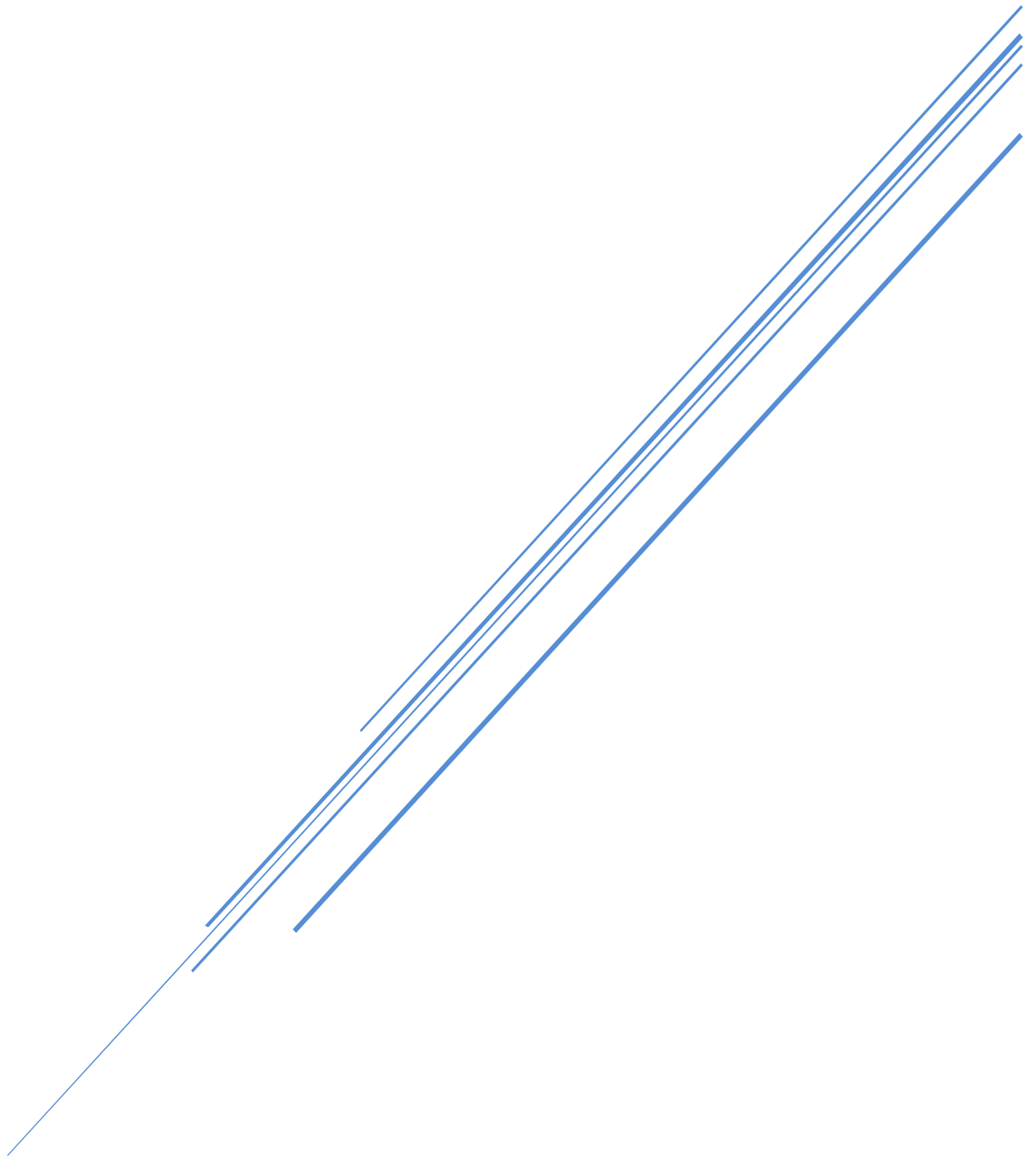


ADVANCED INDUSTRY 4.0

Assignment 1 - Written Report - 1,451 words



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Summary

There are several existing business models that can, and in some cases, already are benefitting from Industry 4.0. The likes of Ford, Siemens, IKEA and Meta are great examples of established businesses from different sectors that have adopted i4.0 technologies to improve their businesses. Companies such as Stitch Fix and games like Pokémon Go are examples of new ideas challenging an established market by utilising a i4.0 data and technology.

By embracing i4.0 businesses will generally be in good stead compared to companies that do not adopt future technologies, a trend already seen in sectors such as home video to streaming and camera technology.

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Introduction

This report will explore Industry 4.0 technologies and how they can be applied to new and/or existing business models in order to generate new or increased sources of revenue and productivity.

Body of Report

There are many key areas in which industry 4.0 is shaping businesses. This ranges from new businesses existing entirely thanks to 4.0 innovations and existing businesses being improved by adopting these new technologies. The report below will explore these key i4.0 innovations, list from (Immerman, 2020), and give examples for each of how they are re-shaping the industry.

Big Data & Analytics

Big data is the collection of large amounts of data which is typically processed and analysed by computers for the purpose of providing insights into trends and habits that can then be used by businesses and manufacturers to adapt their outputs accordingly. Large digital companies such as Alphabet, Amazon and Meta can use large data sets from their users to provide targeted content and advertising to users and generate revenue in this way (Susanto, et al., 2019).

Big data can also be used to analyse machine and tool use on a shop floor, based on previous data it can predict tool wear or machine breakdowns and pre-emptively plan what is known as “predictive maintenance” (Lee, et al., 2017).

Autonomous Robots

Autonomous Robots can work independently of operator input, they can perform frequent repetitive tasks with little downtime or maintenance. Examples in manufacturing can include; assembly, quality control, sorting, welding, forming and palletisation. The advancement and affordability of sensors has also led to autonomous Robots are now being used in the home, Roomba vacuums can automatically clean an area and self-dock whilst the owner is away (irobot, 2022), this opens up new avenues of revenue for companies.

As (Hansen, 2021) shows, Autonomous Robots can help in areas such as parcel sorting. The Hermes Midland Super Hub in Rugby England has seen a 45% increase in this processing capacity thanks to its implementation of an automated sorting system.

Simulation/Digital Twins

A digital twin is a technological simulation of a real object, this can include a 3D representation of physical structures, objects or operational systems. Digital twins enable users to see a product, process or assembly line in virtual space. From this they can optimise through put by simulating and timing production runs and processes. Ford develop digital twins of their cars to cover the different aspects of the production process from manufacturing through to customer experience (Palamir, 2022).

Digital twins can also be used in areas such as healthcare where procedures can be simulated or practiced virtually before being tried on a real patient (Digital News Asia, 2016).

Horizontal and Vertical Systems

Horizontal and vertical integration has been referred to as the “backbone of industry 4.0” (Schuldenfrei, 2019). The purpose of this is to integrate connectivity and visibility within an organisation by having machines and sensors sharing data and communicating with each other.

For example, if an OEM has multiple facilities then horizontal integration can communicate between sites to ensure that data such as output, delays or inventory can be shared seamlessly. As (mbtmag, 2019) explains its about “breaking down Silos”, vertical integration can be used interdepartmentally to remove silos within an organisation so that departments can work together and share data with greater transparency allowing the company to responds dynamically to new or existing projects and challenges.

Industrial IoT (IIoT)

The IIoT is the use of sensors in a process, machine or product to gather and interpret data in real-time and communicate them online. Siemens have integrated these online cloud-based systems to create smart factories (Taylor, 2022).

Manufacturing companies such as Airbus are already putting the IIoT to use, employees will use smart devices and communicate locally or with the main infrastructure which then sends information to robotic tools to complete a task (Taylor, 2022).

MAN Trucks use the IIoT to detect engine faults and other errors and pre-emptively warn customer to avoid costly and time consuming breakdowns (Taylor, 2022).

Cybersecurity Technology and Blockchain.

With digital systems taking an increased role in businesses through I4.0 advancements its important that these systems are adequately protected. Insufficient cybersecurity whilst using the cloud or IIoT can lead to hacking, theft, fraud, sabotage, ransomware and more.

This has created a new market in cybersecurity, which is designed to protect these systems from internal or external threats, this technology can include I4.0 developments such as blockchain or AI. *“Blockchain technology (BT) is a decentralized transaction and data management technology that provide security, anonymity, and data integrity”* (Hasanova, et al., 2018).

The Cloud

The Cloud refers often refers to a large number of interconnected machines and systems through the internet, it is described by (Agrawal, et al., 2012) as *“a successful paradigm of service-oriented computing and has revolutionized the way computing infrastructure is used”*. The cloud can be used for streaming software and also used for data storage via the internet rather than using an on-site machine/device.

The Cloud allows companies to ‘offshore’ expensive physical computers and servers and use online systems instead for a relatively small fee. The Cloud can be used for storing data or computing complex models. Amazons Web Services (AWS) being an example of a large and

relatively new business that uses this model by providing its services to large companies and corporations.

The Cloud can also be used at home, new services such as Hive and EERO allow homeowners to control their heating and internet services remotely via mobile apps, pushing households closer to 'smart homes' (Edenius, 2007).

Additive Manufacturing

Additive Manufacturing refers to the process where items are created by layering and bonding material, therefore material is added rather than subtracted, as per traditional methods.

3D printing is often the most common form of additive manufacturing, it can be used in a wide variety of sectors and can rapidly produce sampled without the need for new moulds or tooling. As show by (van de Werken, et al., 2019) additively manufactured carbon fibre reinforced composites can now be made, their speed of manufacture and physical properties lead them to being used in motorsports such as Formula 1.

Artificial Intelligence (AI) and Machine Learning

AI and Machine Learning are 'smart' machines and computers that can processes data via algorithms and come to conclusions that were not inputted or programmed into them by humans. "These machines learn from data in order to generate increasingly accurate predictions" (Immerman, 2020). From a manufacturing standpoint AI can be used to for predictive maintenance of forecasting demand.

In terms of digital media, AI can be used to tailor adverts to users of platforms such as Meta or Alphabet based on search history and other data points (Marketing AI Institute, 2022). New companies such as Stich Fix us algorithms and AI to suggest clothes unique to that user based on their preferences and past feedback (algorithms-tour, 2022).

Augmented Reality (AR)

AR uses technology such as smart phones or digital glasses to overlay additional visual and sensory input over a real-world environment (The Franklin Institute, 2022).

For manufacturing AR can be used for training purposes by allowing workers to run through a production process virtually before doing it in reality. This can be particularly useful for training in potentially hazardous environments (Sahu, et al., 2021). It can also be used to allow engineers to visualise a product in prototype phases before tooling.

AR can be used in new businesses or services such as the 'Meta Verse' or Pokémon Go and its also being used by established companies such as IKEA, allowing customers to view furniture in their own homes before purchasing (The Franklin Institute, 2022).

Conclusions and Recommendations

The possibilities for Industry 4.0 are vast and it can improve efficiency and productivity in all sectors. As more businesses implement i4.0 the possibilities thanks to data collection and analysis will further expand and create new markets and opportunities that are as yet unknown.

In Manufacturing increased data collection combined with AI and automated robots can allow for automated maintenance scheduling. Further integration between horizontal and vertical systems can lead to new insights and allow companies to further improve their products and processes whilst removing 'hidden factories'.

Along with productivity gains, i4.0 can open up pathways for new business models. Social media and fashion companies now rely on Big data and AI to better market their products or tailor content for their users and customers.

Established businesses may soon lose out to ambitious and innovative competitors if they fail to embrace technological trends. Such examples in the past have been Kodak film being replaced by the digital camera (Harbott, 2012) and Blockbuster being usurped by online streaming services such as Netflix, which they could have bought had they anticipated changing business models (Zelten, 2022).

Therefore, it is imperative for businesses to adapt in the ever-changing market to survive, business models that are more agile will be able to more readably adapt to shifting technological trends.

References

- Agrawal, D., Das, S. & Abbadi, A. E., 2012. *Data Management in the Cloud: Challenges and Opportunities*. 1st ed. s.l.:Morgan & Claypool.
- algorithms-tour, 2022. *algorithms-tour*. [Online]
Available at: <https://algorithms-tour.stitchfix.com/>
[Accessed 2 September 2022].
- Digital News Asia, 2016. *Digital News Asia*. [Online]
Available at: <https://www.digitalnewsasia.com/digital-economy/healthcare-innovation-could-lead-your-digital-twin>
[Accessed 23 August 2022].
- Edenius, M., 2007. HOW TO BRING 'SMARTNESS' INTO A 'SMART HOME' SYSTEM. In: K. U. Greger Sandström, ed. *Smart Homes & User Values*. Gateshead: Open House International Association, pp. 165-177.
- Hansen, B., 2021. *knowledge.beumergroup*. [Online]
Available at: <https://knowledge.beumergroup.com/cep/automated-parcel-sorting-introduction>
[Accessed 27 August 2022].
- Harbott, A., 2012. *Harbott*. [Online]
Available at: <https://www.harbott.com/kodak-and-the-digital-revolution-a-business-model-failure/>
[Accessed 3 September 2022].
- Hasanova, H. et al., 2018. A survey on blockchain cybersecurity vulnerabilities and. *International journal of network management*, 29(2), pp. 1-36.
- Immerman, G., 2020. *Machine Metrics*. [Online]
Available at: <https://www.machinemetrics.com/blog/industry-4-0-technologies>
[Accessed 12 August 2022].
- irobot, 2022. *irobot*. [Online]
Available at: https://www.irobot.co.uk/en_GB/why-irobot.html
[Accessed 1 September 2022].
- Lee, C. K. M., Cao, Y. & Ng, K. K. H., 2017. Big Data Analytics for Predictive Maintenance Strategies. In: *Supply Chain Management in the Big Data Era*. Hong Kong: IGI Global, pp. 50-74.
- Marketing AI Institute, 2022. *Marketing AI Institute*. [Online]
Available at: <https://www.marketingaiinstitute.com/blog/how-facebook-uses-artificial-intelligence-and-what-it-means-for-marketers>
[Accessed 1 September 2022].
- mbtmag, 2019. *mbtmag*. [Online]
Available at: <https://www.mbtmag.com/business-intelligence/article/13251083/horizontal-and-vertical-integration-in-industry-40>
[Accessed 1 September 2022].

Palamir, 2022. *Palamir*. [Online]

Available at: <https://www.palamir.com/news/5-real-world-examples-of-digital-twins>

[Accessed 1 September 2022].

Sahu, C. K., Young, C. & Rai, R., 2021. Artificial intelligence (AI) in augmented reality (AR)-assisted manufacturing applications: a review. *INTERNATIONAL JOURNAL OF PRODUCTION RESEARCH*, 59(16).

Schuldenfrei, M., 2019. *Manufacturing Buisness Technology*. [Online]

Available at: <https://www.mbtmag.com/business-intelligence/article/13251083/horizontal-and-vertical-integration-in-industry-40>

[Accessed 19 August 2022].

Susanto, H., Leu, F.-Y. & Kang Chen, C., 2019. *The Emerging Technology of Big Data : Its Impact As a Tool for ICT Development*. 1st ed. Toronto: Apple Academic Press.

Taylor, K., 2022. *HiTechNectar*. [Online]

Available at: <https://www.hitechnectar.com/blogs/examples-industrial-internet-of-things/>

[Accessed 28 August 2022].

The Franklin Institute, 2022. *The Franklin Institute*. [Online]

Available at: <https://www.fi.edu/what-is-augmented-reality>

[Accessed 3rd September 2022].

van de Werken, N. et al., 2019. Additively manufactured carbon fiber-reinforced composites: State of the art and perspective. *Additive Manufacturing*, Volume 31, pp. 1-19.

Zelten, M., 2022. *Inc*. [Online]

Available at: <https://www.inc.com/minda-zetlin/netflix-blockbuster-meeting-marc-randolph-reed-hastings-john-antioco.html>

[Accessed 15 August 2022].