"The power of the network and how it affects you"

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Status Quo

Everything relates to everything else. This may sound rather maximal but is it really? You, reader, may well be reading this article on a magazine while sipping a Greek coffee made with Arabica beans, sitting on a chair designed in Sweden, made in China from timber imported from Denmark. The WWW, our supply chains and our transportation infrastructure are beautiful examples of how modern systems increase coupling to achieve more with less. Alas, heightened connectivity comes with a cost. A falling tree can leave 50 million people without power; a small fire can *risk* bringing down the world's biggest car manufacturer and the collapse of one financial institute can endanger the entire economy.

But why should you care, after all it's probably some politician's fault. I hope some figures will make it clear – the annual cost of such power outages is estimated between 88-188 billion USD; similarly, the estimated cost of the recession resides between 6-8 trillion USD – both in the USA alone. These are extraordinary losses in terms of resources and we are in desperate need of imaginative risk experts to shield protect our society from such asymmetrical cascades. But where do such cascades arise and why do they occur in the first place? Can we defend such enterprises from experiencing such losses, or even better, eliminate their occurrence completely?

Knowledge

Recent scientific research has revealed an important property of these systems – their *interconnections*, because of their increased coupling, is not randomly distributed. This may appear as common sense to a layman (after all you are not "connected" to random people per se) but the greater implication is that connectivity may indeed be more important than the composing *discrete* elements. Insight on the causal mechanism of this asymmetric distribution has served as the foundation of theorizing with respect to their robust-yet-fragile nature. An entire scientific society has recently emerged, after a series of such discoveries, to better understand these naturally-occurring phenomena as they appear to be at the heart of these questions (Barabási, 2009). Nevertheless, our view within this domain is opaque at best and we urgently need answers to readily improve our ability to protect these systems.

But how has the *risk management* community responded to this influx of scientific knowledge? Risk is traditionally defined as a function of impact and probability of occurrence of a harmful event – notice the omittance of the interconnectivity aspect. Yet in the context of the modern enterprise (and consequently, risks within the enterprise), interconnectivity is fueling the increased complexity that we are witnessing today. As a result, unintended *emergent* properties such as proneness to disproportionate cascades of failure are increasingly describing the modern enterprise (Ellinas et al., 2014). Figure 1 presents a typical example of such disproportionate

cascade propagating throughout a network – a typical depiction of various aspects of an extended enterprise including supply chains, projects and financial interactions (Ellinas et al., 2015).

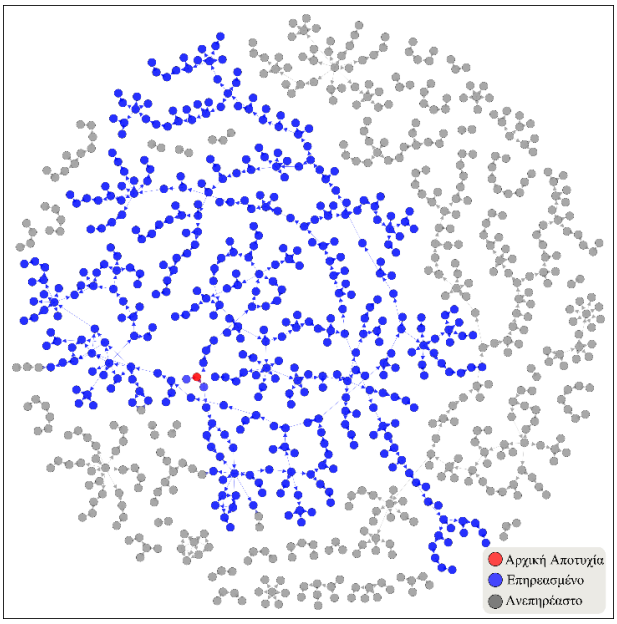

Figure 1: Typical example of a modern enterprise, where a single failure (red) can propagate throughout a large portion of the network. Such networks are typical examples of modern enterprises including supply chains, projects and investment interactions

Our Vision

Exercising good enterprise risk management necessitates harvesting useful complexity to deliver increased functionality with fewer resources while limiting risk exposure. Yet we still apply tools largely tailored to discrete deconstructions of systems, ignoring their true complexity and concluding to a potentially false sense of confidence, further enlarging our risk exposure. Our research focuses in responding to this lack of *holistic* tools in structuring and managing complex enterprises by focusing on the way their components *interact*. By showing that both natural and man-made systems are largely empowered by their *interconnectivity*, we are developing tools that will map the ability of the former to adapt to ever-changing conditions in order to increase robustness. Such reliance implies an increased probability of delivering complex projects per agreed requirements, and thus, certainty on resource expenditure. Acknowledgment of the social aspect is also fundamental – after all we are all, by design, risk-averse creatures filled with cognitive biases which limit our capacity for rational decision making. As time for diffusing the research deliverables to the industry is vital, real data provided by our industrial collaborators form the cornerstone of our research. This forces the development of tools that deal with imperfect, fuzzy data that managers routinely deal with rather than the perfect, artificially-constructed data that theoretical research utilises. Such research endeavours are mere examples of work needed to keep up with the increasing rate of innovation that describes our society.

Specifically, since the late 1990s, we have been witnessing the rise of mega-enterprises such as Google, Apple and Microsoft – their success stories have further inspired a new generation of entrepreneurs that promise to boost entire economies by generating innovation through micro-enterprises. Importantly, both mega and micro enterprises are grounded on their ability to leverage their connections – the former (mega) in search for increased efficiency; the latter (micro) in pushing for growth. Their ability to do so will inevitably dictate the prosperity of our society – our expertise in risk forms an invaluable tool in enabling this endeavour by protecting them from the negative effects of interconnectivity. Mastering the network will inevitably be at the core of it, and it is our duty to strive for enhanced understanding as we tackle our biggest challenges yet.

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