Decision Making through IoT					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	3.196	3	1.065	1.873	.140
Experience	1.675	3	.558	.982	.405
	N	Minimum	Maximum	Mean	Std. Deviation
Effectiveness of Decision Making through IoT	103	1.00	5.00	4.3301	.83300

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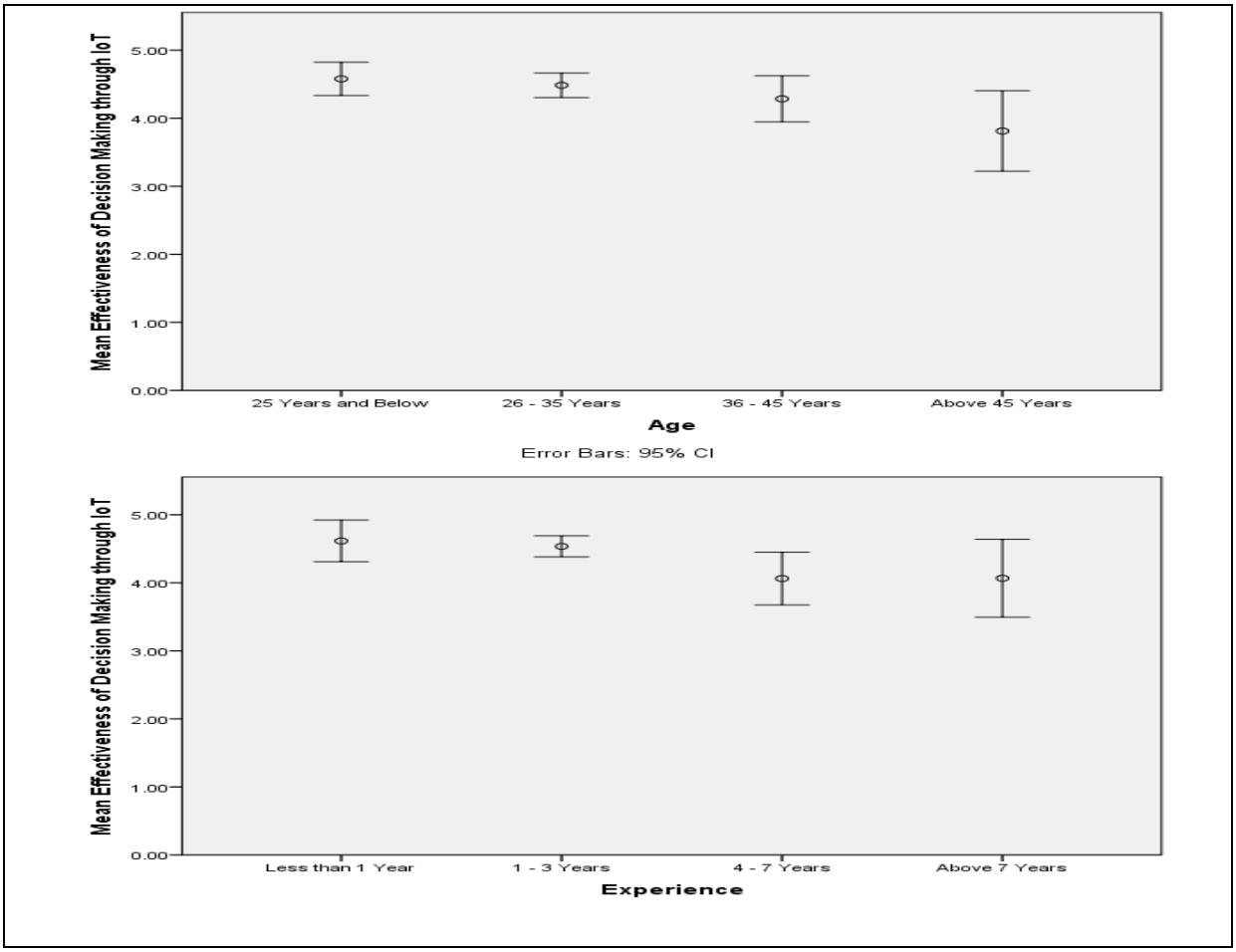

Source: (Primary data)

The estimated significance value is greater than 0.05 for the demographic variables, hereby the null hypothesis is accepted. Therefore there is no significant difference in opinion among the respondents regarding the effectiveness of IoT during the decision-making process in business.

Further from the graph and mean score (4.3301), it can be well understood that most of the respondents agree that IOT was effective during the business decision making process.

Herein Univariate test was performed to determine the effectiveness of IoT in business operations.

Table No. 4: Univariate Test -Effectiveness of IoT in Business Operations

Tests of Between-Subjects Effects					
Dependent Variable: Effectiveness of IoT n Business Operations					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	5.871	3	1.957	3.120	.060
Experience	1.507	3	.502	.801	.496
	N	Minimum	Maximum	Mean	Std. Deviation
Effectiveness of IoTin Business Operations	103	1.00	5.00	4.2233	.90675

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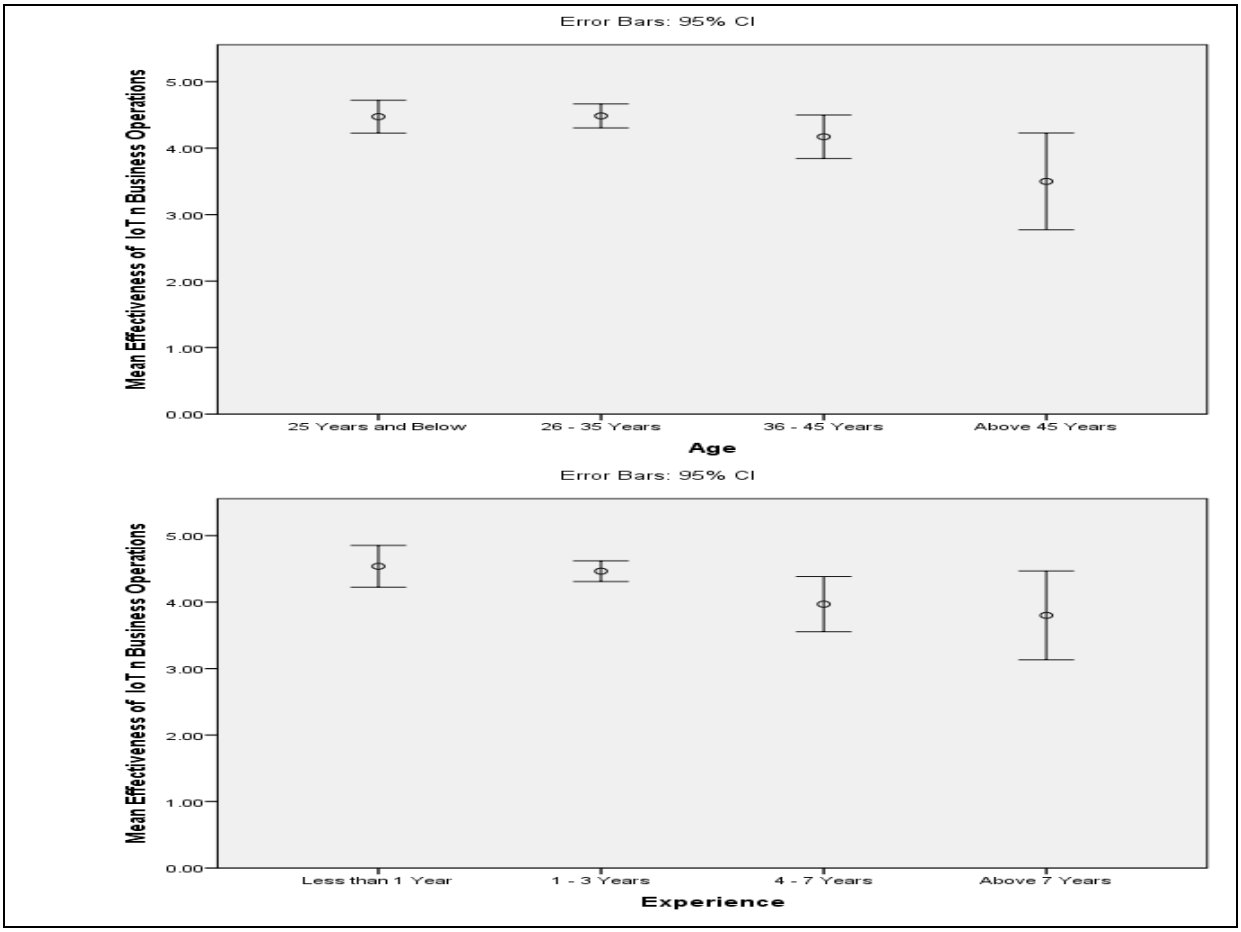

Source: (Primary data)

The estimated significance value is greater than 0.05 for the demographic variables, hereby the null hypothesis is accepted. Therefore there is no significant difference in opinion among the respondents regarding the effectiveness of IoT in managing business operations.

Further from the graph and mean score (4.2233), it can be well understood that most of the respondents agree that IOT was effective in managing business operations.

Herein Univariate test was performed to determine the level of requirement of IoT in business.

Table No. 5: Univariate Test - IoT Requirement for Business in 21st Century

Tests of Between-Subjects Effects					
Dependent Variable: IoT Requirement for Business					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	2.683	3	.894	1.197	.315
Experience	1.776	3	.592	.792	.501
	N	Minimum	Maximum	Mean	Std. Deviation
IoT Requirement for Business	103	1.00	5.00	4.2913	.90349

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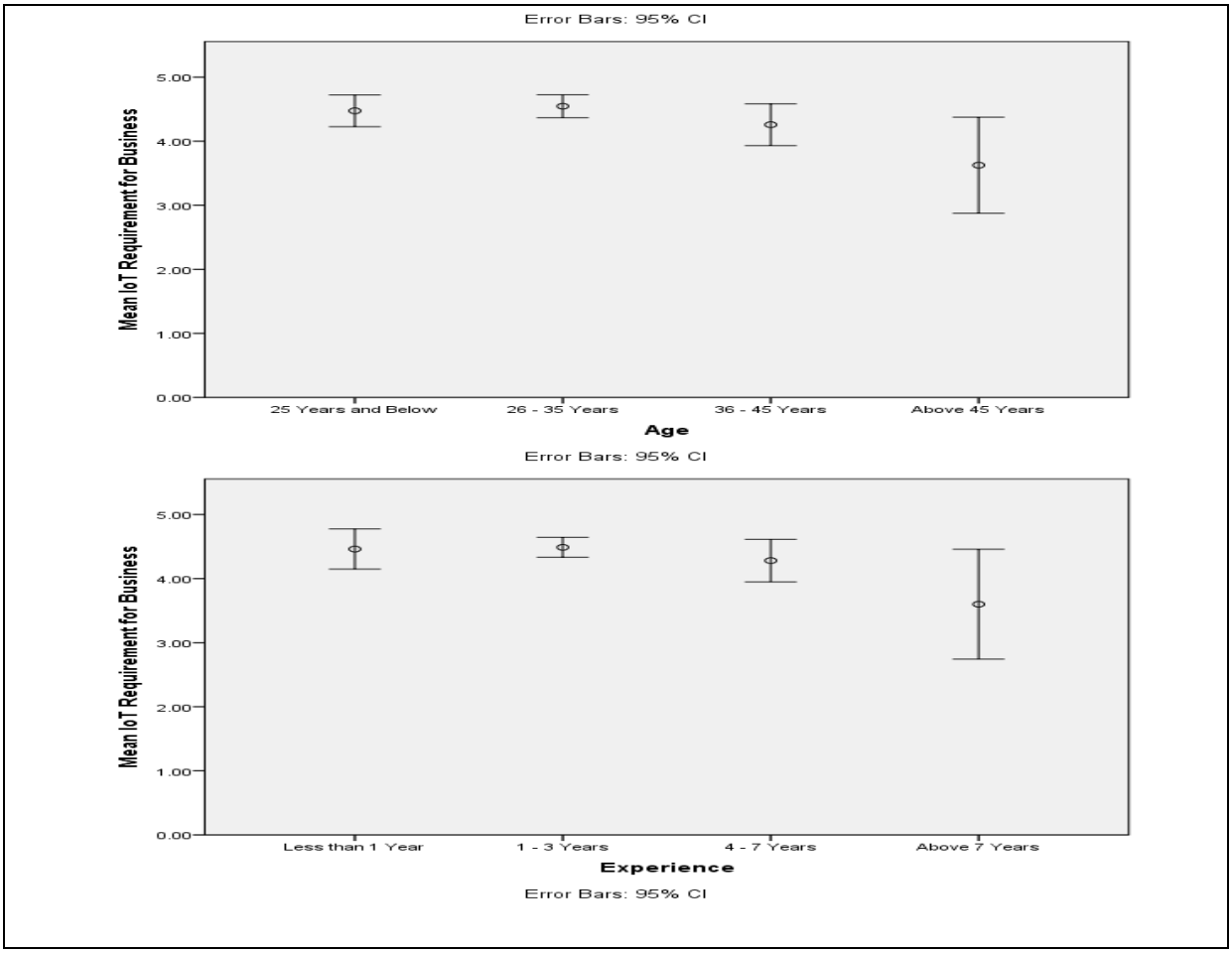

Source: (Primary data)

The estimated significance value is greater than 0.05 for the demographic variables, hereby the null hypothesis is accepted. Therefore there is no significant difference in opinion among the respondents regarding the level of requirement of IoT in managing the business.

Further from the graph and mean score (4.2913), it can be well understood that most of the respondents state that IoT is highly required for managing business in this 21st century.

Herein the regression the analysis was carried to identify whether there is an Impact of IoT on the decision-making process and Business Operation Management

Table 6: Regression Analysis – Impact of IoT on the decision-making process and Business Operation Management

Model Summary				
Model	R	R Square	Adjusted R Square	Std. error of the Estimate
1	0.782	.612	.609	.75115
a. Predictors: (Constant), Effectiveness of IoT n Business Operations, Effectiveness of Decision Making through IoT				
b. Dependent Variable: IoT Requirement for Business				

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.

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1	Regression	26.839	2	13.420	23.784	.000[b]
	Residual	56.423	100	.564		
	Total	83.262	102			

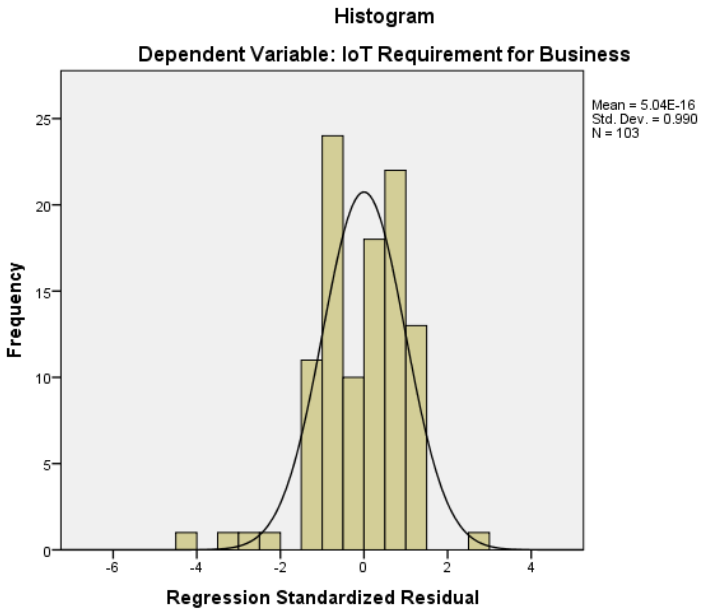
a. Dependent Variable: IoT Requirement for Business

b. Predictors: (Constant), Effectiveness of IoT n Business Operations, Effectiveness of Decision Making through IoT

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.425	.423		3.366	.001
	Effectiveness of Decision Making through IoT	.367	.108	.338	3.394	.001
	Effectiveness of IoT n Business Operations	.303	.099	.304	3.048	.003

a. Dependent Variable: IoT Requirement for Business



Source: (Primary data)

The estimated R-value is 0.782, which is greater than 0.6 [Std. Value] and R-Square value is 0.612, which is greater than 0.5 [Std. Value]. Hereby the model has reasonable forecasting accuracy.

Further, the ANOVA significance value is 0.000, which is less than 0.05 [Std. Value] here the model is fit.

Further, the coefficient significance value is less than 0.05, meaning there is a significant influence of IoT on the decision making process and Business Operation Management.

Herein Multivariate test was performed to determine whether there is a significant difference in opinion for the applications of IoT.

Table No. 7: Multivariate Test – Application of IoT in Various Industries

Tests of Between-Subjects Effects

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Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Age	Reduced cost of operation	1.791	3	.597	.864	.463
	Enhanced operational efficiency	8.662	3	2.887	6.007	.001
	Improvement in Sales performance	3.364	3	1.121	1.863	.141
	Retaining Customers	3.892	3	1.297	2.949	.037
	Possibility of new product and service innovation	5.565	3	1.855	2.868	.041
	Workload and complexity were reduced	1.598	3	.533	1.272	.289
	Provides scope for the creation of a brand.	5.458	3	1.819	3.111	.030
	Easy data storage and retrieval to support decision-making	1.248	3	.416	1.141	.337
	Aids in identifying and correcting errors Immediately	1.542	3	.514	1.004	.395
	Improvised system monitoring and control	2.871	3	.957	1.309	.276
Experience	Reduced cost of operation	4.599	3	1.533	2.219	.091
	Enhanced operational efficiency	6.758	3	2.253	4.687	.004
	Improvement in Sales performance	1.803	3	.601	.999	.397
	Retaining Customers	2.595	3	.865	1.966	.125
	Possibility of new product and service innovation	2.142	3	.714	1.104	.352
	Workload and complexity were reduced	.988	3	.329	.787	.504
	Provides scope for the creation of a brand.	2.172	3	.724	1.238	.301
	Easy data storage and retrieval to support decision-making	1.546	3	.515	1.414	.244
	Aids in identifying and correcting errors Immediately	.349	3	.116	.227	.877
	Improvised system monitoring and control	.355	3	.118	.162	.922

Source: (Primary data)

The estimated significance value is greater than 0.05 for most of the variables, hereby the null hypothesis is accepted. Therefore there is no significant difference in opinion among the respondents regarding the applications of IoT.

Having found there is no significant difference in opinion among the respondents regarding the applications of IoT, rank analysis using the mean score was performed to identify the important applications of IoT.

Table No. 8: Rank Analysis - Application of IoT in Various Industries

Rank Analysis			
	N	Mean	Rank
Reduced cost of operation	103	4.330097	6
Enhanced operational efficiency	103	4.38835	3
Improvement in Sales performance	103	4.252427	8
Retaining Customers	103	4.23301	9
Possibility of new product and service innovation	103	4.320388	7
Workload and complexity were reduced	103	4.417476	2
Provides scope for the creation of a brand.	103	4.203883	10
Easy data storage and retrieval to support decision-making	103	4.466019	1
Aids in identifying and correcting errors Immediately	103	4.378641	4

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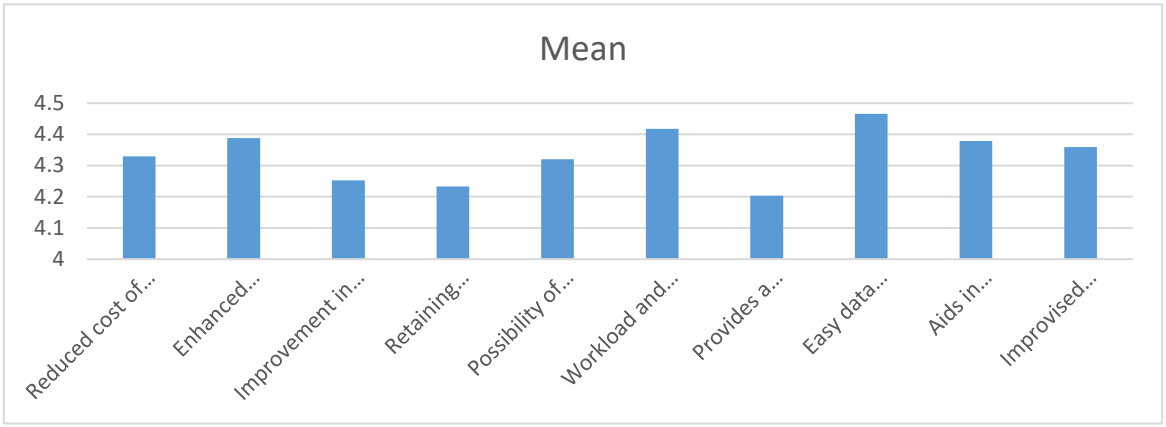
Improvised system monitoring and control	103	4.359223	5



Source: (Primary data)

From the rank analysis made using the mean score following were found to be the important applications of IoT in business belonging to different industries; Easy data storage and retrieval to support decision-making, Reduced workload and complexity, Enhanced operational efficiency, Aids in identifying and correcting errors Immediately and Improvised system monitoring and control.

Findings and Conclusion

Through analysis performed it was understood that most of the respondents belong to the age category between 26 – 35 years with 1 – 7 years of experience in the field of IoT technology. According to their opinion, there is no significant difference in opinion among the respondents regarding the effectiveness of IoT during the decision-making process and in business operation management. They collectively agree that IoT is effective during the decision-making process and in business operation management. Also, they state that IoT is highly required for managing large scale business in this 21st century. Further, it was found that there is a significant influence of IoT on the decision making process and Business Operation Management. Additionally, Easy data storage and retrieval to support decision-making, Reduced workload and complexity, Enhanced operational efficiency, Aids in identifying and correcting errors Immediately and Improvised system monitoring and control are found to be important applications of IoT for business belonging to various industries.

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