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Research Article

Investigating the Impact of IoT on Business Performance

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Abstract

The objective of the study was to determine the opinion of the employees and employers in the manufacturing sector who were using IoT for business operations. Further to identify the impact of IoT on business performance. Herein for the descriptive research design was adopted. The data was collected from 67 respondents from 38 different business units who were using IoT. The data were collected using a structured questionnaire. From the analysis carried out t was understood that the respondents agree that IoT is required for the current business environment. Further, it was found that IoT significantly contributes to decision making, easy data storage and retrieval, helps in identifying and rectifying the mistakes quickly, Improves operational efficiency and better system monitoring easily. Also, it can be interpreted that IoT significantly impacts the Decision Making, System monitoring, Competitiveness of the business unit and operational efficiency. Thus it can be overall concluded that in the Current era IoT is essential for better business performance.

Keywords: IoT, Business Performance, Manufacturing Sector

1. Introduction

In the last generation, the number of rivals in every market has increased dramatically. Firms are facing fierce competition these days, owing to growing demands from the technology sector and global concerns. These upcoming pressures result in globalisation of manufacturing, which is characterised by faster transfer of goods, multiple payment systems, and product compression, among other factors, driving the need for the most integration of successful companies that do not only respond to the needs of their customers or firms. Rather, they focus on future trends by creating new ideas, products, and services that can quickly and efficiently satisfy future needs [1]. Among all the technological stressors, the internet's advent has had a significant impact on companies' production techniques and altered organisational and operational structures. However, the function of the internet in production is still understudied, as is the case with the "internet of things" (IoT) phenomena, which refers to the emergence of complex networks of products and devices connected through the internet, sometimes with omnipresent intelligence. The relevant literature on the subject is scattered and usually focuses on in-depth studies of specific cases, primarily with an emphasis on engineering elements while recognising the quality-related

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issues [2]. The data was gathered from 67 respondents who used IoT in 38 different business divisions. A systematic questionnaire was used to gather the information. According to the results of the study, the respondents believe that IoT is necessary in today's corporate climate. Such "disconnected" activities do not allow for clear feasible categorizations and evolutionary roadmaps of the IoT phenomena, especially in terms of managerial consequences. As a result, the purpose of this paper is to investigate the key data points that represent the IoT and, as a result, theorise a conceptual framework based on the innovation literature in order to investigate and interpret the past, present, and future dimensions of the IoT's impact on manufacturing. Because the Internet of Things is still a developing concept, our approach helps by simply placing and structuring the phenomena inside conventional management paradigms [3].

Many writers have attempted to describe the Internet of Things phenomena throughout the years by extending the notions of "Internet" and "things," defining their characteristics, connections, and interactions. Because of the involvement of the human element, there are discussions and even debates against the usage of the terms "Internet" and "things," thus the name "Internet of people" is proposed. Many of these criteria indicate that Internet accessibility, which includes creating a strong Internet infrastructure, obtaining a low-cost Internet connection, and expanding IP address space, is a requirement for the Internet of Things to become a reality in all aspects of our lives. This allows all "things" on the earth to be connected and addressed. Internet of Things, like any other pervasive technology, offers a slew of benefits for companies and consumers, including new possibilities and a diverse range of applications. Along with this, there are certain threads and issues that need to be resolved in order for all participants in the IoT ecosystem to feel safe and secure. We examine the key features that characterise the Internet of Things and create a framework to understand its development based on management and innovation literature. An study of the Internet of Things phenomena and its key keywords was utilised to develop a conceptual framework in a management design to explain the phenomenon's evolutionary impacts on the innovative sector. This paradigm was then applied to the instance of additive manufacturing's three-dimensional (3D) printing technology [4].

The impacts of IoT on the innovative industry are achieved via a series of stages, including radical, modular, architectural, and incremental innovation. This research presents a basic model for interpreting the effects of the Internet of Things. This was accomplished by systematising the topic's study and organising the contributions into established paradigms in the management literature. An organization's Business Performance System is critical. It helps a company operate as a single unit and provides all employees with access to a single source of data, making it more productive and efficient. IoT improves the amount of data accessible to a Business Performance system, allowing a company to efficiently use and analyse the data. It also aids in improved product and service management. This also contributes to an organization's profitability. The effect of IoT in a business is becoming increasingly apparent at the moment. Organizations may improve customer happiness by offering new services that they previously didn't have the capacity or concept to provide. The Internet of Things has a variety of effects on the Business Performance System. The Internet of Objects (IoT) helps a business performance system link people, processes, data, and things in a way that allows for improved decision-making. This may help to enhance data processing even further [5].

2. Literature Review

Manufacturing innovation has a long history of research. Many empirical studies have linked a company's ability to maintain a nonstop innovation strategy to its longevity [6]. A recent comprehensive literature analysis on manufacturing, which collected contributions from 1993 to

2003, shows how innovation is seen as one of the most important factors influencing company survival. Production and distribution methods, as previously said, should operate in a completely different environment than in the past. Gadgets or "things" are embedded in their environments, which means they may be constantly connected and interacting with one another, altering data flows. Although certain pioneer studies on comparable topics may be dated back to the beginning of the new century, this phenomena has just recently appeared in academic and practitioner literature and been given the term net of things (IoT). Because the concept is still in its infancy, it lacks a common and unambiguous definition. As a result, a systematisation of the whole range of implications and knowledge throughout the idea is critical, and this book aims to do that [6].

The next parts will do just that, expanding on the current literature's fragmented and unconnected pieces to create a more comprehensive and systematic version. We'll begin by referring to one of the most comprehensive definitions of the Internet of Things, which refers to a networked interconnection of everyday things and products that can be routinely geared up with omnipresent intelligence. However, it is also true that the current competitive environment has increased the pace of innovation in terms of discovery, implementation, creation, and market dissemination. This has resulted in a self-reinforcing cycle that has compelled companies to continuously develop services and goods in order to maintain better overall performance [7]. With the advent of the internet and the 1/3 business revolution called as the digital revolution, this fact has become much more true. Superior manufacturing technology is heavily reliant on a variety of ICT technologies in order to achieve greater productivity, higher quality, and reduced production costs. This has a specific effect on methods for automating production and on information structures. Indeed, the introduction of internet-based technology has resulted in the emergence of new production philosophies and business models, such as digital businesses, remote manufacturing, computer-assisted manufacturing, and internet-based manufacturing, such as Wi-Fi milling machines, coordinated measuring machines, networked sensor arrays, and surveillance systems. For example, "create anywhere, produce anywhere" is a novel approach to manufacturing that allows designers and manufacturers to exchange design and manufacturing data across various systems and infrastructures [8].

Recent research have verified these characteristics, implying that the future of manufacturing companies would be mostly records-oriented and knowledge-driven, resulting in much more flexibility and an abundance of automated operations systems. As a result, any production generation will need to be integrated into a network machine and work in "dispensed environments," which are environments populated by interconnected bodily objects and digital systems capable of performing included tasks regardless of the physical location of precise machineries, gadgets, or methods, and dealing with unique databases or statistics acquired externally. The advantages of net-based solutions in production settings are highlighted, particularly in terms of scalability with demand and flexibility in installing and modifying solutions. Cloud-based design and production is a great illustration of these advantages. It refers to a networked, carrier-oriented product development paradigm in which service customers may customise services or goods and reconfigure production structures. “Cloud-based production (CBM) refers to a networked manufacturing model that uses on-demand access to a shared series of various and distributed manufacturing sources to form temporary, reconfigurable production strains that improve performance, lower product lifecycle fees, and allow for optimal resource allocation in response to variable-demand customers,” according to the definition. As a result, this technology may be able to enhance operational efficiency by enhancing engagement in business-to-business (B2B) interactions, such as manufacturer-to-wholesaler or wholesaler-to-store. Such

responses may also detect a lack of inventory for a particular item straight away, speeding up the reordering process [9]. As a result, this environment offers a dependable method to store, integrate, manage, and control each data and process from production to distribution in an organised and efficient manner. As a result of aiding B2B integration, internet-based technology has an effect on working overall performance in terms of value-slicing, satisfaction, flexibility, and transportation overall performance. By combining IoT with ERP, ERP systems will become more intelligent, real-time, and adaptable, increasing their efficiency [10]. Equipment maintenance, energy conservation, inventory optimization, and labour efficiency will all benefit from the Internet of Things [11]. IoT connects the actual and virtual worlds of production with the internet, allowing all elements of the manufacturing process to be connected, including equipment, materials, people, and methods. This allows machines and materials to interact with one another as well as control business operations. Businesses must deploy sensors, connect with numerous devices, and install sophisticated analytics for actionable knowledge in order to automate transactions using IoT [12]. Manufacturing firms will benefit from IoT since it collects valuable data from these sensors and transmits it to factory employees, plant managers, software systems, and many other value chain components [13].

Using paper-based, excel-based, and conventional enterprise software to evaluate inventory is more expensive and may not address all of the company's issues. So, in order to address this issue, inventory management is carried out utilising RFID and 2.0 technologies, which are linked through IoT [14]. Sensors are used to carry out the whole communication process. Web 2.0 technologies, on the other hand, may be used to interact through PCs or mobile phones. There are two kinds of RFID tags, depending on how they are powered. There are two types of them: active and passive. Online 2.0 enables the creation of more operationally rich and responsive web applications. Electronic Product Code (EPC) is a globally unique identification for each product that is often used for product tracking. The most significant disadvantage of adopting IoT in nations like South Africa is the cost, which may be mitigated by partnering with poorer countries. IoT sensors will exchange and analyse data about the product, its use patterns, and how it is handled. When combined with an existing ERP system, the solution can efficiently monitor working conditions. Sub processes are scheduled using a Genetic Algorithm approach. This technique optimises the process by reducing expenses and manufacturing delays. The process has been studied via simulations. The shortcoming is that it does not address the use of data collected from IoT sensors for efficient raw material and finished products transportation [15].

3. Objective

The objective of the study was to determine the opinion of the employees and employers in the manufacturing sector who were using IoT for business operations. Further to identify the impact of IoT on business performance.

4. Methodology

Herein for the descriptive research design was adopted. The data was collected from 67 respondents from 38 different business units who were using IoT. The data were collected using a structured questionnaire.

5. Analysis and Interpretation

Herein for research, a pilot study was conducted with 35 samples initially and the reliability was estimated using the Cronbach Alpha test Table 1.

Table No. 1: Reliability Statistics

Reliability Statistics				
Cronbach's Alpha	N of Items			
.768	15			
Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Improved Operational Efficiency	51.3134	40.431	.418	.752
Creating Competitive Pricing of Products	52.1940	44.886	.056	.779
Increment in Sales	52.7910	41.471	.321	.760
Better Customers Retention	51.3582	37.536	.621	.731
Innovation product & Services	51.5970	40.608	.262	.770
Branding	52.8657	41.482	.261	.767
Reduced Workload	51.8060	39.462	.422	.751
Easy data storage and retrieval	51.2388	40.821	.519	.747
Helps in identifying and rectifying the mistakes quickly	51.2537	41.223	.402	.754
Reduced Complexity in business operations	51.5373	38.707	.548	.739
Supports decision Making	51.1791	41.634	.367	.756
System monitoring was made easy	51.3433	36.986	.644	.728
Decreasing Business Expenditure	53.6418	43.688	.157	.772
Scope for business expansion	53.2388	45.094	.045	.779
Helps in Competing in business competitions	51.4179	38.126	.518	.741

Source: (Primary data)

The estimated Cronbach Alpha value for the factor Business Performance is estimated to be 0.768 which is greater than 0.7 (Std. Value). Thereby the factor and its items are reliable for further study.

Herein analysis was carried to identify whether there is a significant difference opinion among the respondents for IOT requirement to the business Table 2.

Table No. 2: Univariate Test – Requirement of IoT in current Business Environment

Tests of Between-Subjects Effects					
Dependent Variable:	Requirement of IoT in current Business Environment				
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	4.480	1	4.480	0.325	.162
Experience	1.965	3	.655	.895	.449
Descriptive Statistics					
		N	Mean	Std. Deviation	
Requirement of IoT in current Business Environment		67	4.2239	.90153	

Source: (Primary data)

The estimated significance value is greater than 0.05 for all the items, meaning the null hypothesis is accepted. Therefore, there is no significant difference in opinion among the respondents for the IoT requirement to the business among the respondents. From the mean score, it was understood that the respondents agree that IoT is required for the current business environment.

Herein analysis was carried to identify whether there is a significant difference in business performance due to IoT as per the respondents' opinion Table 3.

Table No. 3: Multivariate Test – Business Performance

Multivariate Tests						
Effect		Value	F	Hypothesis df	Error df	Sig.
Age	Pillai's Trace	.230	.894[b]	15.000	45.000	.576
Experience	Pillai's Trace	.733	1.013	45.000	141.000	.462
Tests of Between-Subjects Effects						
Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	Improved Operational Efficiency	.995	1	.995	1.148	.288
	Creating Competitive Pricing of Products	.318	1	.318	.488	.488
	Increment in Sales	.000	1	.000	.000	.989
	Better Customers Retention	1.374	1	1.374	1.296	.260
	Innovation product & Services	.362	1	.362	.237	.628
	Branding	.014	1	.014	.013	.911
	Reduced Workload	7.192	1	7.192	7.557	.008
	Easy data storage and retrieval	.786	1	.786	1.457	.232

	Helps in identifying and rectifying the mistakes quickly	.229	1	.229	.334	.566
	Reduced Complexity in business operations	.060	1	.060	.072	.789
	Supports decision Making	2.615	1	2.615	4.670	.035
	System monitoring was made easy	3.318	1	3.318	3.072	.085
	Decreasing Business Expenditure	.163	1	.163	.231	.633
	Scope for business expansion	.345	1	.345	.664	.418
	Helps in Competing in business competitions	.117	1	.117	.105	.747
Experience	Improved Operational Efficiency	1.772	3	.591	.682	.567
	Creating Competitive Pricing of Products	.691	3	.230	.354	.787
	Increment in Sales	5.035	3	1.678	2.143	.104
	Better Customers Retention	1.010	3	.337	.317	.813
	Innovation product & Services	2.344	3	.781	.511	.676
	Branding	4.032	3	1.344	1.187	.323
	Reduced Workload	6.188	3	2.063	2.167	.101
	Easy data storage and retrieval	.644	3	.215	.398	.755
	Helps in identifying and rectifying the mistakes quickly	.472	3	.157	.230	.875
	Reduced Complexity in business operations	5.392	3	1.797	2.171	.101
	Supports decision Making	3.532	3	1.177	2.103	.110
	System monitoring was made easy	.305	3	.102	.094	.963
	Decreasing Business Expenditure	1.663	3	.554	.785	.507
	Scope for business expansion	.800	3	.267	.513	.675
	Helps in Competing in business competitions	6.754	3	2.251	2.027	.120

Source: (Primary data)

The estimated significance value is greater than 0.05 for all the items, meaning the null hypothesis is accepted. Therefore, there is no significant difference in business performance due to IoT as per the respondent's opinion.

Herein in the rank analysis was carried to important business performance increased due to induction of the IoT Table 4.

Table No. 4: Rank Analysis – Business Performance

Rank Analysis			
	N	Mean	Rank
Improved Operational Efficiency	67	4.3134	4
Creating Competitive Pricing of Products	67	3.4328	11
Increment in Sales	67	2.8358	12
Better Customers Retention	67	4.2687	6
Innovation product & Services	67	4.0299	9
Branding	67	2.7612	13
Reduced Workload	67	3.8209	10
Easy data storage and retrieval	67	4.3881	2
Helps in identifying and rectifying the mistakes quickly	67	4.3731	3
Reduced Complexity in business operations	67	4.0896	8
Supports decision Making	67	4.4478	1
System monitoring was made easy	67	4.2836	5
Decreasing Business Expenditure	67	1.9851	15
Scope for business expansion	67	2.3881	14
Helps in Competing in business competitions	67	4.2090	7

Source: (Primary data)

From the rank analysis carried using the mean score it was found that IoT significantly contributes to decision making, easy data storage and retrieval, helps in identifying and rectifying the mistakes quickly, Improves operational efficiency and better system monitoring easily.

Herein analysis was carried using the linear regression method to identify the Impact of IoT on Business performance Table 5.

Table No. 5: Regression - Impact of IoT on Business performance.

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.762[a]	.580	.456	.66465		
ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.112	15	2.074	4.695	.000[b]
	Residual	22.530	51	.442		
	Total	53.642	66			
Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.987	1.006		.981	.331

	Improved Operational Efficiency	-.249	.126	-.251	-1.983	.053
	Creating Competitive Pricing of Products	.165	.123	.144	1.345	.184
	Increment in Sales	-.045	.109	-.046	-.416	.679
	Better Customers Retention	-.018	.129	-.020	-.139	.890
	Innovation product & Services	-.091	.087	-.121	-1.045	.301
	Branding	.078	.091	.091	.855	.397
	Reduced Workload	.126	.106	.146	1.196	.237
	Easy data storage and retrieval	.097	.167	.078	.584	.562
	Helps in identifying and rectifying the mistakes quickly	-.173	.138	-.156	-1.247	.218
	Reduced Complexity in business operations	.025	.126	.026	.197	.845
	Supports decision Making	.250	.139	.222	1.799	.078
	System monitoring was made easy	.401	.139	.456	2.873	.006
	Decreasing Business Expenditure	.023	.117	.021	.193	.848
	Scope for business expansion	.016	.139	.013	.117	.908
	Helps in Competing in business competitions	.221	.114	.262	1.941	.058
a. Dependent Variable: Requirement of IoT in current Business Environment						

Source: (Primary data)

The estimated R-value is 0.762, meaning the factor Emotional Intelligence and Employee Performance have a 76.2% relationship. Further, the calculated R-Square value is 0.580 which is greater than 0.5 (Std. Value), therefore the regression equation will have 58% forecasting accuracy.

Also, the estimated ANOVA Significance value is less than 0.05, this indicates the model is fit. Further, the coefficient significance value is less than 0.05 from which it can be interpreted that IoT significantly impact the Decision Making, System monitoring, Competitiveness of the business unit and operational efficiency

6. Findings and Conclusion

From the analysis carried out t was understood that the respondents agree that IoT is required for the current business environment. Further, it was found that IoT significantly contributes to decision making, easy data storage and retrieval, helps in identifying and rectifying the mistakes quickly, Improves operational efficiency and better system monitoring easily. Also, it can be interpreted that IoT significantly impacts the Decision Making, System monitoring,

Competitiveness of the business unit and operational efficiency. Thus it can be overall concluded that in the Current era IoT is essential for better business performance.

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