

The Enhanced Performance of Firms with Whole-Systems Cultures

By Martin Burley, Head of Research, MetaWealth Limited.

Summary

Research into the S&P500 group of companies demonstrates that corporate cultures can function as self-organizing systems. Firms that have this type of culture gain significant performance advantages over their competitors. This performance differential can be predicted from publicly available non-financial data. We suggest that this is a significant development for several reasons.

For investors it shows that returns on investment can be improved by investing in firms displaying whole systems characteristics. For managers and executives, it shows that building a strong culture within their firms is a key aspect of gaining competitive advantage over their peers. And for the business community in general, it shows that a clear sense of purpose and strong values do not conflict with profit, but enhance it.

Introduction

With the development of complexity theory, we have acquired a new insight into the natural world. In particular, we have discovered that the phenomenon of *self-organisation* is present on physical, chemical and biological levels. This has increased our understanding of processes such as phase transitions, for example when water turns to ice, and the formation of natural vortices such as whirlpools and tornadoes. Indeed, the principles of self-organisation are finding wide application across many scientific disciplines. They help us understand the functioning of protein networks within cells and, at the social level, the way in which traffic flows.

Given the ubiquity of self-organisation, we should not be surprised to discover the concept can usefully be applied to describe the pattern of activities within firms. However, the standard model of commercial organisations is still the machine model, which was first expounded by Adam Smith, in his 1776 *The Wealth of Nations*. Although social scientists have now begun to view firms in terms of whole-systems thinking, this alternative paradigm has not yet permeated the consciousness of society in general and the commercial sector in particular.

In this paper, we demonstrate that viewing the cultures of business firms as self-organising systems provides new insight into the dynamics of corporate performance. We distinguish between two types of firm, ones that recognize and align themselves around their purpose and values to create a self-organised system and ones that do not. We then show that this is a useful *model* for how firms operate. That is, by analysing firms in terms of these concepts, we made testable predictions, predictions that empirical data showed to be accurate. Our findings have important implications for managers who seek to improve their firm's performance, and for investors. A further useful feature of our data is that it provides a means by which we can track the rate at which awareness of the importance of whole-systems thinking spreads within the business community.

Common characteristics of self-organising systems

In this section, we shall introduce the common characteristics of whole systems. When we use the term 'whole system', we are primarily talking about dynamic self-organising systems. These are ones that can move from a state of disorder to an ordered state. In the ordered state, the system can be either static (e.g. ice), or dynamic (e.g. vortices). Self-organising phenomena that are dynamic in their ordered state are called *dissipative structures*, a term popularised by Prigogine. [Prigogine (1984)] This alludes to the fact that energy flows through the system are increased as they increase their internal order; i.e. they dissipate more energy.

All self-organising systems have at least one *global property*, such as temperature. (I shall use 'temperature' to refer to this property.) The conditions in which the system finds itself determine its state. The boundary temperature at which a system becomes ordered is known as the *critical point*. Systems that maintain themselves near this critical point, at the boundary between order and chaos, are described as being in a state of *self-organised criticality* (SOC).

Another important feature of self-organising systems that are near to their critical point is known as *correlation length*. This is a measure of how widely the system is aligned. Fluctuations within the system reach a certain size. At the critical point, the maximum correlation length present in the system is the size of the system itself, resulting in the system becoming ordered. When the correlation length is larger than the range of the forces that act on the individual particles, it is no longer useful to describe the particles as individuals. Rather, the overall system properties are what matter. This is why the same equations can govern a large class of self-organising systems (assuming the systems are all near their critical points).

Power laws have descriptive power when we are considering a whole system that is near to its critical point. These are equations of the form $f(x) = a \cdot x^k$ where a and k are constants. In the standard SOC model, this has been taken to mean that the structure of the system is similar on all levels (fractal). However, a new model recently developed by Carlson and Doyle casts a different light on the reason why power laws apply to self-organising phenomena. Known as HOT, for *highly optimised tolerance*, their model shows that some systems can self-organise and maintain themselves some distance above the critical point of the system, resulting in higher performance. This model applies particularly nicely to systems shaped by evolution or design.

In the HOT model, 'normal' SOC systems are simply systems in which only one parameter can be changed (e.g. temperature, or density). Thus, SOC appears to be a specific case within the wider HOT model of self-organising phenomena. [Carlson, Jean M & Doyle, John (1999)]

The HOT model is significant because it demonstrates that whole systems can be deliberately designed, as well as naturally occurring. We will return to this point later.

Network Theory and Self-Organising Structures

Recent research into whole systems has shown that network theory is highly applicable to the study of the structure of and dynamics occurring within whole systems. In *Linked: The New Science of Networks*, Albert-László Barabási explores some of these connections and introduces several forms of network. Here we shall give a brief overview of networks in order to introduce a concept of relevance to our research, that of *fitness*.

Scale-free networks have the characteristics of self-organising systems, including power-law distribution ($P(k) \sim k^{-3}$, where $P(k)$ is the proportion of nodes with exactly k links) and a robust, yet fragile structure. When scale-free networks grow, the larger nodes (known as ‘hubs’) have a greater probability of attracting new links – a ‘rich get richer’ model. This is what gives rise to their distinctive topology.

However, a *fitness model* can be used to describe the growth of networks, within which scale-free networks are a particular case. In this model, rather than a node’s chance of attracting new links being determined by connectivity (number of links) alone, it is the *connectivity fitness product* that determines the probability distribution. Each node has a specific fitness value, and nodes with higher fitness are more likely to gain new links. The rich-get-richer model, then, is simply the special case when the fitness of every node is identical. In networks where most nodes have similar fitness, the scale-free topology remains. However, in networks where some nodes are much fitter than others, a star-like topology develops, where the fittest node quickly claims almost all of the links. In this ‘winner-takes-all’ type of system, power laws apply to the probability distributions for individual nodes rather than across all nodes, with each degree exponent proportional to the fitness of the node in question.

One interesting feature of the winner-takes-all network is that it can be used to precisely model the distribution of atoms amongst energy levels in Bose-Einstein condensates - systems in which the atoms, when the temperature drops below a certain point, behave as one ‘super-atom’ or condensate. In other words, identity within the system is now associated with the system itself, rather than its parts. When this happens, the system becomes super-conductive, allowing for perfect energy flow through the system. Modelled in network theory, each node represents an energy level, while a link represents an atom at that energy level. In networks representing Bose-Einstein condensates in their condensate stage, as the temperature decreases, the fitness of the lower energy levels increases. This results in the node representing the lowest energy level attracting the vast majority of links (atoms). [Barabási (2003)]

We believe that within a corporate culture, values play the role of nodes, with specific fitnesses. In cultures where the fitness of certain values is significantly higher than other values, employees are more likely to be guided by those values. This leads to the development of stronger systems, and is significant because it means that managers can encourage the formation of whole systems within their firms by focusing on enhancing the fitness of the core values within that firm. Considering the connection between values and action in terms of the fitness model in network theory was an important step in allowing us to understand how whole-systems processes arise within corporate cultures, by suggesting the significance of strong values.

Theory as Metaphor: Human Social Interactions and Dissipative Structures

We began our research believing that understanding organizations in whole-systems terms would yield useful insights. In particular, we felt that purpose and values are important to the formation of social systems, and form the basis of strong cultures within certain organizations.

For a phenomenological account of social systems, we believe that Pablo Navarro provides an important insight into the way social systems form. [Navarro (1997.) He argues that the intentionality underlying our actions is dissipated through the effect our actions have on other agents. Our interpretation of reality relates subject to object via the intention of the subject, creating a situation. For example, my current situation involves me choosing what words to type next. My actions (the physical act of pressing various keys) are an indication of my intention (the way I relate to the keys – i.e. wishing to press them in a certain order).

An action always transcends the intentionality that precedes it, because of our imperfect knowledge of reality. (Put simply, our actions never work out quite as expected!) Equally, actions are partially opaque with respect to intentionality – we cannot perfectly understand the agent's interpretation of reality by observing his or her actions. However, through conscious or unconscious reflection, we can form a more or less accurate model of the agent's worldview, which we then incorporate into our future intentions. In other words, their intentionality has dissipated through their actions, to become a part of our own intentionality.

Systems form within social contexts due to this dissipation of intention. This takes place naturally and often unconsciously - for it is easier for us to achieve our goals if we align ourselves with the agents around us. If I am walking towards you and I see you begin to veer to your left, I will do better to reflect on your intentions (I deduce you have a 'heading-to-the-left' attitude to the world around you) and incorporate that into my own intentions (I wish to head to my left to avoid you) than if I simply act without taking you into account. In other words, it is the *interactions* between people that result in whole systems forming at the social level.

The advantage whole systems bring to society, as noted above, is that when we are brought into alignment, our energies are directed more efficiently. These systems are, to greater or lesser degrees, self-sustaining. It requires environmental change or conscious effort in order to alter them. (In practice, the multitude of ways in which social environments are continually changing means that many social systems are ephemeral, similar to the eddies which briefly form within a river before 'dissolving' again.)

It is our contention that whole systems arise within the cultures of corporations (alternatively, one could say that such structures in fact *constitute* the cultures, but this stronger claim is not necessary). We believe that such systems can clearly enhance the performance of the culture, and that it is possible to shape the culture of an organisation to evoke whole systems processes, and thereby increase its performance.

The Value of Purpose and Values

Given this account of social systems, why do we believe that purpose and values play an important role in their formation? Let us consider the micro-system units from which the macro-system structures arise.

One intuitive way in which we naturally interpret others' actions is in terms of their purpose and the values that guide them. In the example of the people walking towards each other in the street, it is likely that each have a common or at least mutually compatible purpose – to pass each other – and that each values their physical health and comfort. (This may not always be true: perhaps one person's purpose is to block the other from passing - maybe she is a security guard, for example. Or perhaps one values dominance more than health, and is therefore unlikely to move aside, even if a collision seems inevitable.) It can readily be appreciated that sharing a common purpose (which may be to find a solution allowing the mutual achievement of their individual aims) is necessary for the interaction to lead to a solution that both parties find optimal.

Similarly, if the participants view the same values as important, this facilitates the interaction in a way that leads to a better solution than if they approach the same situation with very different ways of understanding it, for it makes it easier for us to form an accurate understanding of the other person's intentions, and find a mutually compatible way of working together towards the achievement of our purpose.

Therefore, it appears to be a necessary requirement for the formation of strong social systems that the participants share a common purpose and set of values, to some degree. As the creation of social systems allows for more efficient flow of energy through a system, people who are interacting will do so more efficiently when they have a purpose and values in common.

The Significance of *Built to Last*

In *Built to Last*, Jim Collins and Jerry I. Porras identified the common characteristics of a set of companies that had demonstrated exceptional performance over a long period of time. One key characteristic was that these companies all had an ideology (core purpose and values) that played a stronger role in their activities than the comparison companies in the study. The 'visionary' corporations sought to fully align their activities around their purpose and values. Collins and Porras identified 'Preserve the Core/Stimulate Progress' as being at the heart of what made their 'visionary' companies different to the comparison companies. In our terms, we could describe this as preserving the conditions for the development of a whole system, while encouraging both evolutionary and chaotic change to maintain the system's adaptation to its environment. In other words, the most successful companies appeared to be harnessing the power of whole systems.

The HOT model of whole systems shows that dynamic self-organising systems can be created through design (engineering, or evolution) as well as occur naturally. *Built to Last* fuelled our belief that the most successful corporations are deliberately designing self-organisation into their corporate cultures.

Theory as Model: Evidence in Favour of the Performance Benefits of Complex Corporate Systems

The *Built to Last* study was based on a small sample of corporations, which had been selected, in part, because of their ability to survive – all companies in the study have been in existence from at least 1945. The study sought to identify defining characteristics of the most successful corporations, but did not demonstrate successful corporations could be identified on the basis of these characteristics alone. We were interested in taking this next step: to see if it is possible to identify high-performing companies in a larger sample size through a non-financial analysis of their ability to self-organise around their purpose and values.

Though there are some excellent management books making the case for whole-systems cultures [e.g. Wheatley (2001)], attempts to apply whole-systems or network theory models to test quantified predictions in the realm of corporate activity are rare, though there are exceptions. [For example, Hyun-Joo Kim, *et al.* (2002)] In part, this is because of the difficulty of defining terms such as ‘temperature’ in social systems, as compared to the physical counterparts from which the models have been derived.

Instead of attempting to define what a term such as ‘temperature’ would mean in a corporate culture (a definition did arise as a *consequence* of our findings), we choose to identify companies that displayed the self-organising characteristics of whole systems and then see if these companies experienced significant out-performance when compared with firms without these characteristics. Like tracking an animal by its footprints, we were not quantifying the characteristics of the systems themselves, but looking for their effects.

In order to do this we developed our Purpose and Values Methodology (PVM), to reliably and consistently determine whether a company showed evidence of HOT systems guiding its behaviours. PVM does *not* take a company’s financial performance into consideration. Thus, importantly, our findings were not self-confirming. We were not taking the company’s financial performance into account when categorizing their culture. Our research was based on qualitative analysis of the non-financial data that a company makes publicly available. We had our methodology audited by a leading accountancy firm.

We analysed the S&P 500 companies, as these provided a suitably large group, for which a sufficient amount of publicly available data was available in English. We rated all 500 of the S&P 500 companies according to our PVM. We used our findings to divide firms into two main categories: *Vortex Firms* (those that showed strong evidence of having HOT cultures), and non-Vortex firms. We also found 40 cases where we believed the culture was in transition and did not fit into either group. These companies have been excluded from the following analysis.

If our model were accurate, we would expect Vortex firms to outperform non-Vortex firms of similar size, since they are better able to align their activities across the organisation. As the average size of Vortex firms in the S&P500 is 62,500 employees, compared to an average of 30,200 for non-Vortex firms, comparing the two groups directly would be potentially misleading.

We divided the companies into the following classes:

Size of Firm (Number of Employees)	Number of Vortex Firms	Number of Non-Vortex Firms	Total Number
0-4,999 employees	16	53	69
5,000-9,999 employees	19	61	80
10,000-14,999 employees	17	32	49
15,000-19,999 employees	11	28	39
20,000-29,999 employees	20	38	58
30,000-39,999 employees	17	11	28
40,000-59,999 employees	25	22	47
60,000-99,999 employees	20	24	44
100,000 or more employees	27	19	46
Total Number	172	288	460

We found the average total returns from January 1994 to December 2003 for Vortex and non-Vortex companies, for each class.

Size of Firm (Number of Employees)	Average Total Return: Vortex Firms	Average Total Return: Non-Vortex Firms	Average Total Return: All Firms
0-4,999 employees	396%	377%	379%
5,000-9,999 employees	659%	394%	457%
10,000-14,999 employees	426%	288%	336%
15,000-19,999 employees	328%	330%	329%
20,000-29,999 employees	514%	210%	315%
30,000-39,999 employees	859%	214%	606%
40,000-59,999 employees	357%	219%	293%
60,000-99,999 employees	461%	189%	313%
100,000 or more employees	340%	247%	302%
Average Total Return	479%	329%	385%

A t-test showed the difference in returns between Vortex and non-Vortex firms to be highly significant (significant at the 0.01 level). The difference was also found to be significant when median total returns were used. Furthermore, differences in other performance measures including return on equity and return on assets were also found to be highly significant, as would be expected if self-organising systems are genuine processes at work within Vortex corporations, and not merely an alternative framework for describing corporate activity.

Conclusion

Our research demonstrates that corporate cultures can function as self-organizing systems. Firms that have this type of culture gain significant performance advantages over their competitors.

The fact that this performance differential was measured by return on investment and can be predicted from publicly available data indicates that investors are not currently aware of the full value of a firm's culture and that returns on investment can be improved by investing in firms driven by a purpose and set of core values. In other words, the performance advantages that stem from developing a HOT culture are not widely known at present. This in turn provides a means of assessing the degree to which awareness of the importance of the whole-systems perspective spreads within the investment community: once the performance advantages of HOT cultures for firms are known, the share prices of firms with HOT cultures will reflect the expectations of superior performance through higher P/E ratios.

For managers and executives, this research shows that building a strong culture within their firm is a key aspect to its competitive advantage, and that the success with which they do this can be accurately measured. Indeed, within Vortex firms key executives regard building their firm's culture as a crucial part of their work. Managers and executives in non-Vortex firms who wish to promote the development of a whole-systems-aligned culture within their firms are now able to argue for it on purely financial grounds, as well as the ethical arguments that can be made for preferring such cultures (such as the increased autonomy for employees and no longer needing an exclusive focus on profit).

This last point is of wider significance. When a corporation has made it clear that it stands by its purpose and values, it is possible to change its behaviour for the better from inside instead of as a result of external pressure. Employees are endowed with not only the right but also the responsibility to voice their concerns if their corporation's actions conflict with its purpose or values.

By demonstrating that firms perform better when they are focused on a purpose beyond profit, we can take the sting out of the corporate requirement to turn a profit. Firms need no longer view the relationship between values and profit as a dilemma. When combined they are a powerful synergy – a synergy where companies living by their values have over the last eight years on average doubled their returns to shareholders when compared with firms focused on profit alone. We suggest the emerging science of self-organisation and whole systems provide a framework that helps us understand how this dynamic synergy works.

More Information

For more information please contact Martin Burley, Head of Research, MetaWealth Limited: martin@metawealth.com

Christchurch

Centre for Systems Learning
3 Roland Lane, Christchurch 8, New Zealand
Tel. +64 (3) 376 4010
Fax. +64 (3) 376 4017

New York

410 Park Avenue
15th Floor, Suite 1530
New York, NY 10022, USA
Tel. +1 (917) 210 8877
Fax. +1 (917) 210 8182

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