

**Investigating the Implications of the Internet of Things on Business Performance**

Dr. Abhay Shukla<sup>1</sup>, Thirupurasundari D R<sup>2</sup>, Dr Satish G Athawale<sup>3</sup>, I.YASAR SHARIFF<sup>4</sup>,  
Dr.Vijayakumar Thota<sup>5</sup>, Dr. G.Saravana Kumar<sup>6</sup>

**Abstract**

The primary purpose of the research was to learn what industrial employees and employers felt about the Internet of Things (IoT) and how it was being utilised to operate their companies. It's also important to figure out how the Internet of Things affects company performance. The study was conducted using a descriptive research approach. The data was acquired from 67 respondents who worked in 38 different business divisions and used the Internet of Things. A standardised questionnaire was used to collect the information. According to the survey's findings, the majority of respondents felt that the Internet of Things (IoT) is critical in today's business environment. It was also revealed that the Internet of Things (IoT) considerably supports decision making, enables data storage and retrieval, aids in the speedy discovery and rectification of errors, enhances operational efficiency, and promotes increased system monitoring. It may also be inferred that the Internet of Things has a significant impact on decision-making, system monitoring, business unit competitiveness, and operational efficiency. As a consequence, it may be stated that the Internet of Things (IoT) is crucial for increased business performance in the present age.

**Keywords:** IoT, Business Performance, Manufacturing Sector

**Introduction**

The term "Internet of Things" or "Internet of Objects" has evolved to refer to a wide range of electrical or electronic devices connected to the Internet and capable of communicating with one another. Other than machine-to-machine communication, the scope of the links is continually growing (M2M) [1]. The devices that make up the Internet of Things employ a wide variety of networking protocols, applications, and network domains. The Internet of Things is becoming more common as a result of the connecting of physical objects to the Internet through

---

<sup>1</sup>Associate Professor, Department of Computer Science and Engineering, Axis Institute of Engineering and Technology, Kanpur.E-Mail ID: abhay002@outlook.com

<sup>2</sup>Assistant Professor, Department of Computer Science and Engineering, Meenakshi College of Engineering, Chennai.

<sup>3</sup>Assistant Professor, Sasmira's Business School, Worli, Mumbai.

<sup>4</sup>Research Scholar, Business Administration, Annamalai University.

<sup>5</sup>Assistant Professor, Department of Business Management, Satavahana University.

<sup>6</sup>Associate Professor, Jain (Deemed to be) University, Bengaluru, India.

a number of short-range wireless technologies. Wireless technologies include ZigBee, RFID, sensor networks, and location-based technologies, to name a few. The Internet of Things (IoT) will increase the Internet's impact on daily life by making it more pervasive, personal, and intimate [2]. According to the CISCO Internet Business Solutions Group (IBSG), the Internet of Things emerged as a distinct entity in 2010, when there were more inanimate objects connected to the Internet than human users [3].

This occurred in the middle of 2008, according to this definition. This is a constant process that is speeding up, especially with the adoption of CISCO's 'Planetary Skin,' the Smart Grid, and self-driving and intelligent vehicles. Apart from their networking protocols, Internet of Things devices lack a reliable standard for connecting to the Internet at this moment [4]. The Internet of Things may be used to link things like automotive electronics, home environmental management systems, telephone networks, and the control of household utility services when paired with extra management and security capabilities. The Internet of Things (IoT) is a broad phrase that refers to a vision in which 'things' such as everyday objects, places, and surrounds are connected through the Internet [5]. An Internet of Things item is a thermostat, which is currently available in certain homes and can detect when people are in particular rooms and modify the temperature, lighting, and other functions in the house accordingly. When the Internet is extended from "a network of linked computers to a network of interconnected things," the Internet of Things (IoT) will be constituted of a huge and sophisticated network of devices. Sensors to measure their surroundings and actuators to physically act back into their environment (such as opening a door), processors to handle and store the vast amounts of data generated, nodes to relay the information, and coordinators to help manage groups of these components will all be included [6]. As a consequence, it has the potential to substantially extend, enrich, and even revolutionise the relationship between people and their surroundings [7]. Many individuals feel that the Internet of Things (IoT) will be essential in addressing many of today's societal issues, such as the ageing population, deforestation, transportation congestion, and recyclable materials. The considerable consequences that large-scale networked communications are having on our society are expected to be increased as a result of the connection of physical goods [8].

### **Literature Review**

The Internet has a wide range of applications and uses, and the number of individuals who utilise it is steadily increasing. The Internet of Things (IoT), the Internet of Everything (IoE), and the Internet of Nano Things are all words used to describe new ways to integrate the Internet into every aspect of one's personal, professional, and social life [9]. This paper analyses the current state of these technologies as well as their multi-dimensional application potential after reviewing the relevant literature. In order to provide suggestions, the paper evaluates the multiple possible future applications of these technologies and forecasts future advancements, as well as how they will impact people's lifestyles in the future. Integration of IoT with ERP systems will improve ERP system efficiency by, among other things, making them more intelligent, real-time, and adaptive [10]. Equipment maintenance, energy saving, inventory optimization, and greater labour efficiency will all benefit from the Internet of Things [11].

The Internet of Things (IoT) allows the real and virtual worlds of manufacturing to be linked through the internet, allowing all aspects of the manufacturing process to be linked, including equipment, materials, people, and techniques [12]. This permits machines and materials to communicate with one another and operate the business on their own terms.

## Investigating the Implications of the Internet of Things on Business Performance

Businesses that wish to leverage the Internet of Things to automate transactions must employ sensors, communicate with a variety of devices, and apply advanced analytics to get actionable understanding of the situation [13]. Manufacturing companies will profit from the Internet of Things (IoT) because it will collect useful data from sensors and communicate it to industrial staff, plant managers, software systems, and many other components throughout the value chain [14]. Companies are being forced to take a more holistic view of how they should be conducting their business, from conception and design to manufacturing, operation and service, and information technology, among other things, as the Internet of Things expands the range of functionality and abilities of products. IoT enhances load forecasting and production scheduling, as well as enterprise resource planning (ERP), product lifecycle management (PLM), manufacturing execution (MES), and supplier relationship management, by aligning the company's facility's operation with its suppliers and customers (SRM) [15]. The most commonly publicised advantage is that IoT-enabled Big Data analytics opens up various new options for improving operational efficiency, quality, and bottom-line operations [16].

Few automotive companies, such as Volkswagen, are implementing Internet of Things devices into the construction of their vehicles. Volkswagen has built a system that tracks all of their component supply pipelines, enabling them to know where all of their parts are located [17]. The Internet of Things is used at GE's Durathon battery manufacturing in Schenectady, New York, to gather data on their round-the-clock procedures. They've put 10,000 sensors on their assembly line and in every single battery they make, enabling plant managers to keep track of production at all times and exchange data with other departments [18]. In addition to identifying future maintenance issues, IoT-enabled predictive maintenance practises have the potential to eliminate ineffective preventive maintenance programmes, lowering maintenance costs, increasing equipment reliability and availability, and unlocking additional capacity while lowering production costs [19].

### Objective

The study's main goal was to find out what workers and employers in the industrial industry thought about the Internet of Things (IoT) and how it was being used to run their businesses. In order to better understand the influence of the Internet of Things on company performance, more research is being conducted.

### 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.

### 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 No. 1: Reliability Statistics**

Reliability Statistics	
Cronbach's Alpha	N of Items
.768	15

<b>Item-Total Statistics</b>				
	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 No. 2: Univariate Test – Requirement of IoT in current Business Environment**

## Investigating the Implications of the Internet of Things on Business Performance

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 No. 3: Multivariate Test – Business Performance**

Multivariate Tests						
Effect		Value	F	Hypothesis df	Error df	Sig.
Age	Pillai's Trace	.230	.894 <sup>b</sup>	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 No. 4: Rank Analysis – Business Performance**

Rank Analysis			
	N	Mean	Rank

## Investigating the Implications of the Internet of Things on Business Performance

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 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 <sup>a</sup>	.580	.456	.66465		
ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.112	15	2.074	4.695	.000 <sup>b</sup>
	Residual	22.530	51	.442		
	Total	53.642	66			
Coefficients <sup>a</sup>						
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

### Findings and Conclusion

According to the survey's findings, the majority of respondents felt that the Internet of Things (IoT) is critical in today's business environment. It was also revealed that the Internet of Things (IoT) considerably supports decision making, enables data storage and retrieval, aids in the speedy discovery and rectification of errors, enhances operational efficiency, and promotes increased system monitoring. It may also be inferred that the Internet of Things has a significant impact on decision-making, system monitoring, business unit competitiveness, and operational efficiency. As a consequence, it may be stated that the Internet of Things (IoT) is crucial for increased business performance in the present age.

### References



## Investigating the Implications of the Internet of Things on Business Performance

1. Roman, R., Najera, P., Lopez, J., Securing the internet of things, *Computer*, vol. 44, pp. 51-58, 2011.
2. Patel, K., 2017, 6 Benefits of IoT for Hospitals and Healthcare, <https://www.ibm.com/blogs/internet-of-things/6-benefits-of-iot-for-healthcare/>, (last access 30.07.2017)
3. The top 10 IoT application areas – based on real IoT projects, <https://iot-analytics.com/top-10-iot-project-application-areas-q3-2016/>, (last access 30.07.2017) Smart industry, <https://www.utwente.nl/en/fraunhofer/smart-industry/>, (last access 30.07.2017)
4. Balaji, M., & Roy, S. K. 2017. 'Value co-creation with Internet of things technology in the retail industry'. *Journal of Marketing Management*, 33(1-2), 7-31.
5. Cui, Y. 2015. 'Improving Supply Chain Resilience with Employment of IoT'. Paper presented at the International Conference on Multidisciplinary Social Networks Research.
6. Sicari, S., Rizzardi, A., Grieco, L.A., Coen-Porisini, A., Security, privacy and trust in Internet of Things: The road ahead, *Computer Networks*, Elsevier, Volume 76, pp 146-164, 2015
7. Saxena, P., The advantages and disadvantages of Internet of Things, <https://e27.co/advantages-disadvantages-internet-things-20160615/>, 2016, (last access 30.07.2017)
7. Consumers Beginning To Embrace Smart Home Technology – Even If They Don't Know It Yet, 2015, <http://www.theharrispoll.com/business/Consumers-Embrace-Smart-Home-Technology.html>,
8. Connected home technologies sales in the United States from 2012 to 2017 (in million U.S. dollars), <https://www.statista.com/statistics/525878/us-connected-home-technologies-sales/>, 2017
9. Ben-Daya, M., Hassini, E., & Bahroun, Z. 2017. 'Internet of things and supply chain management: a literature review'. *International Journal of Production Research*, 1-24.
10. Borgia, E. (2014). 'The Internet of Things vision: Key features, applications and open issues'. *Computer Communications*, 54, 1-31.
11. Carter, C. R., & Rogers, D. S. 2008. 'A framework of sustainable supply chain management: moving toward new theory'. *International Journal of Physical Distribution & Logistics Management*, 38(5), 360-387.
12. Constantinides, E., Kahlert, M., & de Vries, S. A. 2017. 'The relevance of technological autonomy in the acceptance of IoT services in retail'. Paper presented at the 2nd International Conference on Internet of Things, Data and Cloud Computing, ICC 2017.
13. Creswell, JW & Poth, CN 2017, *Qualitative inquiry and research design: Choosing among five approaches*, Thousand Oaks: SAGE Publications.
14. Kulkarni, A., Sathe, S., Healthcare applications of the Internet of Things: A Review, *International Journal of Computer Science and Information Technologies*, Vol. 5 (5), 6229-6232, 2014
15. de Vass, T., Shee, H., & Miah, S. J. 2018. 'The effect of “Internet of Things” on supply chain integration and performance: An organizational capability perspective'. *Australasian Journal of Information Systems*, 22.
16. 8 ways the Internet of things will change the way we live and work, <https://www.theglobeandmail.com/report-on-business/rob-magazine/the-future-is-smart/article24586994/>

17. European smart cities, <http://www.smart-cities.eu/index.php?cid=-1&ver=4>, (last access 30.06.2017)
18. Ten Reasons Why Barcelona is a Smart City, <http://www.vilaweb.cat/noticia/4175829/20140226/ten-reasons-why-barcelona-is-smart-city.html>, 2014 ,(last access 30.07.2017)
19. Smart Healthcare Products Market, <http://www.transparencymarketresearch.com/smart-healthcare-products-market.html>, 2016, (last access 30.07.2017)