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Digital Transformation Process and SMEs

Dilber ULAS*

Ankara University, Faculty of Political Sciences, Cebeci, Ankara, 06590, Turkey

Abstract

The process of digital transformation is a period in which entities, universities, public and employees are transformed and; new business models and business practices are formed. Digital transformation is a functional use of web in design, manufacturing, marketing, selling, promotion and is data-oriented management model. Therefore, capabilities of firms are increased and their processes are improved. Digital technologies are developments regarding smartphones, cloud computing, big data, artificial intelligence, robotics systems, internet of things, 3D printing, virtualization, cyber security, sensor technologies, advanced robotics systems, automation and etc. which all is intensely used in many fields of economic and social life.SME's consist of 99,83 % total enterprises, and 72,7 % of total employment, 50,6 % of total value added and provide 55,1 % of export, take an important role in economy. They should transform their organizational structures and business making cultures starting from manufacturing technologies to management percepts as to get a productive digital transformation process. The fact that SME's being able to perform cost-benefit analysis of digital technologies and being aware of that technologies is significant.This paper provides a comprehensive view of the factors affecting digital transformation process and describes the digital transformation of the manufacturing sector in Turkey.The programs and softwares that SMEs can use to perform digital transformation, and can benefit from it, are explained. Empirical studies on SMEs shows that SMEs have erratic behaviors in terms of information and communications technology (ICT) investment and need external support to integrate digital transformations in the overall strategy of the firm.

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  * Corresponding author. Tel.: +903125951488.
  *E-mail address:*ulas@politics.ankara.edu.tr

1. The Process of Digital Transformation

Digital transformation is "a change in all job and income creation strategies, application of a flexible management model standing against competition, quickly meeting changing demands, a process of reinventing a business to digitise operations and formulate extended supply chain relationships; functional use of internet in design, manufacturing, marketing, selling, presenting and is data-based management model"[1]. Digital transformation should not be supposed as technological leap. The management of operations should not just focused on software-hardware updates. It is an adaptation of its institutional and operational ecosystems of any entity in terms of new business and thinking methods in an attempt to keep a pace with digitization by benefitting from digital factors. When digital transformation is mentioned, digitization should not only come to mind. It should be application of a flexible business model. Some successful digitization transformation examples can be; solar panels are substituted for tiles used as raw material, electric cars are started to manufacture instead of gasoline-powered vehicles, recycled glass are being used in manufacturing of new glass containers. It is significant that operations can comply with the changed competition rules and demands.

According to McKinsey, digital transformation is rearrangement of technology, business models and processes as to ensure new values for customers and employees in constantly changing and developing digital economy. The speed of digital transformation is actually determined in terms of consumers' demands.The period starting from product design to manufacturingis reduced, market entry period is shortened, product range fastly fulfilling consumers' demands becomes possible with optimal and faster decision processes based on numeric data in each step of manufacturing. This process provides productivity growth for operations and lower their costs. Classic business models have been disappearing and substituted for business models which are flexible, changeable instantly, having real-time responses to consumers' habits and are knowledge-based. When the changes in business world as a result of Industry 4.0 are reviewed, it is drawn attention that manufacturing and manufacturing process become practical, supply chain is better, cost of energy and infrastructure decreases, less human resource is required, qualified manpower increases, income and profit level is risen [2]. Today, the ones, who are able to be afloat in rapidly increasing digital era, are people and operations keeping up with that technology era.

The more significant use of the pillars of digital transformation has been driven by innovation accelerators, which include, among other solutions, IoT, robotics, 3D printing, artificial intelligence, augmented and virtual reality, new generation, security, simulation, horizontal/lateral software integration, internet of things, cyber security, blockchain, nanotechnology, cloud computing, big data [3].

1.1. Driving Factors Expediting Digital Transformation

1.1.1. Advancement of technology and innovation, sensor technology (ST): Innovation is essential in economical growth, makes technology cheaper. Achievements in technology and innovation politics enhance economy of countries. Entrepreneurs who code and work in digital platforms should increase. Digital technologies allow SMEs to improve market intelligence and access global markets and knowledge networks at relatively low cost.

1.1.2. Change of business practices with internet economy, electronic commerce, social media: The Internet provides a platform for millions of daily online transactions and communications that make a significant contribution to individual economies. According to WTO (World Trade Organization),

E-commerce is defined as "manufacturing, distribution sale and delivery of goods and services by telecommunication means. According to The Organisation for Economic Co-operation and Development (OECD), "it s all forms of transaction relating to commercial activities including both organisation and individuals that are based upon the processing and transmission of digitized data including text, sound, and visual images". The digital transformation facilitates the emergence of "born global" small businesses and provides new opportunities for SMEs to enhance their competitiveness in local and global markets, through product or service innovation and improved production processes.

1.1.3. Globalization: As a result of advanced mobility of goods, services and capital, It is being mutually dependent and increase of communication and interaction between societies and governments existing different parts of the world in the process of cross-border reciprocal economic integration and national economy's involving in world market [4].

1.1.4. Industry 4.0: Information technologies and industry are gathered. In fourth industrial revolution, it is foreseen that manufacturing process is digitized, machines are directly connected to each other and personalized manufacturing is possible, besides that, environment is less polluted as a result of productivity growth, avoiding of excessive use of energy and water sources. As manufacturing becomes flexible with digital factories, manufacturing meeting less and personal product demand becomes possible. A considerable amount of energy saving is also provided.

1.1.5. Artificial Intelligence: Artificial intelligence investigates how a human brain thinks and how people learn and decide as they try to solve a problem, and it imitates the results of this study with smart software. Artificial intelligence does not act upon programmer's mind, it learns, understands and judges itself [5]. Manufacturing is occured by robots having artificial intelligence without human intervention. Intelligent software systems that can perform tasks and are in continual learning and improvement.

1.1.6. Internet of Things (IoT): Internet of things is a technology based on data transfer between devices over internet. It consists of interconnected devices from simple sensors to smartphones and wearable devices. It is possible to help a person having a specific duty or to gather an information, to analyze, or to create an activity as to learn a process by combining those devices with automatic systems. Internet of things offers more operativeness relating works, time and money saving and mostly emission saving. IoT   refers to the everyday objects that feature an IP address for internet connectivity allowing them to send and receive data, and so communication occurs between these objects and other network devices and systems (Real-time data collection, monitoring, decision making, and process optimization).

1.1.7. As new consumers, Generation Z's expectations affecting market: They were born in years between 1996 and 2001 and form 25 % of the world population. It is determined that this generation who was born into a world of digital devices, likes mobile devices. Generation Z likes to act as an individual, prefers an online communication rather than verbal communication, subscribes into channels creating entertainment videos, follows trends from vlogs, cares viral marketing, desires to play an active role in the design process of products [6]**.**

1.1.8. Blockchain: Blockchain is defined as decentralized ciphering record book. Blockchain, supporting Bitcoin (it is currency supported by everyone and cannot be controlled by anyone since 2012 until today is a distributed database technology providing encrypted process follow-up [7].

1.1.9. Cloud Computing: It is a general term of internet based information services providing

computer sources which are used or shared between users on request for computers and other devices. Applications, such as Itunes, Microsoft Office ensures that software can be distributed from web browser instead of dowloading in computer. Meaning of Cloud computing is archiving of music and film files, photographs, documents. Music files, photographs, documents can be personally stored in the computers of users instead of data centers. Computer files can be accessed from anywhere and internet from every computer.

1.1.10. Increase in the use of Smartphones: Approximately 1 billion phone is sold every year in worldwide. New generation smartphones offer computer skills. ¼ of the mobile phones in worldwide is smartphone. In Turkey, mobile phone use is 98 %, smartphone use is 77%, computer use is 48 % in 2018. Total number of mobile phone users is 59 million that makes 73 % of the population*.*

1.1.11. 3D Printers: It is a device quickly producing models which are designed in computer or prepared in 3D by using various materials without any mould or fixture. The cost of product design and manufacturing is lowered. It makes manufacturing faster. With 3D printers, 10 houses a day can be established in China. It can be used in product design, lowering mould cost, medical applications, prothesis, plastic plasters, personalised gifts, model making and robot design. 3DP, also known as additive manufacturing, refers to various processes used to synthesize a three-dimensional object.

1.1.12. Chatbots: They are software applications which are designated with the intent of backing up users in service sectors and imitate written or verbal human speaking. Artificial intelligences such as Siri, Alexa, or Google assistant is each advanced chatbot example.

1.1.13. Big Data: It means big data which computer is unable to process. BD is an evolving term that is used to describe any large amount of structured, semi-structured or unstructured data that has a potential to be mined for information. Big data help designers to derive decisive customer needs from the existing data to improve and develop designs [8]. Big Data and data analytics provide a wide range of opportunities for SMEs, enabling a better understanding of the processes within the firm, the needs of their clients and partners, and the overall business environment.

1.1.14. Augmented Reality: Augmented reality (AR) is described as the extension of physical reality by adding layers of computer generated information to the real environment. Information in this context could be any kind of virtual object or content, including text, graphics, video, sound, haptic feedback, Global Positioning Systems (GPS) data, and even smell. It ensures an increase in productivity and a decrease in cost by using of it in manufacturing processes. AR is used to enhance the natural environments or situations and offer perceptually enriched experiences. With the help of advanced AR technologies (e.g., adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive. Information about the environment and its objects is overlaid on the real world. Augmented reality technology, can be applied to the real estate market to conduct visits to fully digital properties, whereas in the medical field, the same resource can be applied to offer virtual training of surgeries and study of organisms.

1.1.15. Developing of sharing economy: The sharing economy, the collaborative economy, the digital economy, the circular economy, the peer-to-peer economy are just some examples of the names regularly used in the economic literature and in the media. The sharing economy matches demand to the supply of under-used assets or skills via intermediaries, with the aid of digital technologies, and does so with speed and efficiency. It also enables consumers to become producers. Sharing economy is offering a something that we do not use for someone's need with/out any expectation.

1.1.16. Nanotechnology (N): "Nano", as a word, means one-billionth of physical unit. There is no consensus on the definition of nano. Nanometre is a unit of measurement that is equivalent to one

billionth of a meter. Nanotechnology deals with nanomaterials which have at least one dimension ranging from 1 to 100 nm.It can be easily understood how small measurement nanometre has when we consider that hair strand of human is approximately 100.000 nanometre [9].Nanotechnology can be defined as application of scientific knowledge to manipulate and control matterpredominantly in the nanoscale (length range approximately from 1 nm to 100 nm) to make use of size- and structure-dependent properties and phenomena distinct from those associated with individual atoms or molecules, or extrapolation from larger sizes of the same material [10].

1.1.17. Digital Supply Chain: DSC is composed of those systems (e.g. software, hardware, communication networks) that support interactions between globally distributed organizations and orchestrates the activities of the partners in supply chains. These activities include buying, making, storing, moving and selling a product. DSC aim to achieve; speed, flexibility, global connectivity, real time inventory, transparency, intelligent, scalability, innovative, proactive, eco-friendly [11]**.**

1.1.18. Robotics: Robots each time with more exceptional ability and intelligence used to automate tasks, reduced labor costs. – Robots each time with more exceptional ability and intelligence used to automate tasks. Greater flexibility and shorter delivery time for products to the market. Vehicles with reduced or no human intervention, Advances in interfaces and sensors with better materials and ergonomic design. Robotics shift the labour/capital mix while managing societal expectations. End-user industries are rapidly adopting robots for industrial purposes to improve the quality of products and reduce manufacturing costs.

1.1.19. Advanced manufacturing technologies: Advanced manufacturing technologies which are used in manufacturing industry can be those given as; cyber-physical systems, autonomous robots, non-smart and non-flexible automation systems, smart sensors, manufacturing systems, Computer Numerical Control (CNC).

2. What Have Been Done for Digital Transformation of Manufacturing Industry in Turkey?

Ministry of Industry and Technology and TÜBİTAK are held as responsible institutions in digital transformation processes with a decision taken in the meeting of Supreme Council of Science and Technology (BTYK) in February, 2016. "Digital Transformation in Industry Platform" was established in 28 December 2016 and working groups were formed under the topics of advanced manufacturing techniques (developing of technology, such as 3D printers, robotics sensor and etc.), education (forming of qualified man power infrastructure), digital technologies in industry (big data, cloud computing, etc.) regulation, standardization, patents (involvement in international studies, standards, regulation infrastructure), infrastructure (technologic, physical), open innovation. Primary issues of SME's and entrepreneurs are determined conducting a survey on digitization in industry in 2017. Collaboration protocol is signed between Ministry of National Education and technical colleges. Digital transformation road map was completed in 2018. Protocol on opening of consistent education centers in the fields of digital transformation required in 15 research universities is signed. Digital technology is added to YOK's Doctorate programme, a pilot study regarding determination of digital maturity level is initiated with TUBİTAK. Decision on supporting of digital transformation with KOSGEB & TUBITAK programmes is taken. Key and Leading Technologies Prioritization for Smart Manufacturing Systems" survey in which about a thousand enterprises was participated was conducted by TÜBİTAK in 2016. Striking results came out at the end of this study. Namely, it is determined that 22% of the enterprises have a detailed information when we review awareness on smart manufacturing systems of operations and their integration levels into digital technologies, sectors which have a raised awareness are electronics, software and material (rubber, plastic), digital maturity level of our industries between Industry 2.0 and 3.0. Awareness levels of our operations regarding fourth industrial revolution are detected in   field work performed with ten thousand

enterprises in the scope of "Turkey's Productivity Growth Map Project" by Ministry of Industry and Technology in 2016. While enterprises have a knowledge regarding 3D printers, there is less recognition of big data, internet of things, cloud computing, RFID technology, open innovation [12]. Technology suppliers provide consultancy service for operations regarding cloud computing, big data, automation, internet of things, sensor technologies, cyber security, robotics systems. Increase in operations willing to use digital technologies depends on increasing of technology suppliers meeting applications and solution needs in digitization process of industry operations. Foreign dependency regarding that should be reduced. Education programmes' modules explaining how digital technologies are used with good application examples, giving information on digital transformation will be presented for SME's. Turkish Industry & Business Association (TÜSİAD) forms "Accelerating Programme of Digital Transformation in Industry (*TÜSİAD* SD)" which gathers micro, small and medium sized technology suppliers and technology users with the intent of impowering digital transformation process of industry. Information about that programme can be accessed from the adress https://tusiadsd2.org/hakkinda.

3. Small and Medium-Sized Enterprises (SME's) Digital Transformation Process

Turkey has changed the definition of small and medium size enterprises (SMEs) in 2019. The accepted definition points to those with 1 to 49 employees as "small" and those companies with 50 to 250 employees as "medium". In financial terms, an SME would have less than 125 million Turkish Liras annually. SME's consist of 99,83 % total enterprises, and 72,7 % of total employment, 50,6 % of total value added and provide 55,1 % of export, take an important role in economy [13]. SME's have many advantages because that are flexible, dynamic, work closely with other people, more informal and less bureaucratic than larger organizations [14]. They should transform their organizational structures and business making cultures starting from manufacturing technologies to management percepts as to get a productive digital transformation process. However the more limited resources of SMEs might prevent them to perform digital transformation. In order to carry out digital transformation in manufacturing industry, those should come into prominence which are raising awareness of SME's about digital transformation, increasing competence oflabor power, providing technical and financial support for SME's about that issue, strengthening the data communication infrastructure. To perform digital transformation;

1. It is required that the management is asking for data-based digital transformation, to be determined who will be responsible what for. Transformation must be led by the owner or manager. SMEs current situation needs to be analyzed to identify challenges, risks, or changed customer expectations. SMEs with the requirements and needs analysis, which enables them to cleraly define measurable goals. The management can review digitalization topics and what new technologies can contribute and explore new business models. And than offer benchmarks and training to support SMEs.

2. Adopting of "learning culture" in SMEs is essential for digital transformation of operations. The world and society are changing at an unprecedented pace. It is needed to have skilled employees, to educate the current employees, to create an inventory of required abilities and skills and to detect gaps. It is vital to compete with new markets as Google, Amozon, Facebook, Apple. Employment of people who have digital skills should be taken into consideration (IT specialists, and socioeconomic support professionals).

3. Defining a simple roadmap of business goals or digital transformation: Based on the digital transformation, objectives with regards to DT are defined. These objectives relate to time, finances, space, and quality (design SMEs new digital strategy, analysis of SME's existing business model, customers requirements, digital evaluation and expectations, set objectives, competence development, collection of best practices for digital transformation, design digital business models options,

information technology use and understanding, evaluation, design of digital value network, feedback from customers) [15].

4. Creation of an awareness of digital and a supportive environment.'To use IT to develop my enterprise'; 'To measure the impact of IT tools (e.g. ROI, sales, performance)'; 'To link my expectations with the reality of apparent user-friendly IT turnkey platforms'; 'To be better informed about available IT training'; and 'To establish transparent communications between entrepreneurs and IT specialist about expectation and deliverables to avoid a deception' [16].

5. Collaboration with SME helpers, innovation labs, research institutions. In order to realize the digital transformation, it may be helpful to consult with companies that have expertise in this field, and to obtain consultancy services. Guiding the SMEs through current trends and demonstrate their importance based on practical examples (best-practice, real-life examples).

6. Support SMEs with the requirements and needs analysis, implement feasible objectives. It is essential that SMEs which ask for digital transformation should be supported by governments. With the aid of government agencies and other stakeholders such as the Trade Association and Chambers, SMEs may be better able to access more assistance in their digital transformation process [17]. Also external supporters such as competence centers or research institutions can help SMEs to understand and implement digital transformations initiatives.

The needs of SMEs in digital transformation process can vary. It is required to privatise the content by means of size of enterprise, sector and SME. Electronic operation is an operation's adopting of other business processes, such as supply, manufacturing, marketing, sale, finance, accounting, human resources to new technology. Digitisation requires radical changes not only in terms of strategy, but also in terms of culture within the company. According to Azhari et al. the model for the digital transformation is include eight dimensions of digitisation, namely strategy, leadership, products, operations, culture, people, governance and technology. The first level, "unaware", describes companies in which there is no strategy for digital transformation, nor are there any digital competencies available. These companies do not yet offer any digital products or services, and are missing an overall organisational awareness for the need of digital transformation. Companies classified by the "conceptual" level, are those which offer a few digital products, but are still without a digital strategy. Those with a "defined" level of digitisation, are the companies who are able to consolidate experiences gained from pilot implementations into partial strategies. At this stage, a culture of digital thinking is taking root in the company. The profitability of these partial strategies and the effects of the pilot implementations are assessed and used to develop an overall digital strategy. At this point, where a clear digital strategy is developed, the company falls into the "integrated" maturity level. Only once this strategy has been implemented across all products and business processes, can the company be classified as "transformed". The now-defined digital strategy will have transformed the business and operations models of the company. Whilst the maturity model provides a good way for companies to classify themselves into a category of digital maturity, it provides no guidance for increasing the maturity level [18]. For example e-commerce needs some specific changes. Those are business processes and marketing, technological structure, product and services (offers), market (buyers and suppliers), relations (suppliers and distributors, customers, employees, business partners).E-business model substantially change the fields such as order picking, order fulfillment, storing, customers relations after sale of traditional management; bring new innovations regarding speed, quality, cost advantages, customers' satisfaction. Direct communication can be made with consumer and industrial markets, applications, such as personal manufacturing, direct marketing, e-customer relations management are worked on [19]. Past studies have examined technologies in general and have found a number of factors impacting the adoption decision of information and communications technologies (ICTs) in organizations. These factors can be classified: Firms Characteristics (including size, type pf business), past experiences, privacy and

security (concerns about Internet security, concerns about legal issues, resistance to change, lack of finance, high cost of computers and network, lack of qualified personnel, limited knowledge of the required technology, infrastructure, lack of marketing, competition, finding reliable technological management consultants andtechnology suppliers, providing guidelines for appropriate hardware and software, ICT and e-commerce adoption (digital transformation support programs) [20], lack of a technological roadmap and an ecosystem for digital transformation (stakeholders such as technology suppliers, investors, public, users, educational institutions), lack of information sharing programs, legislative needs arising with the digital transformation, ensuring a reliable environment [21]. SMEs have access to IT applications that support a number of business functions(e.g. Google Analytics for marketing; Amazon, PayPal for e-commerce or other social media solutions, including Facebook which offers a range of features for SMEs; Skype, Teamviewer and Messenger for collaboration, etc.). The programs and software that SMEs can use to perform digital transformation, and can benefit from it, are explained in the table 1.

Table 1. Programmes and Softwares which can be benefitted from in Digital Transformation of SMEs

FUNCTIONS OF OPERATIONS	PROGRAMMES AND SOFTWARES USED IN DIGITAL TRANSFORMATION
NEW PRODUCT DEVELOPMENT AND DESIGN	Deductions to the customers' needs can be made by big data and analytic, comments and complaints on social media, topics searched in search engines, the watched videos. Customers can lead operations to develop products which they ask for. Use of 3D printers Design preferences of customers can be detected by competitions and surveys. PLM (Product Lifecyle Management) programme Computer-Aided Manufacturing (CAM) Computer Aided Design (CAD)
DEMAND FORECASTING	Big data and advanced analytic can be used. Personalised product orders can be taken. Fair support software
SUPPLY AND LOGISTICS	Membership to B2B sites, Using of integrated systems ensuring reciprocal data sharing with suppliers, spontaneous stock follow-up of storage, providing packaging with automatic machines. Software of Purchasing and payment systems Robotics systems in intercisternal transport (Manufacturing Execution System) softwares, PLC(programmable logic conroller), ERP (Enterprise resource planning)
MANUFACTURING	Use of big data and analytic systems Benefitting from industrial robots Automatically quality controlling Automation Total quality management (TQM), Just in Time (JIT) manufacturing Lean Manufacturing (LM)
HUMAN RESOURCES	Trainings of IT, increasing talent, adapt to changing work practices, digital skills of new employees, ongoing education, training, culture of collaboration, Human resources software Requirement of having multi-disciplinary information, knowledge and experience Use of robots in manufacturing Employees will be able to choose how, where and when to work New and flexible working patterns, mobile working, home working.
MARKETING, SALE AND CUSTOMER MANAGEMENT	Online voice and video calling platforms in communication, such as Skype and blog sites, videos and social media platforms such as Facebook. Use of CRM (Customer Relationship Management) programmes Use of virtual assistants containing artificial intelligence, such as big data, advanced analytic, chatbot, voice assistant Use of augmented reality Keeping of customers information, making demand forecasting, quickly taking and answering of customers' opinions and complaints Following of real time purchasing activities of customer

	Customer's touch points about customer
	Presenting of virtual guides and remote maintenance service for products
	Offering digital training for customers
	Making personal promotions and discount
	Using of integrated marketing methods, such as internet marketing, mobile marketing, omnichannel, viral marketing, social media, vloggers, bloggers, youtuber, direct marketing, brand ambassadors, influencer marketing, attending fairs.
PAYMENT	Offering payment alternatives, such as paying with credit card in website, in store payment apps (a mobile device into a smartphone credit card reader), banking cards, mobile wallets, internet banking, digital currencies (such as Bitcoin), money transfer, virtual card, paying at the door.

4. Conclusion

The main purpose of digital transformation is to redesign the organizational business through the introduction of digital technologies, achieving benefits such as productivity improvements, cost reductions and innovation. Digital transformation is functional use of internet in design, manufacturing, marketing, selling, presenting and is data-based management model. Obstacles in adopting of digital transformation are budget deficiencies of SME's, impossibility of investment due to high investments and operational costs, unability to understand internet technologies, inconveniency of sector, data security, privacy concern, technological developments, insufficient information regarding digital standards, being unaware of the benefits of digitization, having connection problems, lack of qualified employment. While many SMEs have increasingly realised that the internet is a key to success, in many cases they still don't have a website that can be viewed on a smartphone. SMEs use the internet for a variety of purposes. Most of SMEs use it for finding out general information relating to the business, customer emails, online banking, paying bills, ordering supplies and paying taxes online.The fact that classic business models have been disappearing and substituted for business models which are flexible, changeable instantly, having real-time responses to consumers' habits and are knowledge-based. SME's being able to perform cost-benefit analysis of digital technologies and being aware of that technologies is significant.

Lastly, the government has also a role to play to stimulate digital transformation of SMEs. The proposed government interventions include evaluating how the current legal and regulatory framework enhances digital transformation. In addition, the government may provide incentives to SMEs that are embarking on the digital transformation process and e-commerce-related assistance through government agencies that are already established to assist SMEs. When the changes in business world as a result of Industry 4.0 are reviewed, it is drawn attention that manufacturing and manufacturing process become practical. Today, the ones, who are able to be afloat in rapidly increasing digital era, are people and SMEs keeping up with that technology era.

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