A review of frameworks for classification of information systems, notably on the Anthony's Triangle

JOSEPH KIM-KEUNG HO
Independent Trainer
Hong Kong, China

Abstract:

The topic of classification of information systems is foundational in the subject of information systems. For a long time, the Anthony's Triangle has been a popular framework for such classification purpose. While acknowledging its value in this regard, the Anthony's Triangle has some theoretical shortcomings. Nevertheless, these shortcomings are not much discussed in the Information Systems literature. This paper offers a review on the nature and the limitations of the Anthony's Triangle; it then considers three other models, namely the corporate information factory model, the e-Business Application Architecture and the Information Technology (IT) Portfolio model, that have relevance for classifying information systems in an organized way. The review exercise offers some academic and pedagogical value to the subject of information systems.

Key words: Frameworks for classification of information systems; Information system types; The Anthony's Triangle; The hierarchical view of information needs

Introduction

It is a main topic in the subject of information systems to examine information system types. The most famous one is called the Anthony's Triangle, which was based on Anthony

(1988)'s book on *The Management Control Function*. It has been adopted by other writers, e.g., Gorry and Scott Morton (1989), to classify information systems. Subsequently, such a classification called the Anthony's Triangle has been adopted in a number of information systems textbooks, e.g., Laudon and Laudon (2004; Chapter 2), Neumann (1994; Chapter 2) and Lucey (1997; Chapters 15-16). This paper examines the efforts on information systems classification which is useful for comprehending the essence of various types of information system.

A review of the Anthony's Triangle and its usage as a framework for information systems classification

Anthony (1988) examines three types of planning and control activities, i.e., strategic planning, management control and task control, in terms of nature of information, persons involved and balance between planning and control, etc.. Subsequently, Gorry and Scott Morton (1989) adopted Anthony's ideas to formulate a framework for Management Information Systems. Their framework locates information systems in a matrix with two dimensions. The first one is on operational control, management control and strategic planning. The second dimension is on decision making types, namely structured, semi-structured and unstructured. It is important to note that both Anthony (1988) and Gorry and Scott Morton (1989) did not actually produce a diagram in triangle form for information systems classification and their works did not mention the term of Anthony's Triangle. More fundamentally, Harry (1995) points out that ideas similar to Anthony's types of planning and control activities existed in earlier time. For this reason, the term Anthony's Triangle, when employed for classifying information systems, is problematic, for Anthony cannot claim total ownership of the ideas involved. Anyway, ideas underlying

the Anthony's Triangle can be adopted to study information system types in a non-triangle form.

To begin with, Anthony (1988) explains that a framework, which is what the Anthony's Triangle is about, has both a vertical (hierarchical) and a horizontal dimension and can be used in research, in education, for systems design and by managers for fulfilling their responsibilities. On the term of the Anthony's Triangle, Wikipedia (2015) offers the following description: "Anthony's Triangle is an organizational model. Anthony's Triangle takes a hierarchical view of management structure, with many operational decisions at the bottom, some tactical decisions in the middle and few but important strategic decisions at the top of the triangle. The higher in the triangle an item is, the more scope it covers and less precise it becomes. As items move down they become more detailed and apply more precisely." Nevertheless, it is not used for classifying information systems in its brief description on the Anthony's Triangle. Likewise, in Prezi.com (2013), the Anthony Triangle was primarily described as one which offers "a hierarchical view of information needs"[1]. No attempt is made to classify information systems based on it. Eromed Marseille School of Management (2015) explicitly makes use of the Anthony's Triangle to classify information system types, but use the terms "three level pyramid model" and "five level pyramid model" in lieu of the Anthony's Triangle. Another example of information systems classification based on Anthony's Triangle was provided by Neumann (1994), although he did not use the term Anthony's Triangle. His diagram is as follows:

---

[1] The *hierarchical view of information needs* is elaborated on in details by Anthony (1988). For example, at the Strategy Planning level, accuracy of information is "Rough"; timeliness is "Speed usually not crucial"; at the Management Control level, accuracy of information is "Fairly accurate"; timeliness is "Speed more important than accuracy; finally, at the Task

Figure 1: The Anthony's Triangle and information system types
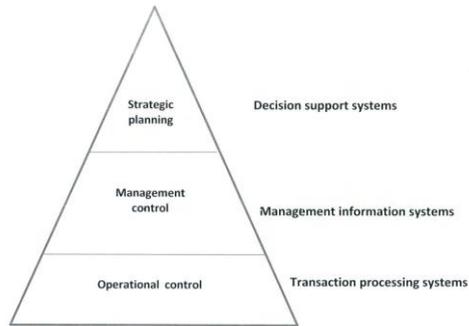
Source: Neumann (1994).

In this diagram, information system types[2], i.e., decision support systems, management information systems and transaction processing systems are related to different levels in the Anthony's Triangle. Some of these information systems, notably decision support systems and executive support systems, have substantial literature of their own and should be considered as major topics in the Information Systems field. Used this way, the Anthony's Triangle provides an organizing framework to classify information system types. Laudon and Laudon (2004) offer an enhanced version of Anthony's Triangle with 4 levels (again, avoiding the term of Anthony's Triangle):

At the strategic level (highest level), Executive Support Systems are located.

At the management level, Management Information Systems and Decision Support Systems are located.

At the knowledge level, Knowledge Work Systems and Office Systems are located.

At the Operational level (lowest level), Transaction Processing Systems is located.

Control level, Accuracy of information is "Accurate" while Timeliness is "Real time".

[2] For a brief introduction to various information system types, readers are referred to Tutor2u (2012) or Laudon and Laudon (2004).

Laudon and Laudon (2004), like what other writers have also done, introduces a horizontal (functional) dimension in their triangle diagram framework. [Functional dimension means accounting, marketing, production, human resource functions, etc.] By using the Anthony's Triangle as a framework, (which offers a hierarchical view of information needs), to classify information system types, it then indicates the nature of various types of information system in terms of their targeted users and the kind of information needs that each of these information systems can support. This point is further illustrated by Laudon and Laudon (2004: 88) in the form of a table that classifies information system types with 2 dimensions, i.e., organizational level (operational, knowledge, management and strategic) and types of decision (structured, semi-structured and unstructured). Nonetheless, not all writers consider the Anthony's Triangle a desirable way to classify information system types. For example, Turban *et al.* (2004: 54) makes use of a table to classify information system types, thus applying the hierarchical view underlying the Anthony's Triangle without using a triangle diagram for this purpose. [A table is also a valid form of a framework.]

A review on the weaknesses of the Anthony's Triangle with special reference to the hierarchical view of information needs

The writer identifies four main reasons why the Anthony's Triangle is becoming less appropriate to classify information system types. The reasons are as follows:

Reason 1: Organizations are getting more organic in response to the increasingly dynamic and complex external environment. The adhocracy organizational form (Mintzberg, 1983) becomes more effective under this situation. Thus the organizational

hierarchy notion (which is embraced by the Anthony's Triangle) is less relevant.

Reason 2: The Anthony's Triangle, being focused on an internal hierarchical view of organization, is not capable to classify information systems in terms of virtual-organizing capabilities (Venkatraman and Henderson, 1998). Despite this, it is, in the writer's view, quite capable to consider mobile information systems (Puuronen and Savolainen, 1997) in its framework as long as doing so is not against the hierarchical view of information needs as embraced by the Anthony's Triangle.

Reason 3: Contemporary information system types are mainly grouped into integrated modules of Enterprise Systems (Kalakota and Robinson, 1999). Therefore, they cannot be conveniently located in the Anthony's Triangle as an organizing framework.

Reason 4: Harry (1995) elaborates on the position that "both liberal and authoritarian views of hierarchy are logically unsustainable and practically irrelevant to the design and implementation of information systems..". His work fundamentally challenges the hierarchical view of information needs.

All the four reasons one way or another take issue with "the hierarchical view of information needs" underlying the Anthony's Triangle. Specifically, in contemporary organizational setting, the tendency is: (a) information flows in various directions and (b) people work with each other, both within an organization and without, in a virtual, real-time, transient and collaborative mode. Another concern of using the Anthony's Triangle to classify conventional information system types is that information system types, such as decision support systems practices and design as reported in the academic

journal of *Decision Support Systems* (Elsevier), have continuously been evolving. Thus, we are dealing with information system types that are not totally static in nature. In a nutshell, the Anthony's Triangle as an organizing framework (and the related one from Gorry and Scott Morton (1989).) to classify information systems types has some vital limitations, mainly due to the hierarchical view of information needs which it endorses. Are these limitations insurmountable? Maybe not. For a counter-argument, it can be said that the hierarchical view needs not be rigidly tied to management philosophies such as scientific management with which "men is an extension of the machine; useful only for doing things that the machine cannot do" while managers in senior positions are employed to do the planning and design tasks (Trist, 1983). Thus, for companies with human resource polices based on the human resources model (e.g., with an environment "in which all members may contribute to the limits of their ability") instead of the traditional model (e.g., tasks are broken down "into simple, repetitive, easily learned operations") (Miles, 1975: Chapter 3), employees of an organization are also encouraged to use information systems types that are related to strategic and tactical decision-making in which they actively participate. In this case, an Executive Support System (ESS) becomes an Everybody's Support System (ESS).

Other models to comprehend information system types in an organized way

There are other models to comprehend information systems, and three are examined here.

Example 1: Inmon, Imhoff and Sousa (2001) proposes the notion of an information ecosystem which is defined as "a system with different components, each serving a community directly while working in concert with other components to produce a

cohesive, balanced information environment". The physical embodiment of an information ecosystem, for these writers, is the corporate information factory (CIF), which has the following components: external world, applications, operational data store, integration and transformation layer, data warehouse, data mart(s), Internet/Intranet, metadata, exploration and data mining warehouse, alternative storage, and decision support systems. In addition, in the CIF model, user profiles with different information needs are explained. The CIF model is not primarily formulated as an organizing framework to classify information systems but it is not difficult to locate information system types, such as transaction processing systems, management information systems, decision support systems and executive support systems within the CIF model. Thus, the CIF model has clarification value as an organizing framework on information system types.

Example 2: Kalakota and Robinson (1999: 103) offers the e-Business Application Architecture, as an organizing framework on a number of e-business application clusters, i.e., knowledge-tone applications, enterprise applications integration, enterprise resource planning, customer relationship management, selling chain management and supply chain management. Their model does not adopt the conventional information system types of transaction processing systems, management information systems, decision support systems and executive support systems. Also, unlike the Anthony's Triangle, it is solely applied in the e-Business setting.

Example 3: Weill and Broadbent (1998)'s Information Technology Portfolio model identifies 4 subsets of Information Technology in an enterprise with different objectives, namely:
(i)   *Informational*: "Increased control; better information; better integration; improved quality" (Weill and Broadbent, 1998).

(ii) *Strategic*: "Increased sales; competitive advantage; competitive necessity; market positioning; innovative services" (Weill and Broadbent, 1998).

(iii) *Transactional*: "Cut cost; increased throughput" (Weill and Broadbent, 1998).

(iv) *Infrastructure*: "Business integration; business flexibility and agility; reduced marginal cost of business unit's IT; reduced IT costs over time; standardization" (Weill and Broadbent, 1998).

This portfolio model has some value for classifying information systems, but primarily for Information Technology (IT) investment purpose. The model itself is not incompatible with the hierarchical view of information needs and covers all information system types in an organization.

The three models provided above are basically supportive on the hierarchical view of information needs, but are concerned with other systems design factors. However, they are not primarily formulated for information systems classification purpose, thus they cannot replace the Anthony's Triangle for that purpose, especially from an organization-structural and decision-making perspectives. It should be noted that the subject of decision support system also provides its specific classification schemes, see Turban *et al.* (2001); however, it is solely confined to decision support system study and does not cover all information system types for an organization. Finally, there are many other frameworks, e.g., Ho (1997) and Ho and Sculli (1994), to study information systems but do not serve as organizing framework on information systems classification. Some of them, notably Ho (1997) and Ho and Sculli (1994), indicate the unitary perspective underlying all the information systems classification frameworks that have been discussed here. They recommend taking a multi-perspective to study information systems.

Concluding remarks

The topic of using a framework to classify information systems is a basic topic in the subject of information systems, with the Anthony's Triangle being the most popular one. It is recognized that many writers, e.g., Laudon and Laudon (2004) and Eromed Marseille School of Management (2015), are unprepared to explicitly use the term Anthony's Triangle in their works on information systems classification. The existing practices in introducing this topic in contemporary Information Systems references are summarized as follows:

(i) Happy to recognize the intellectual contribution of Anthony's work on the refinement of the hierarchical view of information needs and relevance to information systems classification.

(ii) Disagree to use the term the Anthony's Triangle for a framework that endorses the hierarchical view of information needs for information systems classification.

Whatever it is called, the Anthony's Triangle for information systems classification has good pedagogical value for students new to the subject of information systems. At the same time, the Anthony's Triangle has some major limitations for such as framework, though the literature on information systems pays insufficient attention to this topic. This paper thus serves a useful purpose by examining the nature and limitations of the Anthony's Triangle as well as offering some suggestions on notions that have relevance as organizing frameworks on information systems classification. In the writer's view, achieving this purpose does offer some academic and pedagogical values. Lastly, continuous effort should be maintained to refine and development frameworks for information systems classification as the field of information systems is quite dynamic. For this kind of exercise, Anthony

(1988: 4-7)'s ideas on the value of frameworks are still informative.

BIBLIOGRAPHY:

Anthony, R.N. 1988. *The Management Control Function*. Harvard Business School. Boston. Massachusetts.

Eromed Marseille School of Management. 2015. "Why are there different types of information system?" Eromed Marseille School of Management, World Med MBA Program – Information Systems and Strategy Course (url address: http://www.chris-kimble.com/Courses/World_Med_MBA/Types-of-Information-System.html) [visited at March 24, 2015].

Gorry, G.A. and M.S. Scott Morton. 1989. "A Framework for Management Information Systems" *Sloan Management Review* Spring: 49-61.

Harry, M.J.S. 1995. "The Eternal Triangle" in Ellis, K., A. Gregory, B.R. Mears-Young and G. Ragsdell. (*editors*). 1995. *Critical Issues in Systems Theory and Practice*. Plenum Press. London: 309-313.

Ho, J.K.K. 1997. "MPSB Frameworks and Decision Support Systems studies" *Systems Research and Behavioral Science* 14 (4). Wiley. Chichester: 287-293.

Ho, J.K.K. and D. Sculli. 1994. "A Multi-perspective, Systems-based Framework for Decision Support Systems Design" *Systems Practice* 7 (5). Plenum Press: 551-563.

Inmon, W.H., C. Imhoff and R. Sousa. 2001. *Corporate Information Factory*. Wiley. Chichester.

Kalakota, R. and M. Robinson. 1999. *e-Business: Roadmap for Success*. Addison-Wesley.

Laudon, K. and J.P. Laudon. 2004. *Management Information Systems: Managing the digital firm*. Pearson Education, Inc., Upper Saddle River, New Jersey, 07458.

Lucey, T. 1997. *Management Information Systems*. Continuum. London.

Miles, R.E. 1975. *Theories of management*. McGraw-Hill, Kogakusha, Ltd.

Mintzberg, H. 1983. Structure *in Fives: Designing Effective Organizations*. Prentice/Hall International, Inc.

Neumann, S. 1994. *Strategic Information Systems: Competition Through Information Technologies*. Maxwell Macmillan International. New York.

Prezi.com. 2013. "Anthony's Triangle" Prezi, January 22, 2013 (url address: https://prezi.com/wh3_j2jmylr_/anthonys-triangle/) [visited at April 4, 2014].

Puuronen, S. and V. Savolainen. 1997. "Mobile information systems – executive view" *Information Systems Journal* 7. Blackwell Science Ltd.: 3-20.

Trist, E. 1983. "5: A socio-technical critique of scientific management" in Lockett, M, and R. Spear. (*editors*). *Organiastions as Systems*. The Open University Press, Milton Keynes: 56-65.

Turban, E., E. Mclean and J. Wetherbe. 2004. *Information Technology for Management*. Wiley.

Turban, E., J.E. Aronson and N. Bolloju. 2001. *Decision Support Systems and Intelligent Systems*. Prentice Hall.

Tutor2u. 2012. ICT – types of information system. Tutor2u.net September 23, 2012 (url address: http://tutor2u.net/business/ict/intro_information_system _types.htm) [visited at March 24, 2015].

Venkatraman, N. and J.C. Henderson. 1998. "Real Strategies for Virtual Organizing" *Sloan Management Review* Fall: 33-49.

Weill, P. and M. Broadbent. 1998. *Leveraging the new infrastructure*. Harvard Business School Press. Boston. Massachusetts.

Wikipedia. 2015. Anthony Triangle. (url address: http://en.wikipedia.org/wiki/Anthony_Triangle) [visited at March 24, 2015].