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Be on Guard for Networking Failures in a Public System

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Abstract

Networks and networking tend to be regarded as beneficial for individuals and organizations. However, embeddedness in networking efforts can be counterproductive and bring unexpected negative consequences - networking failures. Many studies have been concentrated on technical breakdowns in addressing networking failures. They paid little attention to other factors or mechanisms. This technical-oriented approach hinders system managers from foreseeing the formation and changes of a system, particularly a public system, in due course. This article employs a deductive approach to study the facade of networking and its failures. By proposing a network typology, it scrutinizes the fundamental building blocks of any networks and standard functionalities, explores the laws governing any networks' operations, and traces the possible dysfunctions of networks in static and dynamic environments. Based on the explorations, this research introduces a new tool. It argues that by borrowing the principles embedded in the *Doctrine of the Mean*, it could help prevent disaster seeds from growing in a functional network.

Keywords: building blocks of a network, networking laws, static failures, dynamic failures, the Doctrine of the Mean

1. Introduction

A Chinese proverb says that a disaster is a bed to grow luck, and luck always contains a disaster seed. Applying this dialectical idea to current networking research, we can observe a noticeable asymmetry. Many have been written on a network's functioning (Ter Wal et al. 2020, Dennissen, Benschop and den Brink 2019, Casciaro, Gino and Kouchaki 2016, Charan 1991). For example, social capital theory discusses social networks' benefits at both the individual and group levels. System integration study displays the aggregate effects of a network. Collective competition analysis emphasizes strategic, cultural, and ethnic factors attributed to the success of networking.

However, few studies have considered the dysfunction of a network or the harmful elements associated with networking except technical failure (Hongyan et al. 2020). Without a good understanding of the dark side of networking, it is challenging to build effective networks because before you can think outside the box, you need to know what is inside it (Kelly 2001).

Given this background, this article aims to examine types of network failures and the reasons or environments causing these failures. This paper will discuss the strategic considerations for preventing disaster seeds from growing in a functional network based on this understanding.

This paper is exploratory research. It employs a deductive approach to advance our overall understanding of the limitations of networking. This research is divided into the following sections. Section one discusses the building blocks of a network. The knowledge transformation process suggests that hardware, medium-ware, and fluid-ware are three essential network construction components. The combination of these building blocks forms two types of networks. One synchronizes different identities for exchanging resources and seeking dynamics. The other connects similar identities for aggregating strength or power. The increasing interlinks of various networks--resulted from each member's multiple roles in a network--constitute the current network-oriented world.

Section two analyses networking mechanisms by identifying Christensen's Law and examining the linkage of various networking laws. It argues that four rules or laws are beneficial for understanding a network's evolution in the current world: Moore's Law, Metcalfe's Law, Murphy's Law, and Christensen's Law. Moore's Law states the increasing connection power of hardware in building a new or renewing a traditional network. Metcalfe's Law describes a positive relationship between certain network functionality and the members of the network. Murphy's Law outlines the linkage between possible dysfunction and actual failure. Christensen's Law states that a functional organization tends to be dysfunctional in a dynamic environment. Identifying the four laws and their linkage enables us to overcome the bias to aggregation effects of a network in previous studies and have an in-depth understanding of networking evolution.

Based on the four networking rules, section three examines three possible network failures in a static environment: function failure, interface failure, and efficiency failure. Function failure means that the original purpose of a network could not be fulfilled due to a logic disorder that occurred in network design and implementation. Interface failure implies that part of a network could not be functional due to synchronization barriers. Efficiency failure means that a network delivers a function at a high cost due to the underdevelopment of network components or inappropriate organization.

Section four examines three possible network failures in a dynamic environment: initiation failure, implementation failure, and adaptation failure. Initiation failure means that the network could not renew or upgrade itself due to disability in collective learning. Implementation failure means that a network could not harvest what it has initiated due to lower knowledge transferability within the network. Adaptation failure means that a network could not respond to environmental changes due to the rigid organization of the network.

To deal with these possible-networking failures at both static and dynamic levels, section five integrates the basic idea of the Doctrine of the Mean--traditional Chinese management thinking—into networking management. It states that the Doctrine of the Mean emphasizes two aspects in dealing with a complex world. One is trying to stay in the middle when there is a spectrum of situations or actions. The other is to keep several vital linkages stable by keeping several virtues. Borrowing these ideas, we suggest that the following 3 S' should be the cornerstones in networking management: stick to the middle, stabilize critical relationships, and streamline networking efforts. They are particularly of value for managing a public system.

2. Building Blocks of a Network

There appears to be no means of escaping the spread and implications of networks of different types and forms at the current world, as networking are so closely interwoven into every aspect of our daily existence. Yet there still remains different opinions over what networks are and how they operate. Network is used as both a noun and a verb. In some circumstances, networks imply a set of external relationships. In others, networks mean ways by which new organization are and will be made—which could be formal linkages across functional/institutional boundaries, or informal ties among members as floating teams. Still other people define networks as new ways for members to share information, using management information systems, and other such tools (Charan 1991, Castells 1996). In order to obtain an in-depth understanding, we start our exploration on networking from scrutinizing several basic ideas. As shown in Figure 1, the usage of a network, elements of networking value and building blocks of a network are discussed respectively in this section.

2.1 Networking Usage

Although the definition varies, the opinions over the usage of networks are convergent. There are two answers for why individual or organizations link together in interconnected networks. One answer is that individuals and organizations have to enter into exchanges to acquire resources that they need and do not have (Cook, 1977; Emerson, 1962; Galaskiewicz & Marsden, 1978; Levine & White, 1961; Lincoln & McBride, 1985; Van de Ven & Walker, 1984). This reasoning suggests that individuals or organizations that are dissimilar may become linked (Wholey 1993). In such a background, a network synchronizes different identities or segments for exchanging resources and seeking dynamics.

A second answer is that similarity, or "homophily," determines linkages (Wholey 1993). The similar individuals or organizations cooperate to pursue joint goals (Alter, 1990; Provan, 1983; Whetten & Aldrich, 1979; Wiewel & Hunter, 1985), coordinate efforts to effectively deliver services (Litwak & Hylton, 1962; Morrissey, Taussig, & Lindsey, 1986; Oliver, 1990; Provan, 1983), and develop joint programs (Aiken & Hage, 1968). This reasoning suggests that individual and organizations with similar social status, treatment ideologies, clients etc. may become linked. In such a circumstance, a network connects similar identities or segments for aggregating strength or power.

2.2 Networking Value

The above usages display the functionalities of a network or the value of networking. To further explore the concept of networking value, we define it here as extra usages or utilities generated from interconnection. Based on this definition, the foundation of networking is interconnectivity, while the soul of networking is value add-on.

Consider a traditional business operation: after sourcing materials and services from its suppliers, an organization conducts certain processing activities through coordinating different function areas, then it delivers the enlarged value to its customers. Differing from the individual organization operations, the value creation process of networking could happen in such an environment, in which suppliers and customers may be the same groups of individuals and organizations. The same as the individual organization operations the value creation process of networking involves old value conversion and new value creation activities. Combining the similarity and difference, a three-level networking value structure is suggested here. The networking value consists of, from the lower level to the higher level, Transplanted value, Synchronized value, and Innovated value.

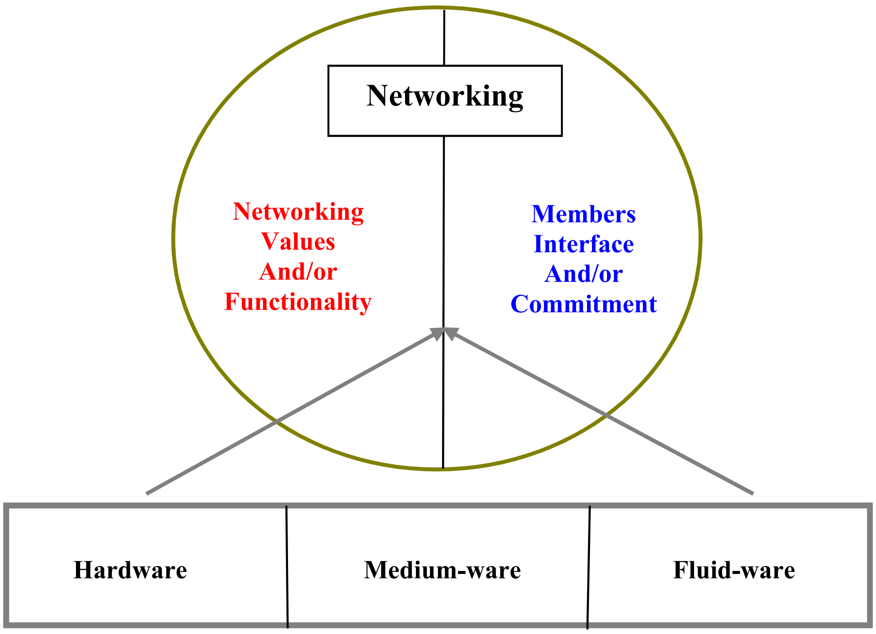

Figure 1. Functions and components of a network

Transplanted value reflects the collection of existing values brought about by partners or members into the network without much changes. This portion of value flows within the network and could be shared by the members. The flow patterns of the transplanted value are affected by inflow-value structure and the network's designed functionality. For example, a product/service-oriented network such Apple-users network usually has an uneven flow pattern. A purpose-oriented network such as interests groups usually shows a quite even flow pattern. Analyzing networked business, it reveals that a substantial portion of the value these businesses generate arises from the "transport effect" -- the value inherent in connecting an entry point in the network to a desired exit point (Coyne and Dye 1998). Franchising, membership developing, merging and acquiring similar business activities, and licensing can be seen as measures for increasing transplanted value of a network. Generally speaking, the more value brought about to a network by the members, the larger the overall networking value is. However, the conflicts among the value flows brought about by the members tend to reduce the networking value at this level.

Synchronized value is generated from eliminating redundant and conflicts among members when they channel in their values into a network, which is one of the most important preconditions of sustaining a network. An indicator for generating synchronized value is the changes of relationship pattern and behaviors of members. These changes are driven by the frequency, intensity, and honesty of the dialogue among members on specific priorities. Sharing information openly, visibly, and simultaneously allows the network to become self-correcting. New information inspires debate, triggers action, generates offers of assistance from network members (Charan 1991)— Merger and acquisition among different businesses can be seen as a sign of starting to generate synchronized value, while new debates, new norms and standards, and associated restructure of organizations from network members are measures for increasing synchronized value.

Innovated value means new usages derived from transplanted and synchronized values in an interconnected environment. Differing from transplanted value and synchronized value, innovated value usually solves problems that have not been defined or sorted out at individual segment level. In generating innovation value, a network becomes the vehicle to redirect the flows of information and decisions, the uses of power and resources, and the loops of feedback within the network (Charan 1991). This type of value can be observed from cooperation among different organizations in developing new products/services, new channels and new organizations. Due to the existence of innovation value, a network is dynamic.

2.3 Networking Components

No matter what functions to pursue, and what combination of the three levels of networking value to possess, a network usually consists of three types of components in terms of knowledge existence forms: hardware, medium-ware and fluid-ware. This division highlights the endogenous dynamic of our society in generating and materializing concepts: knowledge embedded in human bodies is embedded into materials, tools and other useful media (Lan 1996, 1998, 2000).

Hardware refers to different man-made materials and equipment. It is the sum of all existing tangible assets such as factories, cars and computers. This part of knowledge is an entirely embedded human creation and serves as a tool to carry out certain tasks. Contrasting with fluid-ware, hardware is tangible and can be moved independently. Contrasting with medium-ware, hardware can be used independently and is lack of flexibility or dynamics. In networking efforts, computers, cables, modems, satellites, wireless appliances, and various facilities are in this category. Generally speaking, the larger the portion of hardware in a network, the closer linkage among members of the network, and the larger the transplanted value is.

Medium-ware, as its name suggests, lies between hardware and fluid-ware. It is mainly in the form of design, written documents and other media outputs of materializing human concepts. In other words, it is a meaningful set of information articulated in clear language including numbers or diagrams and carried in media other than the human body. Written language, art, recipes, codes, software etc. are all in this category. It is worth noting that medium-ware includes traditional software and is different from middleware. Medium-ware is a type of knowledge, which lies between hard form and pure soft form knowledge. It is collection of software, regulations, instructions, planning, and other coded knowledge. Middleware is a type of software, which lies between server and client. Differing from hardware, medium-ware cannot be effectively functional without further transforming into or being combined with hardware. Differing from fluid-ware, medium-ware is no longer embedded in the human body and can be transferred separately and explicitly. In networking efforts, codes, software, rules, guidelines and constitutions are in this category. Generally speaking, the larger the portion of medium-ware in a network, the clearer functionality of the network, and the larger the synchronized value.

Fluid-ware refers to people's skills and experiences acquired in fulfilling various tasks including intuitions, unarticulated mental models or in simple language, human brainpower or creativity. Other terms such as tacit knowledge, intellectual capital, social capital and "wet ware" are also used to describe this type of knowledge. Differing from hardware and medium-ware, fluid-ware is still accommodated by the human body. Therefore, it is entirely intangible with characteristics of the personal, context-specific, and not so easy to communicate to others. It can only be transferred through people's movement and contact. When individual persons die, embodied knowledge will disappear. Differing from medium-ware, fluid-ware is not fixed. This type of component cannot be captured in databases and spreadsheets and that remains hidden in most cases. In networking efforts, people, philosophy, value, relationship, experience and skills are in this category. Generally speaking, the larger the portion of fluid-ware in a network, the more dynamic the network is, and the higher potential to obtain innovated value.

So, a network such as the Internet might be described as part hardware, part medium-ware, and part fluid-ware. Accordingly, the destiny of the network will be shaped by the combination and interaction of the three components, which affects the features of a network and its functionality. For example, in analyzing the development of a communication system, Valvic (2000) lists three bottlenecks. One is internal bandwidth bottleneck, which is associated with computing power or hardware. Another is connection bandwidth bottleneck, which is mainly associated with medium-ware. The other is thinking bandwidth bottleneck. He argues that human beings represent a bottleneck, a place where the flow of information is constricted in current communication network.

3. Insides into Networking Laws

Increasing interconnectivity not only releases or generates networking value, but also changes or activates rules governing the creation and deduction of networking value. For example, a shared infrastructure decreases the importance of proprietary economies of scale, as each competitor piggybacks on the capacity of rival networks. Interconnection opens up the possibility of competing at the wholesale level by buying and selling network capacity (Coyne and Dye 1998). The price of information products is not determined by marginal production costs, instead by the utilities of the products (Shapiro and Varian 1999). More consolidation occurs in an industry such as Music industry, which generates new technology, new standards, new channels, new business models and new legal questions (Geis and Geis 2001). Based on these problems which cannot be solved by known rules and procedures, this section identifies four rules which are extremely useful for understanding the evolution of a network in the current world: Moore's Law, Metcalfe's Law, Murphy's Law, and Christensen's Law. As shown in Figure 2, Moore's Law and Metcalfe's Law tend to increase networking value, while Murphy's Law, and Christensen's Law show the tendency to erode networking value.

3.1 Moore's Law

Named after Gordon Moore, cofounder of Intel, Moore's law states that for the same cost, computer processing power double every 18 months. A similar law in telecommunication is called Gilder's Law. Named after a productive journalist George Gilder, Gilder's Law states that communications power, or bandwidth, is doubling every three or four months at present.

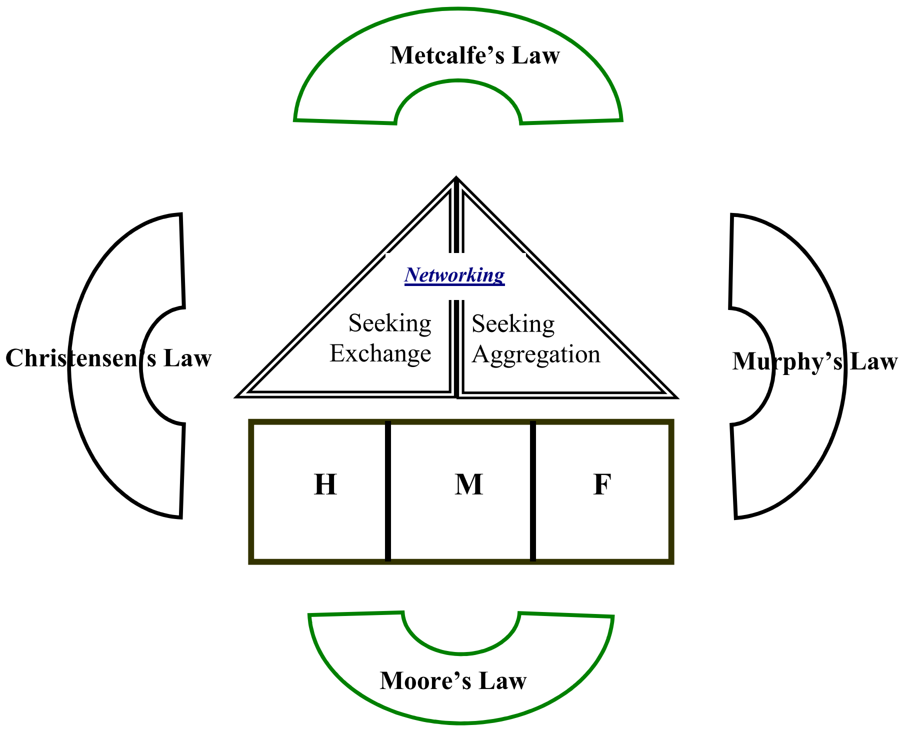

Figure 2. Networking laws

Moore's and Gilder's Laws imply that everything having to do with digital technology gets relentlessly smaller, faster, and cheaper (Downes and Mui 1998), and everything having to do with communication becomes increasingly simultaneous, effective and convenient.

It is apparent that Moore's and Gilder's Laws display the push for networking from supply side. This push is reflected in two aspects. First, it is easier to set up a hardware infrastructure of a network. Secondly, it facilitates the interaction among different components.

3.2 Metcalfe's Law

Named after Robert Metcalfe, founder of 3Com, Metcalfe's law states that the overall value of a network increases exponentially with every additional user. It displays the relationship between members and aggregate effects of a network. It states that users of "network" products tend to value those products more highly when there are a large number of users. The equation $V=(N^2-N)/2$ shows that the value of a network increases as the square of the number of its users.

Metcalfe's law implies that everything having to do with networking gets stimulation to grow larger, and everything having to do with shared consumption becomes increasingly identical in interface.

Metcalfe's law displays the push for networking from demand side. This push is also reflected in two aspects. First, users tend to attract more users to share or strength functionality of a network, and increase synchronized value. Secondly, networking service/product providers tend to attract more users to reduce costs, and increase transplanted and innovated value.

3.3 Murphy's Law

It was Murphy who first observed that if anything can possibly go wrong, it will go wrong. Deceptive in its simplicity, this profound insight marked a turning point in our understanding of why things happen the way they do.

Murphy's law implies that every link within a network can be a possible reason for the breakdown of the network; no matter it is caused by stupidity or accidents. A fundamental tenet of system is that a chain is only as strong as its weakest link.

Murphy's law displays a brake for networking from supply side. The more complex the network is, the more chances the network suffers networking value deduction.

3.4 Christensen's Law

The above three laws are mainly drawn from industry experience and observation. They have been known for certain degree. Christensen's law we name here is originated from Professor Clayton Christensen's systematic academic research on innovation, and its publicity is still confined to academia.

In fact Christensen's law is one step further than Murphy's Law. If Murphy's Law states that anything can go wrong, it will go wrong. Christensen's law states that nothing can go wrong; it will still go wrong. Functional organization tends to dysfunction in a dynamic environment. It suggests that successful functional integration is a liability if the complexity of the environment changes.

One may notice the similarity between Christensen's Law and Ashby's Law of Requisite Variety. Ashby's Law states that the variety in the control system must be equal to or larger than the variety of the perturbations in order to achieve control. However, Christensen's law does not limited to degree of variety. It argues that success brings about failures.

Christensen's Law displays a brake for networking from demand side. The success of networking at certain level may keep it from moving into next level.

3.5 Synergy of Networking Laws

The Moore-Gilder Law mainly deals with the supply side of networking, particularly hardware and medium-ware. It answers why in the current worldwide networking is possible.

Metcalfe's Law is to show how Networking Value is generated, mainly measured and based on it how willingness and capacity can be added on.

Murphy's Law shows that more interface, more failure opportunities. It is a counterforce for increasing Network value.

Christensen's Law shows problems out of nowhere. Nothing could go wrong; it still goes wrong. It is also a counterforce for increasing Network value.

4. Networking Failure in a Static Environment

When a network is setting up and operating in a static environment, the overall pattern of relationship is stable, which is reflected in connections among members, linkages between different network components, and relationship between the network and its external environment. In such an environment, networking may suffer three possible failures: function failure, interface failure and efficiency failure as shown in Figure 3.

4.1 Function Failure

Function failure reflects the inability of a network to create utilities for members. As we discussed in section one that there are two basic functions for a network. One is to seek aggregation, such as franchising. The other is to seek exchange such as the First Tuesday. When a network is aggregation oriented, the members have the same goal, share standards and streamline procedures. When a network is exchange oriented, the members select a common target, share conversion mechanism and streamline activities. The development network is designed to make these trade-offs more quickly and more skillfully, and to create a new function.

No matter which functionality is pursued, a network could fail to delivery its functionality caused by failure to protect welfares of members from jeopardizing such as outsiders' breaking through or security failure, and interests conflictions among members. Function failure means that the original purpose of a network could not be fulfilled. This can be the reasons of a logic disorder occurred in network design stage or implementation stage.

This may happen when the actions of one member have unanticipated consequences for others. Complex systems have behavioral characteristics that are generally unknown to members until they are observed in reality. The Beer Game (unanticipated effects of uncoordinated rational planning in a beer supply chain) is a famous example.

4.2 Interface Failure

It is a distinguishable feature of a network to have many intermediate nodes, which are places for interconnection occurring. Through these nodes, intension, materials, services or other information are selected, or translated, or converted, or passed to a destination. The complexity of a network is directly determined by the existence of these nodes: whether they are identical; whether they are in multiple levels; whether they care about the contents passing through them; and whether they perform the same function temporally and spatially.

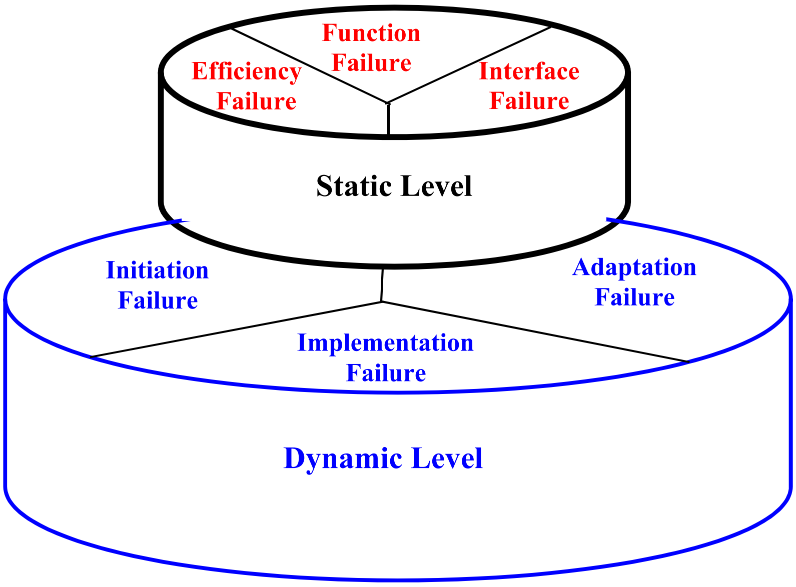

Figure 3. Networking failures at two levels

There are several functions played by a node. The first is recognition when the node is linked to other nodes or destinations. The second is requirements processing. The third is correction. The existence of nodes suggests the importance of interface in a network, because interface expands the network. Moore's law increases the capacity of each node; while Murphy's law increases frequency of break down of a network. Metcalfe's law attracts more nodes into a system, while Christensen's Law leads to chaotic fluctuation of the network.

Interface failure means that part of a network could not be functional due to synchronization barriers. Interface failure reflects incompatibility between at least two sub-systems. Network members may operate on the basis of false assumptions about how the system works or how resources, incentives, or disincentives will be allocated. Many examples of attempted university-industry linkages have shown that incommensurate value systems prevent networks from functioning.

Among the synchronization barriers, trust and trustworthiness are key issues, because trust was claimed as a type of expectation that alleviates the fear that one's exchange partner will act opportunistically (Bradach and Eccles 1989: 104). The real danger without trust is that different value systems will fail to collide. A collision might at least foster evaluation, dialogue, change; but the concern is that they might just quietly exchange places in the chaos of a transitional society “distracted from distraction” (Valovic 2000)

4.3 Efficiency Failure

The efficiency of a network is first determined by the overall structure of functionality delivery media, which is subject to the combination of hardware, medium-ware and fluid-ware, but with a hardware orientation. For example, in communication networking, transmission media plays a central role: a packet switching data delivery system is much more efficient than a system using a circuit switching system; in a business network, the Internet-based supply chain management system is much more efficient than a paper-based supply chain management system. Moore’s law drives the expansion and upgrading of the delivery media; while Murphy’s law brakes the process.

However, the efficiency of a network is also affected by the media adaptation—willingness and capacity to use the delivery media, which is mainly controlled by the combination of medium-ware and fluid-ware with a fluid-ware orientation. For example, in different business networks, the application of the same E-business software suits such as ERP, SCM, CRM or E-procurement show huge difference in generating outputs. In this area, Metcalfe’s law is a positive driver, while Christensen’s Law is a negative driver.

Efficiency failure means that network delivery functions at a high costs. This failure only occurs when there is more than one network. It is another erosion of Networking Value. The reasons for efficiency failure could be the underdevelopment of network components or inappropriate organization of these components. It usually takes a longer time to reveal efficiency failure, because the complexities of a network do not become readily apparent until you have spent a lot of time roving its virtual corridor (Valovic 2000).

5. Networking Failure in a Dynamic Environment

In a dynamic environment, the overall pattern of relationship related to networking is turbulent. Connections among members subject to changes; linkages between components of networking building blocks vary; and relationship between the network and its external environment is different. In such an environment, networking experiences three possible failures: initiation failure, implementation failure and adaptation failure.

5.1 Initiation Failure

Schumpeter (1934) argued that new sources of value are generated through novel deployments of resources, especially through new ways of exchanging and combining resources. In analyzing networking values in section one, we identify innovated value as the highest level value derived from transplanted and synchronized values in an interconnected environment. In this given background, initiation failure means that the network cannot renew or upgrade itself, so that new usage or value can be generated.

Two factors attribute to the initiation failure. One is inability to induce collective learning, which is associated with function failure and interface failure. In such an environment, new problems cannot be defined at an aggregation level. Further more, new efforts cannot be synthesized through cooperation among members or partners. Therefore, collective learning is difficult to be transferred to next level coherence in recognition and behavior. Without such a progress, the condition for successful creative work—members take a single set of standard for granted—cannot be guaranteed (Kuhn 1962).

The other is unwillingness to induce collective learning, which is usually associated with the successes in preventing function, failure, interface failure and efficiency failure. It means that one level oriented success hinders development of the next level oriented operations. For example, to keep networking value from being eroded, secure the network is necessary. Various measures are adopted in doing so (Chapman and Zwicky 1995). Least privilege is one of them. It means that any object should have only the privileges the object needs to perform its assigned tasks and no more. This arrangement did not leave room for a member to initiate any new activities. Universal participation (absence of active opposition) is another measure. While it unifies your arrangement, it does not tolerate any difference. In most function, interface and efficiency oriented systems; simplicity is preferred to complexity. The same as fish does not survive in pure water, keeping efficiency or function failure may also cause initiation failure—Christensen's law.

5.2 Implementation Failure

Initiate new knowledge is only half way for a network to create new networking value. One way to complete this creative cycle is to internalize its creation. When a network fails to do so, it is called implementation failure.

Generally speaking, implementation failure means that what has been initiated through the network cannot be harvested by members. This failure can be seen in two situations. One is to fail to pick up one of many initiatives, which could generate the best networking value. The other is to fail to go through the cultivation process. No matter in which case, low knowledge transferability within the network is a reason for this failure.

There is a dedicate balance between creating an environment that promotes the generation of new ideas and knowing when to gracefully drop a particular idea or business concept in favor of a more attractive one. The critical mind-set shift that this juncture is to recognize that risk mitigation, not avoidance, is the key driver to pursue an idea. In a networking environment,

Dörner (1996) has described the phenomenon of "intransparency" in complex systems: actors cannot see into the system so they don't know how it works. Therefore, they make mistakes how and why the system behaves as it does. They have insufficient "structural knowledge" to produce a "reality model" that serves as a cognitive map to the system they are in.

Stronger network ties are not the same as better network ties. Ritter et al. (2001) have shown that weak network ties are usually the most valuable ones – these ties are to parallel networks that provide valuable or comparative information.

5.3 Adaptation Failure

In a dynamic environment, a network develops via two paths. One is to initiate change and internalize the change. The other is to adapt to environment challenges. The latter plays a more important role for most networking efforts. So Valovic (2000) argues that evolution is about adaptation. Humans adapt both tactically through education and strategically through evolution.

Adaptation failure means that a network cannot respond to environmental changes appropriately or quickly enough for maintaining or developing networking value. This failure attributes to two sets of factors. The first set of factors is associated with internal or structural features of a network. For example, in order to reduce the leaking of network value, Chock Points which forces flows in a narrower channel are necessary. They are used for monitoring the interface between a network and its environment. The fewer the chock points, the safer the network is. However, the least chance it offers for the network to adapt to environment changes.

The second set of factors is associated with the diversity of a network and its internal interface. A network with more synchronized value experiences more difficulty to face environmental challenges, because of high synchronizing cost and re-synchronizing costs.

The same as initiation failure, adaptation failure is usually associated with the successes in preventing function failure, interface failure and efficiency failure—Christensen's law—even nothing could go wrong, it could still go wrong.

6. Integrating "The Doctrine of the Mean" into Networking Management

As networking is increasingly interwoven into every aspect of our daily existence, and networking represents a decisive break with the past (Charan 1991) technology businesses today must re-contextualize their business principles; they must find ways of adapting old-world business rules with new-world implementations (Kelly 2001). To deal with possible-networking failures at both static and dynamic levels, this section integrates the basic idea of the Doctrine of the Mean--traditional Chinese management thinking—into networking management, as shown in Figure 4.

6.1 Introduction to the Doctrine of the Mean

The Doctrine of the Mean, a traditional Chinese management thinking, has been a cornerstone for defining and managing relationship or "personal contacts" oriented complex system. While the spread and implications of networks are penetrated into every aspect of our current life, it needs a reference system for scholars to obtain a more comprehensive and thorough understanding of very nature of networking - why they exist, the dynamics associated with the formation and perpetuation of such networks, and how we can make the most of such networks

Reviewing the Doctrine of the Mean, the following points are worth noting:

- The superior man embodies the course of the Mean; the mean man acts contrary to the course of the Mean.
- The knowing go beyond it, and the stupid do not come up to it.
- (Shun) took hold of their two extremes, determined the Mean, and employed it in his government of the people.
- The superior man cultivates a friendly harmony
- "When one cultivates to the utmost the principles of his nature, and exercises them on the principle of reciprocity, he is not far from the path. What you do not like when done to yourself, do not do to others.
- The duties are those between sovereign and minister, between father and son, between husband and wife, between elder brother and younger, and those belonging to the intercourse of friends.
- Knowledge, magnanimity, and energy, these three, are the virtues universally binding.
- The means by which they carry the duties into practice is singleness.
- Some are born with the knowledge of those duties; some know them by study; and some acquire the knowledge after a painful feeling of their ignorance. But the knowledge being possessed, it comes to the same thing. Some practice them with a natural ease; some from a desire for their advantages; and some by strenuous effort. But the achievement being made, it comes to the same thing.
- To be fond of learning is to be near to knowledge. To practice with vigor is to be near to magnanimity. To possess the feeling of shame is to be near to energy.

Based on the key issues of the Doctrine of the Mean, the rest part of the section discusses the 3 S' of networking management borrowed from the Doctrine of the Mean: stick to the middle, stabilize key relationships, and streamline networking efforts.

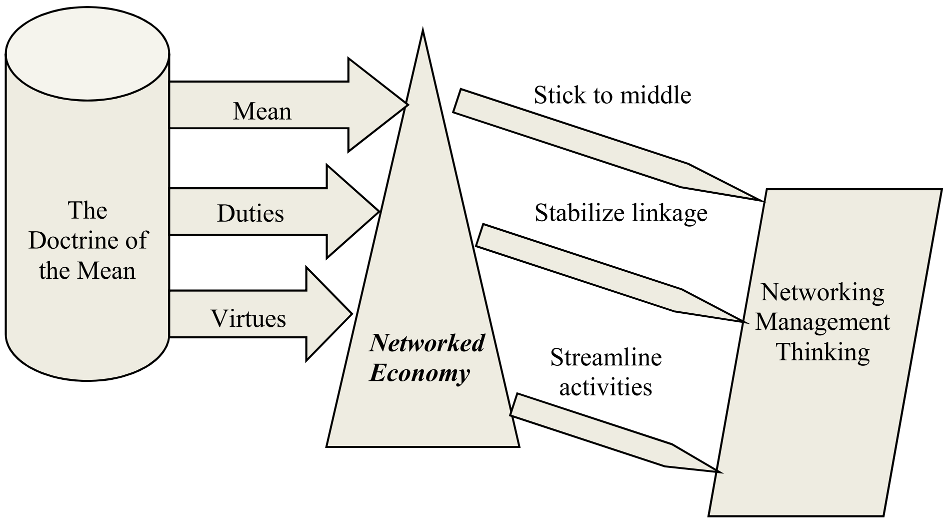

Figure 4. Importing of the doctrine of the mean into networking management

6.2 Stick to Middle

Stick to middle is the core of The Doctrine of the Mean. It shows at least two meanings. When referring to the same action, it means that degree of the action should be appropriate. It should neither overdo or go beyond it, nor do not come up to it. When referring to various actions, it means that having a balance and cultivating a harmony are necessary.

There are many reasons for having a balance and cultivating a harmony in management area. However, in networking management, as discussed in the last two sections that networking failures can happen in different situations. It is very difficult to keep a network from all the failures at the same time. In order to deal with such inter-trigged networking dysfunctions, stick to middle is an easy and also effective choice. One advantage of sticking to middle is to gain a result of fail-safe (Chapman and Zwicky 1995), which means when the networking is going to fail, or some networking efforts are going to fail, let it or them fail in such a state that this not incur more damage to the members.

To employ the rule of stick to middle, one has to sort out networking action options, so that two extremes can be identified; the middle way can be determined; and associated measures can be adopted.

Stick to middle has a wider application in various networking or organizing activities. The handling of half work and half leisure state is an example. The state of half work and half leisure constitutes the very definition of postmodern hell: The individual is never fully in a state of either relaxation or productive professional employment but rather is suspended in the continual tension between the two…In fact, the two distinct areas of human activity may be merging into something that is altogether different but shares attributes of both (Valvic 2000)

6.3 Stabilize Key Linkages

Dörner (1996) argues that the most successful complex systems have the characteristic of "efficiency diversity" – many possibilities for actions that have a high probability of success. Further more, networked structure with several backbones represents an ideal organizational structure for facilitating the development and implementation of effective networks.

One feature of the Doctrine of the Mean is reflected in its arguments on fixed relationship between sovereign and minister, between father and son, between husband and wife, and between elder brother and younger one. Discharging the outdated contents, the format of the Doctrine of the Mean can be borrowed to form a networked structure with several stabilized linkages.

These stabilized linkages have to be established based on interconnectivity and aim to generate networking value, i.e. transplanted value--the collection of existing values brought about by partners or members into the network without much changes; synchronized value--eliminating redundant and conflicts among members when they channel in their values into a network; innovated value--new usages derived from transplanted and synchronized values in an interconnected environment. Keeping key linkages stable will help either to enlarge the network coverage, or upgrade networking value.

6.4 Streamline Basic Activities

There are many efforts are involved in networking activities. The Doctrine of the Mean also offers certain help in organizing these relationship-oriented activities. The following three approaches are valuable in streamlining basic networking activities: approach for nuclei, approach for reciprocity, and approach for similarity:

Approach for nuclei shows how to cultivate a seed in a networking environment. The training of a nucleus usually follows two stages: from inside-oriented stage to outside-oriented stage. As Kung tzu said "He who knows these three things knows how to cultivate his own character. Knowing how to cultivate his own character, he knows how to govern other men. Knowing how to govern other men, he knows how to govern the kingdom with all its states and families".

Approach for reciprocity shows how to organize information flows in a network. "What you do not like when done to yourself, do not do to others." Based on this principle of reciprocity, the means by members to carry their duties into practice will become singleness.

Approach for similarity emphases the results and ignore the differences in process. It could help us to eliminate unnecessary discrimination in networking. "Some are born with the knowledge of those duties; some know them by study; and some acquire the knowledge after a painful feeling of their ignorance. But the knowledge being possessed, it comes to the same thing. Some practice them with a natural ease; some from a desire for their advantages; and some by strenuous effort. But the achievement being made, it comes to the same thing".

7. Conclusion

In summary, this paper argues that any network consists of three types of components: hardware, medium-ware, and fluid-ware. Network functions—whether it is for exchanging resources by synchronizing different identities or aggregating strength by connecting similar identities—are governed by four laws: Moore's Law, Metcalfe's Law, Murphy's Law, and Christensen's Law. The co-functioning of these laws makes a network dysfunction in six possible situations. Three networking failures possibly happen in a static environment: function failure, interface failure, and efficiency failure. There are other three dysfunctions associated with networking efforts in a dynamic environment: initiation failure, implementation failure, and adaptation failure. The dilemma here is that it is complicated to keep a network from all the failures simultaneously. To deal with such inter-trigged networking dysfunctions, it is valuable to incorporate some essential thinking of Confucian's The Doctrine of the Mean into networking management. It suggests a toolkit based on Confucian ideas. The simplified networking management system's hallmarks consist of 3 S': stick to the middle, stabilize critical relationships, and streamline networking efforts.

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