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## SMART MACHINE AND DIGITALIZATION: REDEFINING UNIVERSITY EDUCATION IN NIGERIA FOR GREATER PRODUCTIVITY

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### ABSTRACT

The fourth industrial revolution has prompted various educational strategies and methods that enriched university education and pedagogical content. The upturn of smart machines, a cognitive computing technology that performs functions that were hitherto reserved for humans has penetrated university education with a vista of benefits and challenges. To this effect, the paper discussed smart machines and digitalization, redefining university education for greater productivity. The main objective of the study is to explore how smart machines and the digitalization of university education will boost productivity in teaching and learning. It further discussed the nexus between smart machines and the digitalization of university education for greater productivity. The challenges inhibiting university education in the attainment of greater productivity include inadequate digital facilities, inadequate professionals to develop and integrate digital technology, and the digital divide between teachers and students. The paper asserted that the acquisition of smart machines may not be the silver bullet that will boost the productivity of teaching and learning but the use and exploration of digital tools. The paper suggested among others that there is a need for the establishment of a directorate of digital technologies with the responsibility of providing technical support to teachers and training of teachers on the use of modern digital tools.

**Keywords:** Smart Machines, Digitalization, Educational Institutions, University Education, Productivity.

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## INTRODUCTION

The fourth industrial revolution has prompted the development of smart technology, changes in organizational behaviour, and how humans relate with one another and the entire ecosystem. The educational system is not exempted; the surge of the fourth industrial revolution has introduced various methods, strategies, and platforms where education reaches the vulnerable and the underserved in society. It is against this backdrop that nations adopt various strategies to provide not only inclusive education but education that will be globally relevant and competitive. The national policy on education acknowledged that education is an instrument for economic, social, and political development; an aggregate tool for economic empowerment for the poor and the socially marginalized group; an effective means of developing the full capacities and potentials of human resources, as well as the development of the competent workforce through the acquisition of practical life skills relevant to the world of work as a veritable means of developing sound intelligent learning societies, fit and relevant to the 21<sup>st</sup> century (FRN, 2014).

The fourth industrial revolution introduced various artificial intelligence, robotics, and digital technology. Artificial intelligence is the use of computers and machines to do tasks that are hitherto reserved for humans. The upsurge of artificial intelligence has changed the entire educational system and provided various platforms that aid effective teaching and learning. The integration of digital technology has prompted the digitalization of the educational system by providing the necessary tools and restructuring the entire educational landscape for better productivity and effective utilization of educational resources. The adoption and diffusion of digital technology in educational institutions have provided a plethora of opportunities and benefits that if well utilized will enhance greater productivity and attainment of educational goals.

The federal government of Nigeria being mindful of the importance of digitalization has made concerted efforts in recent years to diversify the economy by investing in digital technology. The Nigerian economy has increased digitalization through the use of mobile networks. It is pertinent to note that in 2019 Federal Government of Nigeria launched the National Digital Economy Policy and Strategy intending to reposition the Nigerian economy by diversifying the economy and expanding of digital economy and ICT sector.

Despite the efforts of the federal government in the launching of digital economy policy and strategy, the main source of the Nigerian economy is based on oil and gas. The educational institutions are using archaic methods of teaching and learning namely the use of chalkboards, constant interface with students, and non-integration of digital content in the pedagogy. These disinvested students on the benefits of digital tools in teaching and learning. It is enlightening to observe that the advanced economy has integrated smart machines and digital technology into pedagogical content and the benefits are massive in every facet of educational endeavor. It has made education accessible to the underserved in society and moved education from personal learning to personalize learning, thus allowing learners to learn at their own pace and convenience.

The advantages of the diffusion of technology are enormous and federal government policy and strategy appears not to be yielding the desired results. This prompted various unanswered questions. Why are the educational institutions adopting the traditional system of teaching and learning? Is it because of instructional facilities or required manpower? Is it connected with the policies on digital technology? Is it because of the non-availability of digital technology or the unsustainability of digital technology? These and others have made the

researchers to explore smart machines and digitalization: redefining university education in Nigeria for greater productivity.

The purpose of the study is to explore the use of smart machines and the digitalization of university education to enhance greater productivity in teaching, learning, and community service. To achieve this, the researchers adopted a philosophical method of analysis. A philosophical method is a rational study of reality, knowledge, and values. (Wikipedia). In this context, it is to examine how the use of smart machines and digitalization can optimize the attainment of educational goals and in the process contribute to the literature on digitalization in education. Philosophical research is a systematic attempt to study the relationship and consistency of ideas and knowledge to help provide plausible solutions to societal problems (Zukauskas et al., 2018).

The study hinges on the Technology Acceptance Model (TAM). The TAM was introduced by Davis in 1989 and later improved by Davis, Bagozzi, and Warhead in 1992. The TAM aimed to explain the theoretical rationale for the successful adoption of technology in any organization. The use of technology in any system is dependent on two constructs according to the theory. They are perceived usefulness (PU), perceived ease of use (PEOU), attitude, and behavioural intention to use (Ma & Liu, 2005). The theory postulated that the propensity to use any technology is determined by the benefits the individuals derive from using the technology and the cost or efforts of using the technology. The theory is apt to the study because the use of smart machines in any educational institution will be determined by individuals who perceive that the use of technology will not only be useful but effortlessly.

To this end, the ultimate aims of the study are to explore the relationships between smart machines, and digitalization and how the integration will enhance greater productivity in teaching and learning in university education. The scope of the study is the diffusion of smart machines and the digitalization of university education in Nigeria. The paper will contribute to the repository of knowledge on the use of digital technology for teachers, students, administrators, and managers of university education in Nigeria.

### **Concept of Smart Machine**

The upturn of digital technology in the fourth industrial revolution has led to various platforms for teaching and learning. It has prompted various smart machines that have influenced every facet of human enterprises. The use of smart machines is not new or peculiar to the fourth industrial revolution. Pratt and Sales (n.d) writing on smart machines averred that smart machines can be traced to the first industrial revolution when “rudimentary machines automated tasks completed by humans in the 18<sup>th</sup> century”. The advent of computers, smart machines, the Internet of Things, and data led to modern smart machines that have revolutionized the educational landscape and entire human endeavours.

Smart machines are “cognitive computing technologies” that are capable of making decisions without human input. Pratt & Sales (2023) opined that they are devices embedded with machine-to-machine and/or cognitive computing technologies such as artificial intelligence (AI), machine learning (ML), or deep learning, all of which it used to reason, and solve problems, make decisions and even take action. They teach themselves how to do things. Smart machines include robots, self-driving cars, and other cognitive computing systems designed to work through tasks without human intervention. Sabry (2021) argued that four components make machines smart, these components include:

- Intelligent – the ability to function independently;
- Secure – ability to prevent and correct errors in processing;
- Manage- ability to manage and predict events in the future;
- Connect- ability to interact with other devices and systems.

Smart machines are built on existing technologies such as cloud computing, robotics, and the Internet of Things (IoT). However, Smart machines are digital disruptors because of the positive and negative impact they have and will continue to have on society. In business, the competitive advantages these technologies provide are expected to bring higher profit margins and lead to more efficient manufacturing processes. However, smart machines are also expected to displace workers as well as dramatically change the nature of work and other societal norms (Pratt & Sales, 2023).

For this paper, smart machines in education consist of all digital technologies that perform functions hitherto performed by human intelligence that enriched pedagogical content and the attainment of educational goals. It consists of artificial intelligence, robotics, machine learning, and other devices that are used in enhancing teaching, learning, and research without human intelligence. A smart machine is the integration of humanlike abilities into computers to reason, make decisions, and solve societal problems (Pratt & Sales, n.d).

Martiner-Comesana et al. (2020) opined that artificial intelligence is the ability of machines to solve problems and perform other functions that require human intelligence. Robotics is a unit of artificial intelligence that is responsible for the creation of intelligent and effective robots. It is enlightening to note that artificial intelligence operates in computer-simulated environments while robots operate in physical environments.

The adoption of smart machines in educational institutions has exposed the managers of tertiary education to consider the human and non-human actors in the management of education. Those smart machines are called digital disruptors because of negative connotations bearing on ethical considerations and the notion that workers will be redundant. According to Hess (2018), smart machines are capable of taking over many of the tasks that humans have needed to perform on farms and in factories, offices, homes, schools, hospitals, businesses, and the military. Smart machines will impact public and private organizations including education. In most cases, the organization of the future will likely be staffed by some combination of smart robots, smart machines, and human beings, with humans doing those tasks that technology can't do well. Examples of smart machines are artificial intelligence, and robotics among others.

### **Benefits of Smart Machines to Education**

It is pertinent to state that the benefits of smart machines are enormous because the diffusion of these technologies into educational institutions has affected education in the following ways (Walden University, 2023):

- Creates a more engaged environment: smart machines encourage active participation in the classroom. Using devices like a computer, tablet, or other type of technology in your classroom can help turn traditionally dull subjects into interactive and fun activities.
- Incorporates different Learning Styles: each child in the classroom is different, and it can be challenging to adjust your learning plan to fit every student. Fortunately, technology in education can help you modify your lessons. For example, Ryan Greene, an MS in

Instructional Design and Technology graduate, chose online learning to earn his degree at Walden, and now applies his knowledge on integrating technology to help improve his classroom. “Kids who might want to draw during the entire class can now create an infographic to demonstrate their capabilities and understanding of the content, which I might not have previously seen or assessed,” Greene said his instructional design degree helped him elevate his approach in the classroom, giving students a more tailored experience that can benefit them in the future.

- Improves collaboration: teachers have observed an increased frequency of students helping each other when they’re using technology in the classroom. Many technology-based tasks involve other aspects, and this leads to situations where students need to seek help from their peers or the teacher. Additionally, when students are assigned to small groups, the students who are more technologically advanced can assist their inexperienced peers.
- Prepares children for the future: according to a CompTIA (2015) study, nine out of 10 students indicated that using technology in the classroom would help prepare them for the digital future. By teaching students skills like PowerPoint, you can help set your students up for success. Introducing instructional technology in the classroom at a young age can help prepare students for future digital demands.
- Connects the teacher with his students: technology can help teachers form a better relationship with their students and their colleagues. For example, 84% of teachers report using the internet at least weekly to find content that will engage students. Integrating technology into your lesson plans as well as using it to expand your knowledge of subject matter can make a significant difference in the classroom.

The benefits of smart machines to the educational system cannot be overemphasized; it is incumbent on the managers of tertiary education to not only procure the basic digital technology but also to restructure the educational landscape for greater productivity. This brings to the fore digitalization and digitizing (Martiner-Comesane et al., 2020; Bail, 2024)

## **Digitalization**

The simulation of human intelligence to machines has prompted the restructure of the pedagogical content, social interaction, and academic behaviour of human and non-human actors in educational institutions. This led to the introduction of computer-aided education where computers and machines are used to enhance teaching, learning, and research. To achieve educational goals and remain relevant and competitive there is a need to restructure the existing traditional models of learning to accommodate the knowledge-driven epoch or procure the necessary smart machines for greater productivity. This brings to the fore the concepts of digitalization and digitization. Digitization of converting traditional resources to digital forms, is a technical process of converting the analogue to a digital format for effective teaching and learning.

Digitalization also known as digital transformation, technology-enhanced learning, or e-learning defined as the use of digital resources and innovative practices in the process of teaching and learning (Arisoy, 2022; Suleiman & Danmuchikwali, 2020). In the same vein, Ogunode and Ndayebom (2023), averred that digitalization is the integration of modern tools in teaching and learning to not only enhance the attainment of educational goals but to create room

for remote learning. Digitalization in higher education is the development of technology, advanced strategies, and new methods for effective pursuit and practice of educational mission (Alenezi, 2021; Akinyemi et al. 2022; Scholar & Daniel, 2014).

The upsurge of digital education is enhanced due to the proliferation of computers. It is interesting to note that COVID-19 accelerated the diffusion of technology in education where alternative learning and remote learning arrangements were designed (ILO, 2021). The sudden eruption of COVID-19 led to the closure of educational institutions especially in the less-advanced economy while the developed economy quickly adapted to the use of digital technology in teaching and learning.

Post-COVID-19 has witnessed the massive proliferation of platforms and methods to make education accessible and affordable. Suleiman et al. (2020) enumerated three related items in the use of digital technology and they are teaching without physical contact, immersive practice, and contact on-site. These highlight the benefits of digitalization of educational institutions. With digital technology, the learners will learn at their own pace and involvement. It will expand the reach of education to the vulnerable and those in war-torn areas. Digital technology will help to achieve Sustainable Development Goal No. 4- ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. With the upturn of smart machines and the procurement of digital tools education can be made affordable and accessible.

The digital transformation has led to various strategies and methods in the generation, dissemination, and preservation of knowledge. The proliferation of digital technology is of immense benefit to educational institutions. Haleem et al. (2022) averred that the use of cutting-edge digital technology not only fascinates and entertains students but also enhances the dynamic and engaging learning process. It also fosters the development of 21st-century skills like communication, critical thinking, and collaboration among others. All these skills, methods, and strategies adopted into educational institutions do not only achieve greater productivity in the process of teaching and learning but also provide skills for lifelong learning.

## **Educational Institutions**

Education globally is acknowledged as a veritable instrument for social change and the emancipation of man from the shackles of poverty and liberation of the mind. From immemorial effort has been channeled towards building an inclusive education that will be globally relevant and competitive. To achieve this, the nation mobilizes resources to build educational institutions that will help to build national development, social change, and development of society. Educational institutions are acknowledged as knowledge factories where individuals are enriched with ideas, information, and experiences that help to build individuals and society (Wordu, 2023).

Nigerian educational institution is divided into basic education, post-basic education, and tertiary education. Each of these levels of educational institutions has definite functions and roles to play in the development of individuals and society. The climax of them all is the university education which is at the apex of educational pursuit. Educational institutions provide the podium and the structure that will enhance the actualization of educational goals. It is pertinent to mention that the teachers and learners are very fundamental in the attainment of educational goals but emphasis must be placed on the provision of a serene environment with the basic human and non-human resources that will aid greater attainment of educational goals.

Educational institutions are saddled with the responsibility of providing the needed instructional content that will enhance greater productivity in the attainment of educational goals. So, for the betterment of individuals and society, and greater productivity in the attainment of a robust educational system, educational institutions should be well-positioned with the basic digital infrastructure that will make them relevant and visible in the academic world.

## **University Education**

University education is the third and highest ladder for the attainment of an educational career. It is a very high-level, knowledge factory where raw materials of humanity are honed, trained, and redefined for the betterment of individuals and society (Emeka, 2018; Nwachukwu & Okoli, 2015). University education is saddled with the responsibility of providing the needed manpower and skills that enhance societal development. Enag (2022) opined that the responsibilities of tertiary institutions go beyond the traditional role of preserving heritage, identity, and education.

In a knowledge-driven economy, the responsibility of tertiary education is further stretched to include the development of information society and the development of the digital economy (Kholiavko et al., 2020). This is achieved through the unlearning and relearning of educational activities. More so, through empirical research and innovation, university education can provide landmark technological breakthroughs that will solve societal problems and the development of society. University education is the hub of knowledge, new information/ideas, preservation, and dissemination of knowledge for greater attainment of educational goals, and with digital diffusion of technology into the university education greater productivity/goals attainment will be achieved.

## **Productivity**

The increase in the rate of unemployment and moral decadence of university graduates in Nigeria has called into question the viability of tertiary education in Nigeria. This has raised the question of the efficiency and effectiveness of educational institutions. This brings to the fore the concept of productivity in the educational system. Productivity in education is a measure of the quality of inputs to the educational process, the quality of the process, and the quality of the outputs from the process (Adieme & Sergent-Awuse, 2016).

In an information-based economy, key factors crucial to the effectiveness of educational institutions include the presence of digital technology. By leveraging digital tools, students can engage more actively in their learning, facilitating personalized learning experiences tailored to their individualized pace and preferences. Additionally, the incorporation of digital tools can play a pivotal role in extending educational opportunities to marginalized population in society and in the process boost productivity in education. Others are the teacher competency and the willingness to use technology for teaching and learning, the pedagogical content and the ethos of the institutions contribute to the productivity of educational institutions.

## **Nexus between Smart Machine, Digitalization and Productivity in University Education**

Globally, knowledge and information are acknowledged as essential tools that enhance productivity in the academic environment and the business circle. It is against this background that the administrators of tertiary education are acquiring new technologies and developing new

competency models that will strengthen the process of teaching and learning. Smart machines like artificial intelligence and the digitalization of pedagogical content have helped in the upsurge in digital skills and innovations that enhance professional knowledge and development and the ability to encourage lifelong learning (Rosak-Szyrocka et al., 2023). The adoption of smart machines into educational space has enhanced information and knowledge in higher education and in the process significantly increased their productivity.

The use of smart machines and digitalization has increased the proliferation of information models, and digital tools by educational institutions which are used in gathering information, organizing, and disseminating knowledge to attain educational goals Cabalerio-Cervine and Vera (2020), emphasized that digital technology makes information content easier to find, access, and manage. It also encourages electronic learning making education accessible and affordable even in crisis-prone areas. With digitalization, learning becomes student-centered more of an activity, and less passive. The dissemination of digital tools in university education has helped the latter in the attainment of educational goals of teaching, research, and community development.

Smart machines and digitalization have engendered 21st-century digital tools in tertiary education to enhance collaborative learning, personalized learning, media literacy, communication skills, and critical analytical skills to boost greater productivity in teaching and learning. A study carried out by Mahini (2012), opined that the use of digital technology by students helps in the collection and analysis of data, testing of hypotheses, design of experiments, and conclusion in real-time without constraint of time and space. The author further states that the digitalization of the classroom encourages students to seek information and knowledge outside the classroom which will boost their scores and build confidence, self-motivation, independence and broaden their learning environment.

It becomes enlightening to state that the infusion of technology in the pedagogical content will create positive contextual training space for the student in the attainment of education objectives. Giacomo et al. (2017), averred that digital technology has a great impact on students learning, scholastic success, and intellectual performance. The author further asserts that high digital skills are related to the improvement in academic performance, quality of learning, and cognitive development of the learner. Other benefits of digitalization and the use of smart machines are easy to access to learning materials, personalized learning, reaching the vulnerable in society, and the use of digital tools in the research and analysis of data at a fast rate and effectively. Therefore, there is no gainsaying that the use of smart machines and digitalization of the academic environment is a panacea for greater productivity of academic outcomes.

### **Challenges of Using Smart Machines and Digitalization for Greater Productivity**

The use of smart machines and the digitalization of the education system provide a landscape of opportunities as well as some challenges. There is no denying that the introduction and adoption of technology in tertiary education have enhanced communication of knowledge, knowledge processing, easy access to information, interactive teaching environment, individualized learning, easy access to online learning, collaboration or teamwork, critical thinking and digital skills, among others that encourage global competitiveness. Interestingly, these benefits are not without challenges and some of the challenges inhibiting the use of smart machines and digitalization for greater productivity are:



### **Inadequate Digital Facilities**

One of the greatest undoing in the attainment of greater productivity with the use of digital tools is the exponential increase in the upsurge of smart machines without a corresponding increase in the usage of digital tools in teaching and learning. According to Oblinger (2018), changes brought about by the surge in artificial intelligence and robots are taking place faster than in the educational system. Unarguable, the fluidity of smart machines has made it difficult for public universities to procure enough digital technology to enhance their teaching and learning productivity. Inadequate digital tools are undermining the attainment of greater productivity in service delivery thus inhibiting the achievement of educational goals. The shortage of digital facilities in higher educational institutions is one of the bane against the integration of digital tools and effective use in teaching, learning, and research (Wordu, 2020; Ogunode & Ndayebom, 2023). There is no gain in saying that the attainment of education goals and contribution to global relevance need the application of digital tools in teaching, learning, and research. It becomes incumbent on the managers of educational institutions to ensure that technology is an integral part of school administration.

### **Paucity of Funds**

Education all over the world is acknowledged as capital intensive and cannot be financed by the government alone therefore there is clamor for private participation in the funding of education, especially tertiary education. It is imperative to state that different authors have attested that the biggest challenge ravaging tertiary education is inadequate funds. Some of which include Nnokam (2021) and Mogboh (2022) who opined that the challenges facing tertiary education in Nigeria are traceable to inadequate funding. Inadequate funding has a ripple effect on other facets of school administration. Some of them are inadequate digital tools, brain drain and lack of institutional capacity among others. Unfortunately, the annual budget allocation to education is abysmally poor which has left the managers of university education restraint in hand to the visitor of the institution.

### **High Cost of Smart Technology**

The upsurge of smart technology and the expense of digital tools have made it difficult for every lecturer and student to have and use digital technology for teaching and learning. Internet which is the brain box in the interconnectivity of computers is very expensive, and computers are out of the reach of students. Also, the financial burden of reconstruction of the physical facilities to accommodate the use of artificial intelligence is a challenge for greater productivity of educational institutions in Nigeria. Wordu (2020) opined that the educational environment in Nigeria is besieged with infrastructure decay as a result of long neglect and lack of maintenance culture.

### **Lack of Expertise**

The ability to use technology is dependent on the availability of technology and the technological know-how. The educational institutions lack the digital professionals that can help to integrate digital tools into pedagogical content and more worrisome is the fact the available ones are

leaving the teaching profession to oil and gas while others are going for a greener pasture outside the country (PanjiO'gli, 2023). The diffusion of smart machines needs digital literacy and this is achieved through professional training and upskilling by lecturers. Unfortunately, these skilled professionals are in short supply in tertiary education in Nigeria (Titus, 2018).

Other challenges as stated by Gkrimpizit et al. (2023) are:

- Access and quality: It is imperative to note that there is a digital divide between the have and the have-not. Those who have enjoyed the benefits of digital transformation while those who do not have are not exposed to digital skills that influence their productivity;
- Resistance to change. Tertiary education is a legal entity with structural procedures, and a culture with an ethos for achieving set goals. Some lecturers for fear of uncertainty and unwillingness to leave their comfort zones impede the use of digital technologies and thereby undermining the productivity of educational goals;
- Lack of IT infrastructure namely Wi-Fi, poor internet access, and slow connectivity
- Non-readiness of educational institutions to adapt and implement digital technologies. To achieve greater productivity in tertiary education there is a need to integrate digital tools in the training of teachers and adoption of technology in pedagogical content;
- Inadequate IT support services for the students as well as for teachers; and
- Lack of leadership change,

It becomes enlightening to note that for greater productivity in the attainment of educational goals, the leaders of tertiary education as a matter of importance should map out strategies to address the challenges hitherto mentioned.

## **CONCLUSION**

The upsurge of the fourth industrial revolution has brought a paradigm shift in educational institutions and changed how students and teachers relate, how information and learning materials are sorted, and the entire process of educational administration and management. The integration of smart machines and digitalization of the educational system has changed the pedagogical content and enriched the educational system by providing education and making it available and accessible to the vulnerable and underserved in society. Smart machines are cognitive computing technologies that apply intelligence that is hitherto preserved for humans. It is machines that perform human intelligence and administrative tasks that enrich the pedagogical content.

The adoption of smart machines and the digitalization of educational institutions have led to various strategies and methods in information generation, analysis, dissemination, and preservation of knowledge for greater productivity and attainment of educational goals. The benefits of the use of smart machines and digitalization in educational institutions are enormous because they expose the students and teachers to the use of modern digital tools and skills like communication skills, problem-solving skills, and collaboration/teamwork among others. It is pertinent to note that the digitalization of educational institutions is not exempted from challenges and some of the challenges are paucity of funds, inadequate digital facilities, and inadequate professional experts in the use of technology among others. The paper conclusively states that the acquisition of smart machines may not be the silver bullet that will lead to greater

productivity in educational institutions but the exploration and the use of the potential will enhance greater attainment of educational goals.

## Suggestions

Based on the challenges of using smart machines and digitalization of university education in Nigeria the following suggestions are proffered:

- The managers of tertiary education should have a strategic plan for developing and integrating digital technology into the pedagogy. This shall include ways of raising internally generated revenue and bridging the digital divide by ensuring every student and teacher has equal access to technology by creating Wi-Fi in faculty buildings and libraries.
- The establishment of the directory of digital technology whose responsibilities among others the training and giving support to students and teachers on the use of digital technology. The university should adopt a Computer Based Examination for all year-one courses and general services courses.
- The managers of tertiary education should collaborate with ICT organizations in providing computers and other digital tools that will aid teaching and learning.
- Faculty officers should organize conferences and workshops on the use of smart machines as it affect tertiary education in Nigeria.

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- Zukauskas, A., Vveinhardt, J. S., & Andriukaitiene, R. (2018). Philosophy and paradigm of scientific research. DOI:10.5771/intechopen.70628.intecpen.comlchapter158890Examples of smart machine technologies.