IoT Adoption Direct Benefit for Organizations

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The Internet of Things (IoT) ushered in a new industrial revolution, the fourth industrial revolution (Industry 4.0), resulting in radical changes across all industries. IoT has differentiated itself from other technologies by incorporating smart features that enable it to sense, collect, communicate, and analyze massive amounts of data from various internal and external sources across a global network. These IoT features offer numerous benefits to organizations and make IoT critical to business success in the coming years.

Keywords: IoT benefits ; Direct Benefit ; IoT Adoption ; Internet of Things

1. Introduction

IoT allows businesses to exchange real-time data with numerous facilities, operators, customers, supply chains, and other connected devices using Internet network infrastructure. Thus, IoT offers promising opportunities and benefits for organizations that enable them to make better decisions, enhance production, streamline business operations, and more efficiently satisfy customer requirements while maintaining competitive advantages [1][2]. These benefits have attracted various sectors to adopt IoT, including healthcare, agriculture, transportation, oil and gas, manufacturing, supply chains, and logistics.

2. IoT Adoption Direct Benefits

Many experts and researchers have mentioned the potential benefits of IoT technology that motivate organizations to adopt IoT. The term "benefits" refers to the advantages that IoT provides, which result in positive outcomes for an organization [3]. IoT offers various benefits to organizations that can be observed directly and are mainly related to an organization's operational and internal efficiency [4]. In other words, these direct benefits refer to the enhancements introduced to the activities of the organization's internal functions using IoT technology [5], such as data availability, better decision-making, operation process efficiency, assets management efficiency, improved safety and security, and improved supply chains and transportation.

2.1 Data Availability and Accuracy

IoT sensors enable seamless real-time data collection from all organizational sectors, processing, and analysis periodically and continuously [6][7][8][9][10]. Furthermore, these data are unique and valuable because of their high quality, accuracy, and accessibility from anywhere and at any time [11][12][13][14][15]. Autonomous data collection, analysis, and visualization are critical to the organization's digital transformation [5][16][17][18]. In addition, IoT allows the collection of large amounts of data [19], displaying [20], and sharing [21], not only from the internal sources of the organization but also from external sources that feed the facility, such as suppliers and customers who are served after receiving the products or services owing to the interconnectivity of things [7][22][23]. The ability of IoT to transmit real-time information leads to more transparency [24], visibility [25], improved quality [26], and an appropriate level of intelligence [23][27][28].

2.2 Better Decision-Making

IoT allows organizations to make decisions, plan, and schedule activities based on real-time data-driven choices rather than consequential information processing [3][26][29][30][31][32][33][34][35]. By using data from IoT systems, decision-makers can gain new insights into the value proposition, increase value creation, enhance customer relationships [2], adopt more effective policies and practices [11], and mitigate uncertainty [36][37]. Accordingly, IoT reduces complexity [21], conflict [9], and the decision-making cycle through the availability of related information to all decision-makers [5][12][15]. Furthermore, IoT enables objects to make automated decisions by communicating information about themselves without human intervention and increasing self-awareness capability among different systems, enabling them to react quickly to events [7]

[8][21][27][38], such as sending purchase orders for raw materials when stocks are low [9]. These ideal decisions are generated automatically using a large amount of multi-source data and intelligent algorithms (e.g., machine-learning algorithms), which increases the automation level [39].

2.3 Operation Process Efficiency

IoT device interconnections improve operations and communications management [36], increase agility [10], and enhance performance by combining systems that run the business with controllers, sensors, and data storage to support business operations [35]. This connectivity helps to increase efficiency [40], performance [25], and optimization in the organization's day-to-day operations and assists in improving quality with high-end safety [1][41]. For example, Mercedes-Benz has improved the quality and increased auto production's operational efficiency and flexibility by integrating IoT technology in assembly lines and materials handling in their factories [42].

In addition, IoT sensors are used to perform remote monitoring [43] and automate workflows/processes without human intervention [44][45], thereby reducing human error [21][30][46]. Such a process can enhance autonomy and manage various interruptions [6]. Furthermore, wireless connectivity, low-cost sensors, and big data techniques may offer valuable data to examine the equipment's status and performance [2]. Historical and real-time data can be modeled, correlated, analyzed, and visualized to investigate the performance status of the equipment, allowing predictive maintenance and cost reduction [1][47], unplanned downtime [5][13], and unanticipated interruptions [48]. This process promotes early diagnostics and part replacement according to the prediction without compromising the company's profit because of extended shutdowns [37]. As a result, IoT can reduce overall operational costs by enhancing predictive maintenance [27], minimizing equipment failure [12], reducing waste [26], and improving energy efficiency [17][21].

2.4 Assets Management Efficiency

Effective resource utilization requires communication and information exchange between assets and the organization [1][6][41][43]. The connected sensors embedded in all equipment and tools allow the direct tracking of assets directly [14][28][30], whether localized or geographically distributed [37], as well as the acquisition of more precise information regarding the equipment's health [40], and improve the speed and accuracy of the equipment [5], through a set of algorithms for investigating the equipment's performance status over time [47]. Such a process provides visibility into asset status [40], allows remote diagnostics, easily locates issues [3], and improves asset utilization [49]. IoT data can also help companies track products condition "from the floor to store" and beyond [27], including the time spent in cargo and the time it took to fly off the shelf, and even the temperature at which it was stored [48]. Furthermore, IoT allows for more accessible information sharing for live inventory levels and captures internal and external movements to help manage stock [26][48]. This process leads to inventory and raw material reductions and better purchasing decisions [2].

2.5 Improved Safety and Security

IoT has enormous potential in high-risk EHS industries [10][23], where human lives are at risk from incidents, such as collisions with heavy objects, falls, and electrocutions [8]. IoT applications are prepared to offer safe, reliable, and practical solutions to improve safety conditions in the working environment [47] because of their capability to facilitate remote operation, enable collaboration between human workers and robots, and provide rich low-level data, such as high or low-level temperatures [6]. Additionally, IoT technology offers an innovative design for an autonomous system that localizes, monitors, and cautions site workers who work in danger zones [31], especially in remote and hostile locations, where the challenges and risks associated with these facilities are elevated [16]. The IoT also provides alerts for anomalies or any actions that threaten the organization, ensuring security and protection against physical dangers, such as like fire accidents in the working environment [12][49]. In addition, the IoT enables the preservation of workstations against physical threats and ensures equipment safety [1]. The unique capabilities of these systems allow the organization to maintain situational awareness, respond effectively to incidents and threats, and comply with occupational safety and health [16][41].

2.6 Improved Supply Chains and Transportation

IoT systems can enable unparalleled visibility along the supply chain by connecting supply chains with the organization and effectively tracking export and import activities [3][12][23][37]. With this feature, production activities can be scheduled and planned through the supplied data in response to demand and other market dynamics [38][50][51], bringing transparency to the processes [36], retrieving demand and supply [7][29], and feedback information in real-time for all concerned parties [39]. Concurrently, IoT technology can aid organizations in fleet management [27]. Sensor networks can monitor field personnel, field vehicles, mobile equipment, and product transportation systems (e.g., planes, ships, trucks, and trains) in real-time [16][27]. However, manually coordinating an entire fleet is challenging for one fleet management

operator [16]. Therefore, using IoT geo-positioning sensors' location data, automated fleet management can be implemented using data-driven systems to track equipment operator and driver performance, identify hassle-free delivery routes, assess field personnel, and assist facility managers and supervisors in optimizing fleet deployments [8][16]. Amazon is a good example of improving fleet management by applying IoT technology. By geo-positioning sensors, Amazon can track their vehicles along with the drivers assigned to them at any time. This feature allowed them to ensure safety compliance with the drivers, track the shipments locations vehicles' health, and enhance the overall visibility of the supply chains [52].

3. Conclusion

Despite the direct benefits provided by IoT, IoT offers variety of indirect benefits. These benefits differ from the direct benefits by needing some time to be observed. Indirect benefits are related to the development observed in organizational strategies and competitive and economic advantages [4][5], such as competitive advantage, business and network integration, sustainability, customer satisfaction, products and services innovation, and new revenue stream.

However, IoT technology is still in the development phase, and its applications are still growing across different industries, which indicates the potential for the emergence of more features and benefits in the future.

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