

FIG WORKING WEEK 2019

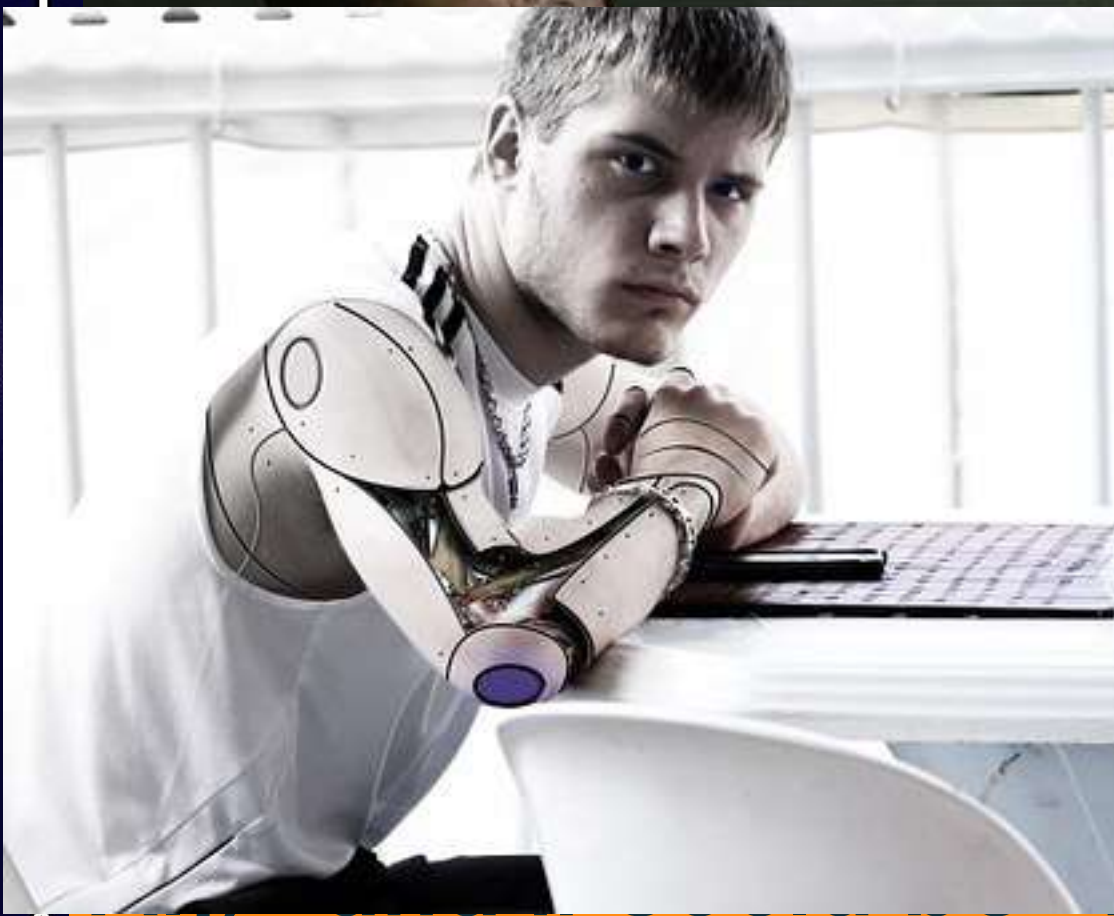
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**TIMING - SPATIAL INFORMATION
SYSTEM IS THE INFORMATION
INFRASTRUCTURE TO DEVELOP THE
SMART WORLD**

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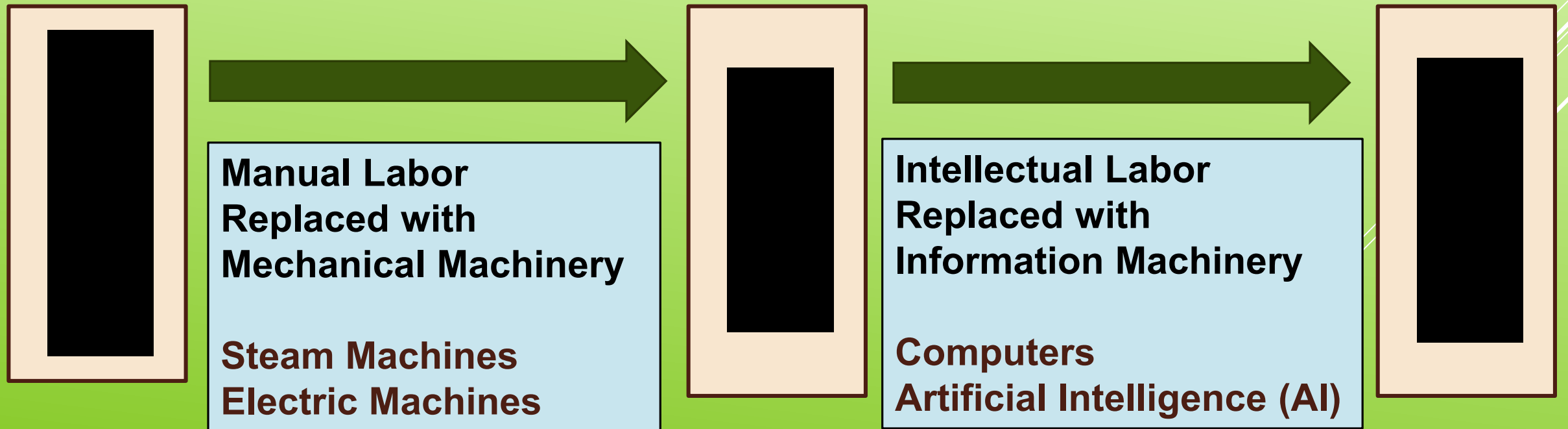
A **history of our civilization.” (Stephen Hawking 2017)**

~ALVIN TOFFLER



WORLD DEVELOPMENT UNDER THE TECHNOLOGICAL VIEW POINT

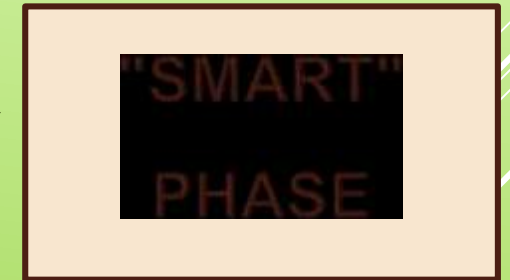
During 1960-1990, Alvin Toffler generalized the development model of the world in the form of three "civilizations" impacted by technological influences to human labor [see 3 books: The Future Shock (1970), The Third Wave (1980) and The Power Shift (1990)]:



THE SHIFT FROM "ELECTRONIC" GENERATION TO "SMART" GENERATION

Since computers connected to Internet, the "electronic" generation has been formulated, traditional objects have been changed to electronic objects, such as e-commerce, e-citizen, e-society, e-government, etc.

Since artificial intelligences connected to Internet of things (IoT), the "smart" generation has been formulated, electronic objects have been changed to smart objects, such as smart phone, smart home, smart city, smart administration, etc.



Human intelligence replaced mostly with artificial intelligence
All things connected to Internet in on-line and real-time mode for data capture
All captured data referenced to real-time GIS are input data for artificial intelligence

MAIN CHANGES IN THE "SMART" GENERATION

- ❖ **Artificial intelligence (AI) helps people to issue optimal decisions to make lowest costs and highest benefits in production and service. In short-term, the initial investment cost can often be higher than the one from traditional investment, but in mid-term and long-term, benefit should significantly be higher than the one from traditional investment.**
- ❖ **Social structure of labor, employment, income will totally be changed. Labor will be reduced, but income will be increased. Social benefits distribution will be changed also.**
- ❖ **The "smart" generation requires complete reform of human capital education and training.**

Human thinking is based on qualitative considerations, but in contrary, the thinking of artificial intelligence is based on quantitative considerations resulted from quantitative analyses of related data. From the reason that AI is worked based on quantitative analyses, AI's decisions get always the "optimal" level.

And...

WHAT KIND OF ENERGY DO WE NEED TO RUN T AI "MACHINE"?

Conceptually we know: "Motion consists merely in the fact that bodies are sometimes in one place and sometimes in another and that they are at inter- mediate places at intermediate times." (Russell- Taylor 1959)

But practically, we are strongly interested to learn:

What do we have? Where and When and How?

What will be happening? Where and When and How?

What to do? Where and When and How?

THE ROLE OF INFORMATION IN THE "SMART" GENERATION

- ❖ **Artificial intelligence (AI) is a key driving force to make the shift from the "electronic" phase to the "smart" phase.**
- ❖ **AI in a certain system needs full, accurate, updated information about the space where the system located, all entities and their activities in the system for analyzing and issuing decisions on management and development of the system.**
- ❖ **AI must be connected to the space of the system and the network of entities operating in the system in on-line and real-time mode because the system is a kinematic object.**

WHY TIMING-SPATIAL INFORMATION IS INFORMATION INFRASTRUCTURE

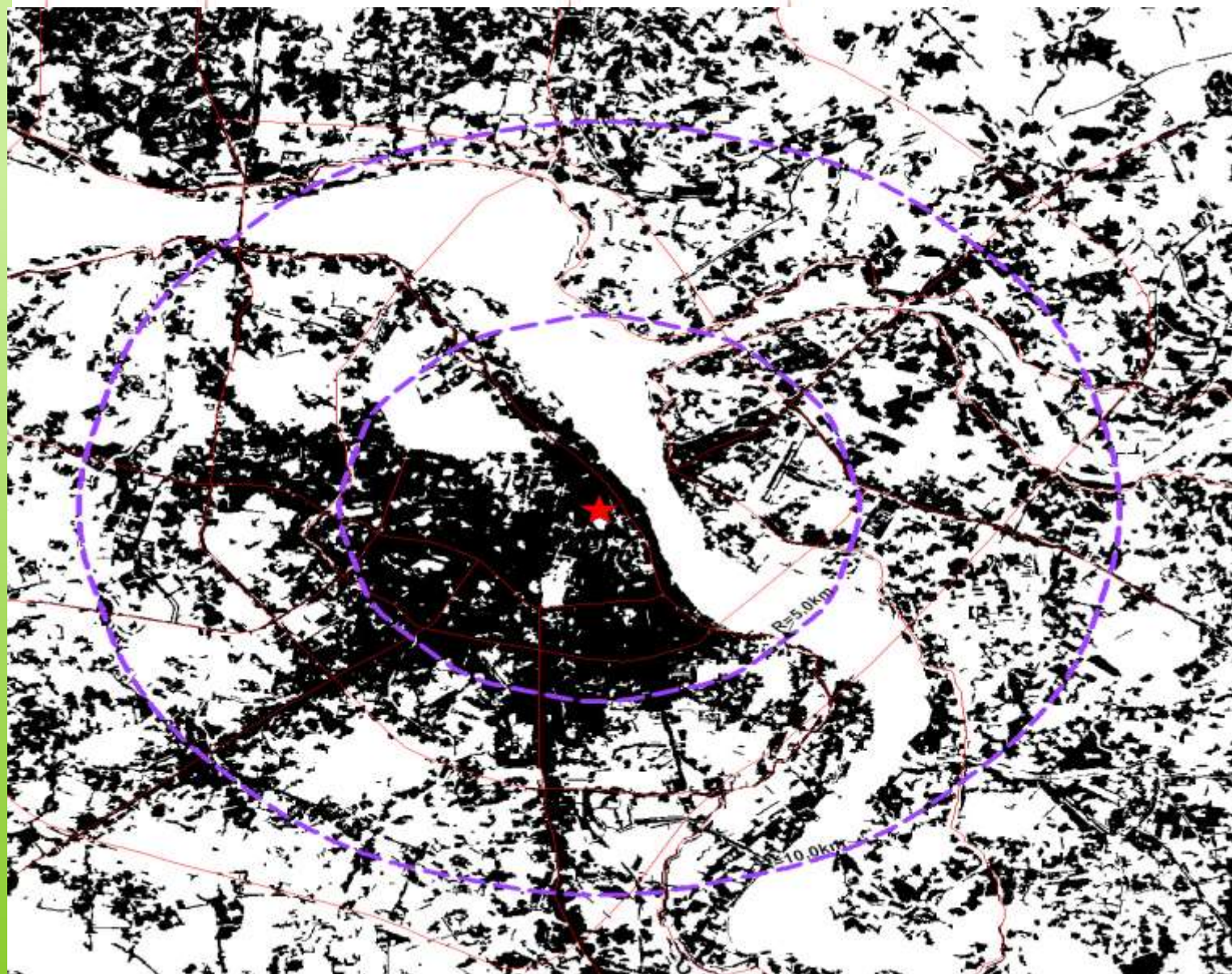
- ❖ The information we need must be introduced in the form of a function depending on 4 variables x, y, z, t (x, y, z are spatial dimensions and t is temporal dimension). Four variables x, y, z, t are fully determined by surveying means such as kinematic GNSS, remote sensing data processing or modern total-stations in the same time of capturing data related to the information.
- ❖ All captured data must be referenced to a geodetic reference system to be served for analyses and processing.
- ❖ In static view point, geo-spatial information system (GIS) is a best model of the real world to help people for perception of place where they are living and for finding good scenarios of development. In dynamic view point, traditional GIS will be replaced with the timing-spatial information system, i.e. real-time GIS - GIS which is updated continuously over time. It is the real-time model of the real world.
- ❖ Using the superiority of AI, it is necessary to have a fully, accurate and updated information system referenced to the timing-spatial information system (real-time GIS) to analyze needed data for making optimal decisions.

TIME AND SPACE DIMENSION OF URBAN GROWTH (EX. HANOI)

(PHAM VAN CU ET AL. 2006)

1975

1999



1992

2003

TIMING-SPATIAL INFORMATION SYSTEM SERVING FOR SMART CITY OPERATION



Database of citizens

Database of organizations

Capture of environmental information

Capture of social information

Capture of economic information

Capture of geographic information

Real Time GIS

"To say that a thing moves in space is only to say that, over an interval of time, it occupies different places, without filling all of them throughout that interval."

NEW OPPORTUNITY OF SURVEY AND MAPPING

- ❖ **From history, humanity used survey and mapping as a good tool for modelling the places where people are living for their awareness and managing work. Thus, modelling of the real world is the main task of survey and mapping, in which survey plays the role of geo-data capture and mapping has the role of formulating the real world model.**
- ❖ **Before the "electronic" phase, the survey and mapping had been worked in manual manner supported by optical and mechanical equipment. In beginning of the "electronic" phase, the satellite technology and ICT have created a big opportunity for innovation of the survey and mapping with 3S technology: GNSS, RS and GIS. It is the "electronic" generation of survey and mapping.**
- ❖ **Currently, humanity has the starting point of the "smart" phase. The survey and mapping stand in front of new opportunity to create the real-time and on-line based on implementation of an important task: formulation of real-time model of the real world in form of the timing-spatial information system to be the information infrastructure for changing world in the "smart" generation.**

CHALLENGES FOR SURVEY AND MAPPING

- ❖ **Thinking challenge:** People's thinking about the role of "smart" survey and mapping in construction of the "smart" generation should be totally changed, firstly in developing countries.
- ❖ **Technological challenge:** Technical resolutions for building the "smart" survey and mapping in on-line and real-time mode, that are associated with archiving, managing and processing big data are not easy to be practically implemented, at least in developing countries.
- ❖ **Financial challenge:** Construction of the timing-spatial information system as well as other technical infrastructures for developing the "smart" generation requires a huge financial resources. It is a significant difficulty in developing countries.
- ❖ **Human capital challenge:** The "smart" generation requires very high quality human resources that needs the complete reform for education and training in the field of survey and mapping.

Data we do need to operate AI must be BIG and the knowledge we do need to provide to the computer must be interdisciplinary and..

As the science and technology are more integrated Interdisciplinarily as bigger data become And it is a big challenge in many cases and Vietnam is not an exception.

WHERE IS VIETNAM ON THE WAY TO THE "SMART" WORLD

Results from UNDP's world survey on E-Government in 193 countries/economies

COUNTRY	2017	2018	2019	2020
Denmark	0.9975	0.9975	0.9975	0.9975
Australia	0.9975	0.9975	0.9975	0.9975
Singapore	0.8828	0.8812	0.8812	0.8812
Malaysia	0.6175	0.7174	0.7174	0.7174
Brunei	0.5825	0.5825	0.5825	0.5825
Thailand	0.5825	0.5825	0.5825	0.5825
Philippines	0.5825	0.5825	0.5825	0.5825
Vietnam	0.5825	0.5825	0.5825	0.5825
Indonesia	0.5825	0.5825	0.5825	0.5825
Cambodia	0.5825	0.5825	0.5825	0.5825
Myanmar	0.5825	0.5825	0.5825	0.5825
Lao PDR	0.3090	0.3056	0.3056	0.3056
Niger	0.0593	0.1095	0.1095	0.1095
Somalia	0.0270	0.0566	0.0566	0.0566

Data we do need to operate AI must be BIG and the knowledge we do need to provide to the computer must be interdisciplinary and..

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And it is a big challenge in many developing countries and Vietnam is not an exception.

WHERE IS VIETNAM ON THE WAY TO THE "SMART" WORLD

- ❖ In country wide, Vietnam has already completed the phase of computerization of all data related to management in the State's sector and the business sector. That means Vietnam currently stands at the beginning of the "electronic" phase. The Vietnam State has a slogan "Finding shortcut ways to the smart world!". It is difficult to find a suitable shortcut way because the "smart" phase could be developed after the "electronic" phase is fully completed.
- ❖ Currently, the "electronic" administration is implemented in some fields such as the taxing collection and the customs. In land administration, land information system is operated in local area networks (LAN) only.
- ❖ In survey and mapping, the national CORS network has initially been in process of construction since 2018; in 2010, the national geographic information system at the scales 1/10,000 and smaller was completed, but it is not yet updated; the national satellite images receiving ground station has been operated since 2010, but users can not access to received data.

CONCLUSIONS

- ❖ In general, development of the "smart" generation is being formed as a key trend in the world. In Vietnam, the State has decided to build the needed infrastructure for development of the "smart" generation. It is a great opportunity for the field of survey and mapping, that also faces great challenges.
- ❖ From theory as well as practice, the timing-spatial information system plays the role of an information infrastructure for developing "smart" generations. On the one hand, the timing-spatial information system is the real world model to help people to define scenarios of development, to provide the monitoring and evaluation tool, and to supply input data for AI to make decisions.
- ❖ Entering the "smart" generation, the field of survey and mapping has the main task of producing timing-spatial information, creating information infrastructure for "smart" world development.

THANK YOU

