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IOT A MANAGERIAL TOOL FOR EFFECTIVE BUSINESS MANAGEMENT

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ABSTRACT
The Internet of Things (IoT) is a rapidly evolving technology that has the potential to transform various industries, including business management. The integration of IoT devices and sensors with business processes has the potential to enhance operational efficiency, improve customer experience, and enable data-driven decision making. Keywords: Internet of Things, Business Management, Supply Chain Management, Customer Relationship Management

INTRODUCTION
Internet of Things (IoT) has flourished over the last decade as a new wave of digital transformation, which enables real-time sensing, collecting and sharing data. The unique features of IoT like ubiquity have enabled the possibility of developing advanced applications across many domains. The momentum IoT has generated makes it an ideal frontier for driving technological innovation (Siow et al., 2018), garnering significant attention from both practitioners and scholars. IoT is perceived as a disruptive innovation given its potentiality to truly reshape our world (Manyika et al., 2013). Pervasive applications of IoT are dramatically transforming many aspects of societies and economies such as healthcare (Pang et al., 2015; Tuan et al., 2019), transportation (Davidsson et al., 2016), logistic (Hopkins & Hawking, 2018), manufacturing (Birkel et al., 2019; Hasselblatt et al., 2018), and tourism (Byun et al., 2017; Gretzel et al., 2015). It is estimated that the IoT market size will reach $1.2 Trillion worldwide by 2022 (IDC, 2018). However, IoT's extensive publicity and promising future do not guarantee its widespread success, since many concerns and potential issues of gaining actual value of IoT are not yet fully known (Nicolescu et al. 2018). IoT mass adoption and actualizing its values depend not only on technological advances but more on understanding its business and managerial needs and challenges. Porter and Heppelmann (2014) maintain that we need to identify the dynamics of IoT technologies from business and management perspective to survive and gain competitive advantage during the technological transformations.

The diffusion trend of IoT leads to a call for studies to advance our understanding of research on managerial and entrepreneurial opportunities of this disruptive innovation (Clarysse et al., 2019). Despite exponentially expanding opportunities arising from IoT and ever-growing attention it attracts among scholars, practitioners, and the general public, a critical literature review indicates the lack of systematic and rigorous study on the business and management perspective of this technology. Mostly, the extant literature has taken a narrow view to discuss specific aspects of IoT business and management such as generating value from IoT data (Hajiheydari et al., 2019), concentrating on IoT applications in servitization (Rymaszewska et al., 2017), or providing a descriptive business model for IoT (Dijkman et al., 2015). This gap highlights the need for an integrative study that considers the current body of knowledge to connect the disciplinary perspective and insight around IoT studies with business and management identity.

There are several grounds that signify examining IoT from the business and management lens is both timely and essential. First, the ever-increasing growth of investment, the predicted market size (IDC, 2018), and the continuous introduction of pervasive applications (Forbes, 2019) necessitate understanding of IoT business implications. Further, calls continue for the 'Managerial and Entrepreneurial Opportunities and Challenges of IoT', principally based on the role of this

disruptive technology in generating new venture opportunities, shifting the nature of competition, and eroding the traditional business models (Clarysse et al., 2019).
Finally, due to growing expansion of IoT applications and related publications, researchers suggest quantitatively examining the related literature (Lu et al., 2018), to explore the hidden thematic structure of IoT research (Yoon et al., 2018), and IoT issues associated with managerial and organizational areas and theories (Mishra et al., 2016).
Previous studies have mainly focused on 'general IoT research domain'. By applying either quantitative or qualitative methods, researchers attempted to examine the generic IoT knowledge field and objectively or subjectively analyse the literature. Co-word analysis (Kim & Kang, 2018; Yan et al., 2015), co-citation analysis (Ng et al., 2018), bibliometrics (Mishra et al., 2016), and scientometrics approaches (Erfanmanesh & Abrizah, 2018) are some of quantitative methods have been used to explore IoT research domain. On the other stream, qualitative and mainly literature review approaches have been followed to examine the IoT study domain (e.g., Atzori et al., 2010; Li et al., 2015; Siow et al., 2018; Lu et al., 2018). It thus appears that scholarly attempt with direct focus on uncovering the intellectual structure of IoT literature from the business and management perspective is largely disregarded. This study contributes to advancing the current discourse on IoT in particular considering business and management issues more holistically, by integrating, representing and synthesizing current knowledge through an innovative methodological approach.

Research Objectives

The main goal of this systematic and rigorous research is to map and link the knowledge landscape of IoT in business and management domains. To this aim, the present study seeks to: (i) extract the inductive topical framework to portray the IoT research field in business and management, and more specifically for the highly focal domain of 'business model'; (ii) analyse and explain the main business and management latent themes and sub-themes in the research field of IoT; and (iii) highlight the trend of business and management studies in the
IoT field to detect novelty and emergence. To address these objectives, we analysed the corpus of IoT research in the business and management disciplines applying an explanatory sequential mixed-method approach. This study thereby provides three key contributions. First, it drives and presents phenomenon-based constructs and grounded conceptual relationships in the IoT literature on business and management. Second, we explore and discuss the related latent subjects of these constructs and their relationships, with special attention to the business model theme. Finally, we provide theoretical contribution by proposing research agenda for future study avenues in this context, based on the identified thematic map.

Literature Review

Conceptual Review

The Internet of Things (IoT) is a rapidly evolving technology that connects physical objects to the internet, enabling them to collect and exchange data. The integration of IoT devices and sensors with business processes has the potential to enhance operational efficiency, improve customer experience, and enable data-driven decision making. The potential of IoT in business management has been widely recognized, and many companies have already started exploring the use of IoT in various areas of business operations. In today's business environment, companies face intense competitive pressure and rapidly changing market dynamics. The managers increasingly view the global sourcing model as a key to their efforts to operate cost effectively. Managers must evaluate certain factors, such as action orientation, output maximization, communication, self-disclosure, receptivity to feedback decision-making and perceptiveness analytics, in their business operations for organisation enhancement. The managers need skills to work often in less than satisfactory working conditions, focus on producing results, yet accommodate the needs of colleagues, friends,

and subordinates (Das, 1991). Action-oriented managers are confronting secular industry shifts, changing customer requirements and new technologies. All these changes compel managers to innovate by building new and different capabilities with emerging technologies to ensure that their businesses stay competitive.

Whereas managers, who fail in self-disclosure, lead to a loss of engagement and motivation of staff in the organisation. So, self-disclosure helps managers to generate trust and motivation among employees. The factors such as trust, shared values, and benevolence strengthens the relationship between the employer and employee which lead to success in the organisation (Ladyshewsky, 2009).

At the same time, Receptivity to feedback improves efficiencies and enhances effectiveness while also driving innovation which impacts employees' performance. The managers required a mix of skills for different levels in the organisation. At the lower level of management technical skill is most important; at the middle management level process skills (directing, coordinating, planning and controlling) are most essential; and at the senior level conceptual skill is most relevant (Nwachuku, 1989). The perceptiveness in managers can successfully leverage the benefits and address the challenges in using a global talent pool. The perceptive manager's steadily expanding business by analyzing emerging markets environment and staying at cutting edge by grabbing opportunities. The factors which represent the effectiveness of managers are continues to transform the way companies associate with their customers, engage with employees, and bring innovative products and services to market. The effective managers are more stable in their jobs, professionally qualified and satisfied with their careers (Joshi, 1995).

The global business world demands an understanding team who can lead to success in different paradigms.

The team works under the supervision of managers who require appropriate skills for organisation strategic development. So, an employer needs to have the most recommended managers with a robust team who are passionate about their work and strive to take their organisation to greater heights. The study is an attempt to conceptualize a research model on managerial effectiveness with intervening correlates which are observed and drawn out with the help of a review of the literature. The conceptual research model may also be helpful for practitioners, decision-makers and managers for widespread awareness regarding managerial resources.

Specifically, the finding will be used to explore and identify the most important correlates and their relationship with the managers.

An Overview of IOT in Business

The Internet of Things (IoT) is changing the game for businesses by connecting devices, processes, and people in unprecedented ways. It promises to boost efficiency, drive productivity, and make everyday operations smoother and more convenient. It promises to boost efficiency, drive productivity, and make everyday operations smoother and more convenient.

Operational Benefits of IoT in Business

Enhanced Operational Efficiency

Operational efficiency is one of the biggest reasons businesses are investing in IoT. With IoT, companies can gather real-time data to track performance and optimize processes. This ability to keep an eye on things as they happen means fewer inefficiencies, faster decisions, and smoother workflows.

- **Real-Time Data Collection**: IoT's real-time data collection allows businesses to monitor performance continuously, which means instant adjustments and fewer bottlenecks. This responsiveness ensures better resource allocation and minimizes waste.

- **Process Automation**: Automating routine tasks with IoT means less human intervention, which in turn reduces errors and cuts costs. Whether it's managing inventory or performing maintenance, IoT automation frees up human resources for more strategic work.

Improved Quality of Life

IoT isn't just about making business operations smoother—it also makes life easier for both employees and customers.

- **Enhanced Customer Experience**: IoT allows companies to offer highly personalized experiences. By analyzing real-time usage data, smart devices can adjust services or make recommendations that cater to individual preferences, delivering a better overall customer experience.
- **Remote Accessibility**: IoT devices can be monitored and managed from anywhere. This is particularly helpful in industries like healthcare or smart home tech, where remote control means better service and increased convenience for users.

Environmental Benefits

Many businesses are making sustainability a core focus, and IoT helps them get there by optimizing resource usage and cutting down on waste.

- **Resource Management**: IoT solutions can track and manage resource consumption, such as water, electricity, or raw materials. This helps companies be more efficient and cut costs while also reducing their environmental impact.
- **Reduced Operational Waste**: Sensors in IoT systems provide insights into inefficient processes, helping businesses eliminate waste and operate more sustainably, all while saving money.

Business Innovation and New Opportunities

IoT, as a catalyst for innovation, opens doors to new products, services, and completely fresh business models.

- **Data-Driven Decision-Making**: IoT devices generate a wealth of data, offering insights that drive strategic business decisions. By predicting trends and understanding customer needs, businesses can stay ahead of the curve and better serve their markets.
- **Competitive Edge**: Early IoT adopters can innovate faster and with greater impact. Access to extensive data and automation means businesses can create unique offerings that help them stand out from the competition.

Some Identified Disadvantages of IOT in Business

Security and Privacy Concerns

While IoT offers numerous advantages, its increased connectivity also brings significant risks, particularly concerning data security.

- **Cybersecurity Risks**: With each new connected device comes an additional entry point for hackers. Businesses need to ensure that their security measures are up to par to prevent unauthorized access and data breaches.
- **Data Privacy Issues**: IoT collects vast amounts of data, often including sensitive information. Mishandling this data can lead to privacy violations, regulatory fines, and a loss of consumer trust.

Interoperability and Complexity

The more devices you add, the more complicated the system becomes—especially when those devices come from different manufacturers.

- **Integration Challenges**: Many IoT solutions lack standardization, which makes integrating devices from multiple vendors a challenge. This can hinder the smooth functionality of a mixed IoT ecosystem.
- **Increased Management Costs**: Keeping all these devices compatible takes effort. Businesses need to invest in ongoing software updates, device maintenance, and specialized staff, which can increase overall costs.

Infrastructure and Reliability Challenges

IoT relies heavily on stable infrastructure to keep everything running smoothly—but that can also be a major limitation.

- **Network Dependency**: IoT devices need consistent network connectivity. If the internet connection is unstable, the performance of IoT devices may degrade, potentially interrupting business operations.
- **Reliability Concerns**: Many IoT solutions depend on reliable high-speed networks. Businesses in regions with poor internet infrastructure may find it challenging to adopt IoT fully.

Ethical and Social Implications

The widespread adoption of IoT brings up several ethical questions, particularly regarding privacy and constant monitoring.

- **Privacy Concerns**: IoT devices gather huge amounts of user data, which raises ethical questions about consent, transparency, and data usage. Addressing these concerns is crucial for maintaining user trust.
- **Surveillance and Monitoring**: IoT can enable near-constant monitoring, which can make people uncomfortable, particularly in public spaces. Balancing IoT's capabilities with respect for individual privacy is a growing concern, especially as smart cities become more common.

How Valuable Is IoT?

The Value of IoT Lies in Its Potential for Transformation

The true power of IoT lies in its ability to connect devices, collect real-time data, and automate processes. This seamless integration between the physical and digital worlds allows for more informed decision-making, streamlined operations, and enhanced customer experiences.

For businesses, the value of IoT is often directly linked to operational efficiency and improved productivity. Imagine a smart factory where machines autonomously report their maintenance requirements before problems arise, reducing costly downtimes. Or retail environments where IoT sensors monitor inventory levels in real-time, ensuring products are always available to meet customer demands. By providing a constant flow of actionable data, IoT helps businesses predict, adapt, and respond proactively—fundamentally changing how industries operate and boosting their competitiveness.

IoT also serves as a catalyst for innovation, creating new revenue streams and driving the development of fresh business models. Companies can now offer subscription-based services that adapt in real-time to customer behavior or implement predictive maintenance solutions that prevent issues before they occur. Early adopters of IoT are not only able to innovate more rapidly but also create unique value propositions that differentiate them from competitors. As the technology matures, we can expect to see entirely new business ecosystems emerge, driven by the power of connected devices.

Remember that the value of IoT is directly linked to how well these challenges are managed. Those who can successfully navigate the complexities will unlock the full potential of IoT, reaping the benefits of enhanced efficiency, innovation, and customer satisfaction.

A Conceptual Overview of Managerial Effectiveness

Managerial Effectiveness

Today companies are seeking effective managers to meet a dual mandate of achieving more efficient and effective operations. By including cost reductions, while developing technology-based innovation and business transformation in a comprehensive, integrated manner. Organisations are tending towards a new paradigm of management and the changes occurring in the younger generation of managers (Ravichandran and Nagabrahmam, 2000). Achieving objectives presents major challenges and requires companies to have highly skilled professionals trained in many diverse areas and new technologies combined with industry specific expertise. Moreover, companies are relying on managers to operate global delivery models and their subordinates help them to meet all the ever-changing objectives. The "more effective" and "less effective" managers differed in terms of the degree to which they displayed communication behaviour, participative behaviour, supportive behaviour, positive behaviour and responsive behaviour (Amsa, and Aithal, 1989).

Globalisation demand for highly effective and decision-making managers to provide the effective use of personnel from across the globe. So, an organisation can offer a variety of benefits, including deep industry expertise, innovative in industry-specific solutions, processes and technologies. All companies have large talent pools of highly qualified technical professionals for innovation and growth. However, evolving customer demands have led to the increasing acceptance and use of offshore resources for higher value-added services. These services include application design, development, testing and systems integration, technology and industry-specific consulting and infrastructure management leadership competencies associated with the innovator, director and mentor roles found to contribute most to managerial effectiveness, thus specific directions for managerial action have been derived (Trivellasa, and Reklitisb, 2014).

Correlates of Managerial Effectiveness

Action-oriented managers not only make and implement good business decisions but also get things done, whether on their own or through others. However, it is very critical to manage employees who are not highly self-motivated. So, managers must have a strong sense of immediacy, focus on the task at hand and seeing it through to fruition for less motivated employees.

For managers, self-disclosure can be a simple approach to communication that involves sharing information, history, present, emotions and thoughts. Self-disclosure helps managers to overcome the depersonalization barriers in employee communication. This simple approach can help managers to improve intimacy, face-to-face communication and group connection.

Theoretical Review

Definition of IoT

If IoT is to be defined, it can be seen in the view of Vermesan et al. who defined the Internet of Things as simply an interaction between the physical and digital worlds. The digital world interacts with the physical world using a plethora of sensors and actuators [Miao W., et al 2010].

IoT can also be defined as "An open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in face of situations and changes in the environment"[Ms.Neha Kamdar,2016].

Current research on Internet of Things (IoT) mainly focuses on how to enable general objects to see, hear, and smell the physical world for themselves, and make them connected to share the observations. In that sense, monitoring and decision making can be moved from the human side to the machine side.

So in general we can say IoT allows people and things to be connected Anytime, Anyplace, with anything and anyone using any network and any service.

The Edge Things

In the edge side the things could be sensors, actuators, devices and a significant thing called gateway. The important function of this gateway is to establish communications between things and cloud services and also manage the actions between the things. The term edge come from Edge Computing where data are processed at the periphery of the network, as close to the originating data as possible. The edge can be smart city, smart building, a manufacturing floor, energy grid, oil rig, wind farm, dairy farm, planes, trains or automobiles. The key element which makes the edge processing significant is to turn on the data processing and action taking the most close to real-time.

Field Protocols

As sensors, actuators and devices are present at the edge, they must communicate with each other and also with Smart Gateway. This type of communication are based on field protocols, the most popular protocols are:

Bluetooth: It is a significant protocol for IoT applications. It has been designed to offer significantly reduced power consumption.

Standard: Bluetooth 4.2 core specification,

Frequency: 2.4GHz (ISM), Range: 50-150m (Smart/BLE),

Data Rates: 1Mbps (Smart/BLE).

Zigbee: Similar to Bluetooth, it has a large installed base of operation, although perhaps traditionally more in industrial settings. ZigBee PRO and ZigBee Remote Control (RF4CE), among other available ZigBee profiles, are based on the IEEE802.15.4 protocol, which is an industry-standard wireless networking technology operating at 2.4GHz targeting applications that need comparatively unusual information exchanges at low data-rates over a restricted area and within a 100m range such as in a home or building.

Wi-fi: This type is often a distinct choice for many developers, especially given the ubiquitous of Wi-Fi within the home environment within LANs. It offers fast data transfer and the ability to handle high quantities of data.

NFC: Near Field Communication (NFC) is a technology that enables simple and safe two-way communication between electronic devices, and especially applicable for smartphones, allowing consumers to perform contactless payment transactions, access digital content and connect electronic devices. Essentially it extends the capability of contactless card technology and enables devices to share information at a distance that is less than 4cm.

IoT Smart Gateway

A main capability of IoT Gateway is enabling communication from the Edge to the Cloud. It means it must understand field protocols and convert it to cloud protocols. Smart Gateway has the capabilities such as routing, Dataflow, management of data, monitoring of data and storage of data.

Cloud Protocols

The most of IoT solutions, even those ones live almost entirely on the edge need to integrate with cloud services or other IoT solution based on cloud. We need to communicate using a cloud protocol as listed below:

MQTT: Message Queue Telemetry Transport (MQTT) was introduced by IBM in 1999 and standardized by OASIS in 2013. MQTT is frequently used and supported by embedded devices,

and is also common in machine-to-machine interactions. It is designed to provide embedded connectivity between applications and middle wares on one side and networks and communications on the other side.

AMQP: The Advanced Message Queuing Protocol (AMQP) is a protocol that was designed for financial industry. It runs over TCP and provides a publish/ subscribe architecture which is similar to that of MQTT. The difference is that the broker is divided into two main components: exchange and queues. The exchange is responsible for receiving publisher messages and distributing them to queues based on pre-defined roles and conditions. Queues basically represent the topics and subscribed by subscribers which will get the sensory data whenever they are available in the queue.

CoAP: The Constrained Application Protocol (CoAP) is another session layer protocol designed by IETF Constrained Resource Environment working group to provide lightweight RESTful (HTTP) interface. Representational State Transfer (REST) is the standard interface between HTTP client and servers. However, for lightweight applications such as IoT, REST could result in significant overhead and power consumption. CoAP is a document transfer protocol. CoAP is designed to enable low-power sensors to use RESTful services while meeting their power constraints. It is built over UDP, instead of TCP commonly used in HTTP and has a light mechanism to provide reliability. CoAP architecture is divided into two main sublayers: messaging and request/response. The messaging sublayer is responsible for reliability and duplication of messages while the request/response sublayer is responsible for communication. As in HTTP, CoAP uses GET, PUT, PUSH, DELETE messages requests to retrieve, create, update, and delete, respectively.
HTTP: HTTP is a "connectionless" protocol. With the HTTP bridge, devices do not maintain a connection to Cloud IoT Core.
Instead, they send requests and receive responses. This is the standard protocol for web services and still will be using in IoT solutions. The overhead of this protocol is well known but we will continue use of this protocol in some case when latency and bandwidth are not issues.

Advantages of IoT Applications
- ***Security:*** You can monitor your home using your mobile phones, with the ability to control it. It can provide personal safety.
- ***Stay connected:*** You and your family members can always be in the network. You can virtually stay connected.
- ***Efficient use of electricity and energy:*** If your home appliances are communicating with you about the work done, their maintenance and repair will be easy. If appliances can operate by themselves then electricity utilization will be possible by an efficient way.
- ***Best Health Care and Management:*** The patient monitoring is possible on a real time basis without doctor's visit and also enables them to make decisions as well as offer treatment when emergency is there.
- ***Cost- Effective Business Operations:*** A large number of business operations like shipping and location, security, asset tracking and inventory control, individual order tracking, customer management, personalized marketing & sales operations etc. can be done efficiently with a proper tracking system using IoT .

Disadvantages of IoT Applications
- ***Privacy issues:*** Hackers can break into the system and possibility of stealing the data.
- ***Becoming Indolent:*** People are more habituated to have a click based work making them lazy to any sort of physical activity, applied science in their daily routine.
- ***Unemployment:*** Lower level people like unskilled labour may have high risks of losing their jobs.

CONCLUSION

IoT has been gradually bringing a sea of technological changes in our daily lives, which in turn helps to making our life simpler and more comfortable, through various technologies and applications. There are countless applications of IoT into all the domains including medical, manufacturing, industrial, transportation, education, governance, mining, habitat etc. Uses of IoT in various applications are described in this paper. In present and in future also, IoT is on the way of making the human's life as a 'connected' and 'smart' one.

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