

Emerging Technology

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1 Technology Management

Technology is a mathematical theory, an algorithm, a method, a hardware device or a software which is developed for certain purposes. One important goal of a *technology* is that it can be applied in (i) solving a problem which has ever been solved, (ii) aiding to solve a problem or (iii) improving our living or work.

Technology management is a management process covering (1) the management of the usage of technologies with access right granted for work, (2) the management of the development of a new technology and (3) the management of the access right of the new technology.

For comparison, the definition of management could be stated by the same principle in the following. *Management* is a process covering (1) the management of the usage of resources with access right granted for work, (2) the management of the development of a new resource and (3) the management of the access right of the new resource¹.

1.1 Implications

Thus, technology management is a problem dependent managing process. The set of technologies to be acquired depends on the problem to be solved. If the professional who handles this management process is called the technology manager, a technology manager would need to be capable to understand the scope of a problem to be solved and then decide which technologies have to be used.

A technology manager would need to bargain for the accessibility of such technologies. If a technology to be used has not yet been developed or the technology is not accessible, the technology manager would need to determine its specification for the development team to make it. Once the new technology has been developed, the technology manager would have to understand how difference it is as compared with other similar technologies in the market and the new technology should be filed in patent. Once the new technology has been patented, licensing on the use of the new technology should be managed by an independent professional team in the firm.

1.2 Technology manager

Under such circumstances, a technology manager should be knowledgeable in a number of areas, namely (1) the technical details of the technologies potentially for use in solving problems; (2) the managing the process of technology

¹For human resource management and financial management, their definitions are similar. (a) *Human resource management* is a management process covering (1) the management of the usage of human resources with access right granted for work, (2) the management of the development of a new human resource via training and coaching; and (3) the management of the access right of the new human resource. (b) *Financial management* is a management process covering (1) the management of the usage of financial resources with access right granted for work, (2) the management of the development of a new financial resource via investment and (3) the management of the access right of the new financial resource.

development; (3) technology development; (4) the design of the licensing policy for each new technology being developed; (5) the recruitment of the professionals to assist the technology manager to complete all those tasks. Furthermore, a technology manager should also be knowledgeable in (6) marketing and (7) making strategic decision on the future technology development and the usage of technologies. Last but not the least, a technology manager should be (8) able to design the operations for all these tasks. To equipped with such knowledge and skills, what courses a pre-technology-manager should acquire?

2 Emerging Technology

Emerging technology refers to the set of technologies which are available in nowadays and in near future. These technologies have been developing for many years and have been applied in many areas. In near future, these technologies and their advancements are hardly be replaced by any new technology.

Figure 1 shows the landscape of emerging technologies. It covers the technologies developed to support application systems. Moreover, the tools developed to aid the development of the application systems and the emerging technologies are themselves emerging technologies. Usually, a manager only looks at the available application systems and selects from them the appropriate systems for the business operation being managed. For a more capable manager, he or she should look at the available application systems and the emerging technologies. If there is no suitable application system available for use, the manager should be able to design and manage the development of a new application system with the appropriate emerging technologies.

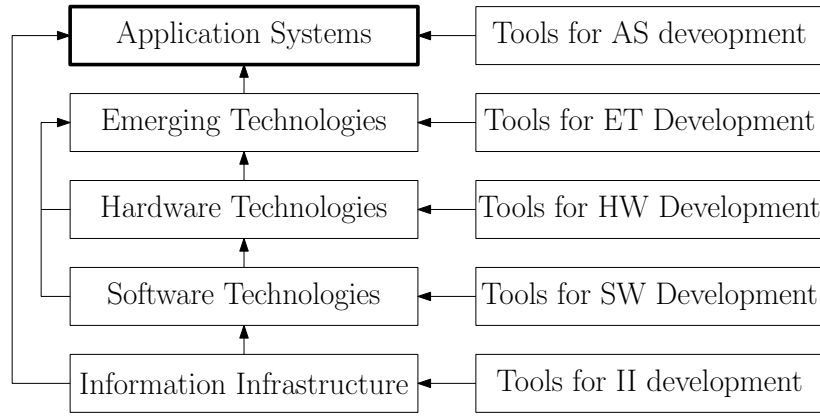
Emerging technology also embraces a collection of thousands of technologies. Today, 5G, WiFi, ChatGPT and Google Bard are emerging technologies. However, in four hundred years ago, they were not.

2.1 Emerging technology in the 17th century

In the seventeenth century, there was no electricity (respectively, computer). Can you imagine how people managed accounting information in that period of time? What technologies had been used for managing accounting information? Can you imagine how people made a shirt in that period of time? What technologies had been used for making a shirt? Obviously, all these works had to be done by people manually aided with various different tools. The tools included human workers, paper notebooks, abacuses, metal locks, pigeons, horses and the imperial post offices. Thus, these tools were the emerging technologies at that period of time.

2.2 Emerging technology in today

Today, Siri and Google Assistant are emerging technologies. They could be used as voice recognizers for the users to command a computer-based informa-



All of them are emerging technologies.

Figure 1: Landscape of emerging technologies. All the technologies included in the blocks are emerging technologies. They include the application systems and the technologies being developed; and the tools for developing such systems and technologies.

tion system to perform data analysis and reporting. Google Translate is an emerging technology for online translation. The AI model embedded in the Google Translate is yet another emerging technology. Auto-Drive vehicle is an emerging technology. The real-time video processing system in the auto-drive vehicle is an emerging technology. The real-time image understanding system in the vehicle is also an emerging technology. Blockchain is an emerging technology. It could be applied to develop other emerging technologies for use in financial sector and health care sector.

2.3 Emerging technology management

As emerging technology is simply a subset of ‘technology’, emerging technology management could simply be defined in the same way as technology management, by replacing technology to emerging technology.

Emerging technology management is a management process covering (1) the management of the usage of emerging technologies with access right granted for work, (2) the management of the development of a new technology and (3) the management of the access right of the new technology.

3 Learn/Understand Emerging Technology

To understand a technology, it could be accomplished from two approaches. First, one could start from its (technical) working principle and then infer the

potential applications of such technology. This approach is a tough approach as the learners need to have sufficient mathematical knowledge to understand the technical background of those ‘technologies’. The second approach is a bit easier, one could start from an application and then learn from the application what technologies have been applied. The learners have only to learn from the applications why those technologies are applied and thus to learn the application scopes of each of these technologies.

From the perspective of the second approach – starting from an application to learn the technologies being used for supporting such an application, one should be clear that applications are developed for different group of users and different industries.

1. Technologies for personal applications. Table 1 lists a number of emerging technologies being used in John Sum daily life and work.
2. Technologies for business administration. Table 2 lists a number of emerging technologies which have been used to facilitate business administration.
3. Technologies for business operations. Selection of technologies to facilitate an operation is a tough decision problem as it is adhere to the operation design. Selection of technologies is depended on the operation design. On the other hand, the design of an operation is also depended on the technologies available.
4. Technologies for industrial applications. Similar to business operations, selection of technologies to aid an industrial application is a tough decision problem. Selection of technologies is depended on the operation design for an industrial application. On the other hand, the design of an operation is also depended on the technologies available.
5. Technologies for car manufacturing. Definitely, robotic technology is a set of technologies being used. Again, selection of other technologies to aid car manufacturing is a tough decision problem. Selection of technologies is depended on the operation design for a car manufacturing. On the other hand, the design of an operation is also depended on the technologies available.
6. Technologies for health care.
7. Technologies for information and communication.
8. Technologies for logistics and transportation.
9. Technologies for education.
10. Technologies for aerospace industry.
11. Technologies for financial industry.

12. Technologies for smart home.
13. Technologies for smart cities.
14. Technologies for homeland security.
15. Technologies for research. Some of them have been depicted in Table 1.

For each of the above categories, how many technologies you can name of and how many technologies you know how to use? How many of them their working principles you really understand?

4 Note on Workflow Management

In Table 2, it has listed that information system is able to facilitate administration workflow management. Here, let me explain what is it about.

4.1 Project budget request

Imagine that a team in a department would like to request for a budget for a specialized project, see Figure 2. The team will first need to file a budget request form and pass it to get approval from its department manager. Once the department manager has signed to approve the request, the form will then be passed to the financial department for budget availability. If it is available, the request form will be passed to the chief financial officer (CFO) for the final approval. The request form is then passed back to the team confirming the budget approval. A budget approval form is then passed to the financial department to reserve the budget for the team.

The above flow of the budget request from a department team to the CFO is so-called the workflow for budget request. Clearly, this workflow can definitely be facilitated by the use of an information system. The flow of the budget request form is made electronically and each approval step can be done online.

4.2 Business operations

Clearly, many workflow management systems have been developed for *order placement and fulfillment* and *manufacturing*. A key benefit of these systems is simply to facilitate the workers to report their completion of their works online. The managers are then able to online monitor the progresses via the workflow management systems regarding the progresses of the operations.

Table 1: Personal (John Sum) Use of Emerging Technologies.

Technology/Software	Daily Live	Daily Work
Line	Text Message	–
WhatsApp	Text Message	–
Siri	Text Message	–
Amazon Echo	Smart Home	–
NCHU Webmail	–	Email
Gmail	–	Email
Yahoo! Mail	Email	Email
Gate Barrier	Plate Recognition	Plate Recognition
Navigation System	Drive Direction	Drive Direction
Google Map	Route to Destination	Route to Destination
Bus Schedule App	Bus Schedule	Bus Schedule
Hotspot	Notebook WiFi Access	Notebook WiFi Access
Spell Check	–	Editing
Word Suggestion	–	Editing
Spell Correction	–	Editing
Grammar Check	–	Editing
Google Search	–	Use of English
	–	Acquire Knowledge
Google Translate	–	Use of English
	–	Chinese Abstract
Wikipedia	–	Use of English
	–	Acquire Knowledge
ChatGPT	–	Acquire Knowledge
	–	Paraphrasing
	–	Research
	Chat	–
Google Bard	–	Acquire Knowledge
	–	Paraphrasing
	–	Research
	Chat	–
Gmail	–	Teaching
TeamViewer	–	Research
Computer	–	Research
Matlab	–	Research
DevC	–	Teaching
Python	–	Teaching
	–	Research
MikTex	–	Editing
WinEdit	–	Editing
Textstudio	–	Editing
IPE	–	Diagram drawing

Table 2: Emerging Technologies for Business Administration.

Technology/Software	Business administration
Line	Text Message & Group
WhatsApp	Text Message & Group
Siri	Voice-to-Text
Cell phone	Official and personal communication
Webmail (Official)	Official communication
Gmail or Yahoo!Mail	Personal communication
MS WORD spell check	Reporting & documentation
MS WORD word suggestion	Reporting & documentation
MS WORD spell correction	Reporting & documentation
MS WORD grammar check	Reporting & documentation
MS PowerPoint	Presentation slide preparation
Google Search	Use of English for documentation
Google Translate	Use of English for documentation
ChatGPT or Google Bard	Paraphrasing
Google Meet	Virtual meeting
Database management system	Data management
Information system	Administration workflow(*) management
	Document management
Computer	Work
Projector	Reporting
Network communication	Information infrastructure

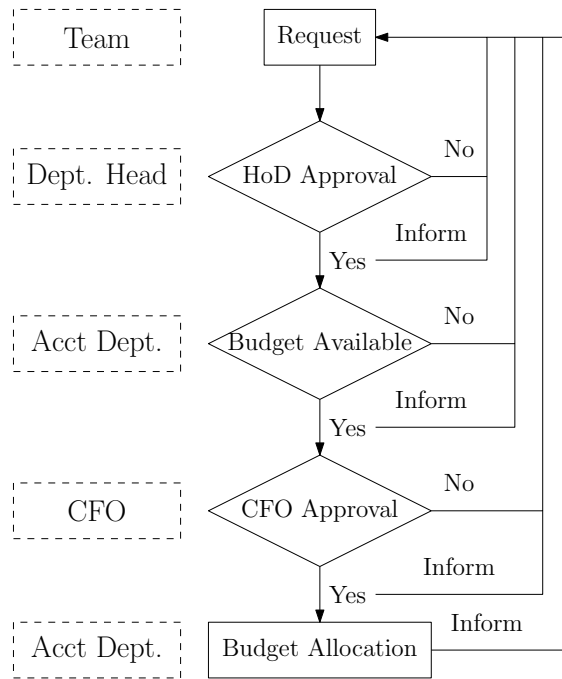


Figure 2: The workflow of a project budget request process. In each stage of decision, the corresponding party has to inform the department team for the decision so that the team is able to know the progress of its request.