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System view of the firm: toward a synthesis of the theories of the firm

Abstract

This paper is essentially a specification on analytical framework of a PhD thesis. The thesis itself is entitled: "Intellectual capital and economic performance of firms in the knowledge-based economy: a close look at evolution of modern enterprises" and is a study that seeks to understand the nature and function of the business firm as it is evolving with the changing today economy. The first step in this study seeks to synthesise contending views of the firm as theorised by economic and management scholars. Aided by a meta-theory: 'general system theory' or GST, an integrated 'system view of the firm' is devised as a synthesis of these existing theories and the core analytical framework for the thesis. This paper proposes the devised system view of the firm as a candidate for a synthesised analytical framework for study on the business firm. It reviews existing theories of the firm, traces a brief history of GST, and deliberates on the meaning and power of the proposed 'system view of the firm'.

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> In standard economic analysis very little is said about firms and why they exists. In the standard story, there is a mysterious thing called 'the firm' acting to maximize profits subject to production and market constraints. The firm has been viewed as a car speeding down the highway. Economic theory could often predict the car's destination; it could not, however, explain the body style, speed or route selection.
>
> (Fitzroy, et al. 1998, p. 206)
> *Management and Economics of Organization*

> Without demeaning the contributions that any of us have made, I think we must acknowledge that the present state [of the theory of the firm] is one of incoherence. If we ask, "What does economics have to say about the role of the business firm in a market economy?" the response will be silence followed by an excited babble of significantly conflicting answers—an interesting babble, but a babble nonetheless.
>
> (Winter 1988)
> *On Coase, Competence, and the Corporation*
> in (Williamson and Winter 1993, p. 179)

> If production takes place by individuals deciding to take part in such activity, and if this productive activity takes place largely within things called firms, then what is this thing, the 'firm'?. The answer … is that the term covers a multitude of concepts.
>
> (Buckley and Michie 1996, p. 21)
> *Firms, Organizations and Contracts*

THIS paper is an attempt to look closely into the "mysterious thing called 'the firm'," and propose an analytical apparatus that may well inject the needed coherence into the "babble" which echoes "a multitude of concepts." Business enterprise—*the firm*—is a product of industrialisation process that began a century ago. It is thus high time that this offspring of the industrial era was viewed under a mature insight that harvests the rich research traditions of prior generations. The central theme of this paper centres around a candidate for such a view. The proposed 'system view of the firm' is argued to have a power of coherence and comprehensiveness—the twin quality of a practicable theory. It is hoped that

the proposed model of the firm can be of use to future research that scrutinises further this incredible child of industrialisation.

This paper comprises three main sections. Section one reviews economic theories of the firm, draws some association with related management thoughts or practices, and echoes the need for a synthesised, more mature theory of the firm. Section two traces the history and meaning of a meta-theory—general system theory or GST—that underpins the construction of the major thrust of this paper. Section three bides the earlier two sections together in a model of the firm by the name: 'system view of the firm'. A concluding remark argues for the power and potential of the propose model of the firm as a candidate for a synthesised of the theory of the firm.[1]

1 Theories of the firm

First off, a matter of terminology needs clarification. In conventional economic discourse, when one refers to "theory of the firm" the instant definition recalled in the mind of a representative economist of standard training would more or less resembles that in a basic dictionary of economics such as the following passage on the theory of the firm:

> **Firm, theory of the.** The study of the behaviour of firms with respect to: the inputs they buy; the production techniques they adopt; the quantity they produce; and the price at which they sell their output. Two basic approaches to the theory can be identified: (a) The traditional approach assumes that producers aim to maximize profits; whether they are monopolists or perfect competitors, they produce at a point where MARGINAL COST equal MARGINAL REVENUE and employ inputs to a point at which their MARGINAL REVENUE PRODUCT is equal to the cost of employing them. ... (b) More modern theories attempt to represent the complications of large institutions which characterize

[1] The proposed model is the core analytical framework developed for a PhD research project. The thesis, conducted by the author and supervised jointly by Friso den Hertog and Luc Soete of Maastricht University, is titled: *Intellectual capital and economic performance of firms in the knowledge-base economy: a close look at evolution of modern enterprises*. It is being conducted as part of a fulfilment for a PhD degree under the MERIT–UNU/INTECH PhD Programme in Economics and Policy Studies of Technical Change, University of Maastricht, Maastricht, the Netherlands. Details of the thesis project is attached as Appendix B. Any view expressed and error made here are entirely the responsibility of the author, notwithstanding invaluable guidance from the supervisors and essential support from the PhD programme.

> society today, ... It is not clear whether the alternative theories actually contradict the claim of the traditional approach that firms maximize profits ... . It is thus usually accepted that the insights of traditional theory are useful despite their dependence on apparently unrealistic assumptions.
>
> (Bannock, et al. 1992, p 63)

And there the matter usually rests. There is a need, therefore, to state up-front that for this discourse, what is meant by the term 'theory of the firm' encompasses a more elaborated deliberation than what is conventionally granted. For this paper, the term demands a deeper and broader imprint in the same fashion that Archibald treated it in a more detailed dictionary. (Eatwell, et al. 1988, pp. 357-62)

Secondly, the main purpose of this section must also be clearly stated. Much has been said and argued over contending theories of the firm. To cite Archibald's dramatic description: " ... the theory of the firm has been, and perhaps still is, the battle ground for some fierce methodological warfare" (Archibald 1988, p. 357). Our purpose is certainly *not* to join in this warfare. On the contrary, we intend to propose a truce on it, by illustrating that there is essentially no need for further fierce fighting. The rationale is simply that all diverse views of the firm carry respectable merit, although none carries enough merit to be singled out as *the* sole theory of the firm. Thus, for the sake of theoretical progress, these rich varieties of theories are better off *together* rather than *singly*. Indeed, as earlier hinted, that is the main attempt of this paper: to put together all previous views of the firm into one integrated whole. Of course, prior to that, we must first look at what are in stock.

Machlup estimated that "there are at least 21 concepts of the firm employed in the literature of business and economics" and catalogued ten of them. His exercise was to illustrate "how ludicrous the efforts of some writers are to attempt *one* definition of *the* firm as used in economic analysis" and that there should be "no argument about which concept of the firm is the most important or the most useful. Since they serve different purposes, such an argument would be pointless." (Machlup 1967, pp. 26-

28). We could not agree more. Further, although it may look as if we were trying here to "attempt *one* definition of *the* firm," we are not. To repeat, what we attempt is one collection that not only glues together all the different definitions or views of the firms, but also gives each of them a meaningful place in the new picture.

With that objective, our review of the theories of the firm is necessarily different from other reviews in a sense that we do not seek to critique these theories per se. Rather, we focus on what to be harvested from each for the purpose of our final picture. Of course, we benefit greatly from earlier critical scrutiny[2], which helps illuminate what are worthy and eliminate what are not. Also, given the said objective, our catalogue of the theories of the firm is a taxonomy based primarily on the main thrust of each school of thoughts[3], a summary picture of which is given in Appendix A: Diagram 1. The following discusses this diagram only on issues deemed relevant to the central theme of this paper. As such, our discussion is not intended to be an exhaustive elaboration of each of the schools of thought, a subject treated much better in other work, some of which are included in our reference list.

We identify four economic schools of thought on the firm, each of which is clearly distinguishable from the others by its main conceptual thrust, although methodological and analytical affinities do exist in many respects—an issue to be touched upon where relevant. The four main conceptual thrusts are: *production*, *transaction*, *resource*, and *innovation*, which, in corresponding order, are the main interests in the neo-classical, transaction cost, resource-based and evolutionary theories of the firm. The major argument and analysis of each of these schools of thought are in order.

[2] Most important among many others are: Archibald (1988); Best (1990); Boulding (1942); Conner (1991); Cyert and Hedrick (1972); Foss (1993; 1996a; b; c); Ghoshal and Moran (1996); Holmstrom and Tirole (1989); Jensen and Meckling (1976); Machlup (1967); Milgrom and Roberts (1988); Montgomery (1995); Moss (1984); Papandreou (1952); and Tarascio (1993).
[3] Other taxonomy is of course possible; see for example Best (1990), Conner (1991), and Foss (1993) for various other classifications of the theories of the firm.

Neo-classical economics: "the representative firm"

The basic analysis of the neo-classical view of the firm is very well summarised in our above-cited passage on theory of the firm from *The Penguin Dictionary of Economics* (Bannock, et al. 1992) and, in order not to suffer readers to unnecessary boredom, will not be repeatedly described again. The following discussion will in effect discuss more the major critiques and contributions of the neo-classical view of the firm.

As a main-stream, or in Winter's words: "text book orthodoxy" (Winter 1988), elaboration on the firm, this view of the firm has enjoyed estimable attention as well as endured stringent ridicule.[4] This was indeed the major battleground in the early warfare on the theories of the firm (see, for example Cyert and Hedrick 1972; Machlup 1967). The majority of the arguments for or against the neo-classical view of the firm centre around its simplicity or 'simplisticity,' depending on which camp one wishes to ally with. Both its key assumption—*perfect competition* (and its underlying assumptions of perfect information and perfect rationality endowed in "homo-economicus"), and key analytical apparatuses—*marginalism* (with constant or decreasing returns to scale), *static equilibrium*, and *optimisation*, have been the object of devotion as well as assault. Yet, Penrose evaluated this particular debate most succinctly when she stated : "of all the approaches [the neo-classical so-called 'theory of the firm'] is probably the most often misunderstood and misapplied by both its defenders and its attackers." (Penrose 1995, p. 10) The fact is, although conventionally and misleadingly given the name 'theory of the firm,' this analytical model is in essence but part of price-theory. It is not about the firm, it is about how the concept of an imaginary—i.e. Marshall's "representative firm"—can serve as an analytical apparatus to explain the forces that determine prices and quantities in a general equilibrium analysis. The firm as 'a production function' is only one of the many other functions that are used to define theoretical long-run general

[4] Although there are of course numerous variations of the neo-classical view of the firm with more sophisticated treatment of the original, for the sake of our discussion, these variations still carry the same fundamental implications of the original and hence, will not be much deliberated upon here.

equilibrium. In this picture, the firm is only a supporting actor, not the leading one, despite the misguided title of the story. To extend the analogy, as a supporting actor, the firm in the neo-classical view is fundamentally a "black box," it exists in a larger context of the market (one of the leading actors) and the characterisation of its internal dynamics is not of central concern to the main plot.

Yet, a glimpse of the firm as provided by the neo-classical view is still of value to understanding business firm. For one thing, it points to the most elementary, yet fundamental, constituent of a firm—*production*, or what a firm does when one looks even casually at it. In this sense, neo-classical view of the firm gives us a practical starting point. The firm's activity of producing goods and services has to be part of the analysis, one way or another. Although neo-classical analysis certainly does not look 'inside' the firm to scrutinise further *how* this activity works, it does make an imprint of the concept. Further, the significance of 'profit' is also a legacy of the neo-classical. Despite the still on-going debate on whether firms actually *do* or *can* maximise their profits in the real world, and whether this is the only material objective to be considered, profit is the most relevant issue to distinguish study of business enterprises to that of other forms of organisations. Profit, in other words, is a necessary, though obviously not sufficient, characteristic, of a business firm, regardless of how profit is defined or achieved.

Another important contribution of the neo-classical view is that it inspires many subsequent inquiries into the nature of the firm. Dissatisfaction with the narrow treatment of the firm as given by the neo-classical school has motivated its defenders and attackers alike to put more meaning into the concept of the firm. Cyert and Hedrick (1972) and Holmstrom and Tirole (1989) provide a good critical review of this series of efforts, which range from adding more sophistication to the analytical scheme, to varying definitions of the objectives, to relaxation or outright dismissal of certain assumptions underlying the main assumption of perfect

competition. One of these efforts resulted in another prominent view of the firm: transaction cost economics' view of the firm.

Transaction cost economics: "the administrative firm"

Irrefutably inspired by Coase's long-neglected seminal work (Coase 1937), and forged and refined to a point of distinction by his student Williamson (1981; 1983; 1988; 1989; and 1999, among others), transaction cost economics (TCE) has evolved into a hybrid of neo-classical and institutional economics traditions. As a hybrid, TCE is accepted into the circles of both schools of thought and has to date earned quite a respectable place, though not one that is unchallenged, in economic discourse.

As such, TCE now spans diverse issues, empirical as well as theoretical, some of which go beyond the concept of the firm (see for example, Alchian and Demsetz 1972; Cheung 1983; Fama 1980; Fama and Jensen 1983; Hart 1988; Hart and Holmstrom 1987; Holmstrom 1979; 1982; Holmstrom and Milgrom 1991; 1994; Jensen and Meckling 1976; Malmgren 1961; Miles and Snow 1986; Milgrom and Roberts 1988; Rindfleisch and Heide 1997; and Ross 1973). Yet, its origin and core are essentially an inquiry into the existence and nature of the firm itself. Coase embarked on the subject by the simplest of all questions: why firms exist at all, if market, via price mechanism, can best determine production, at least according to the world of pareto equilibrium. This touches straightway upon the existence and boundary of the firm. TCE's answer to the question is, to put it simply, firms exist because market is not invariably successful in yielding its power of the "invisible hand." In the case where market failure is a possibility, particularly as a result of bounded rationality and/or opportunism, the "visible hand" of the firm hierarchical instrument may replace the invisible hand of the market. This is because in such a case, a "transaction cost" may arise out of the need to administer the transaction so as to ensure the desired results. When there is such a cost, market mechanism can be either too risky, or too costly, or both, as a governance mechanism, when

compared to having the same transaction occurred under the "contractual" governance of the firm. The firm is in short, according to TCE, an alternative mechanism of transactional governance. The firm internalises, administers or contracts a set of such transactions, and hence is in essence "a nexus of contracts" according to this logic.

This leads TCE to open up the "black box" to investigate the variety of transactions that take place in and around the firm. The issues scrutinised involves the origin, nature and implications of the many faces of firm-related transactions. No wonder, studies within transaction costs economic extend a wide range of issues, including but of course not limited to: agency theory and employment relations, relational and incomplete contracts, asset specificity and its many facets, economics of teamwork, incentive, property rights, corporate culture and managerial behaviour, corporate structure, corporate ownership and control, diversification, vertical integration, and diverse forms of inter-firm relationship, to name but the most obvious. It is important to note, though, that although TCE departs from neo-classical tradition in certain respects, particularly in its basic assumptions, it still professes great methodological affinity with the neo-classical, most strikingly in the reliance on marginalism and equilibrium analysis. Some (for example, Best 1990) even argue that TCE is but a branching out of the neo-classical view of the firm.

With the vast range of topics that it opens up and its 'new' view of human behaviour, TCE is attracting quite a substantial load of, positive as well as negative, attention within the research community. Most notably, in the recent years TCE has started to venture into the realm of formal business training, with text books in managerial economics such as Besenko, et al. (1996), Fitzroy, et al. (1998), and Milgrom and Roberts (1992) being increasingly offered and adopted. At the same time, TCE is also being increasingly scrutinised. Critiques of TCE basically centres around its rather 'grim' view of humanity. Although the assumption of bounded rationality is relatively well-taken as a needed dose of realism (see particularly Conlisk

1996, for a good review), the hypothesis of opportunism has received substantial criticisms (see in partiular Dore 1983; Ghoshal and Moran 1996; Granovetter 1985; Perrow 1986; Pfeffer 1996; and Simon 1991). Opportunism, especially in its stark form as emphasised by Williamson, is seen by some as a prejudiced, and hence unrealistic, view of human behaviour. It is argued that the rigid assumption, though illuminating as an analytical device, can have undesirable implications if taken to the extreme. As cautioned by Ghoshal and Moran (1996), TCE can have negative and self-fulfilling negative consequence if blindly applied.

For our purpose, though, TCE plays a distinctive role. At the very least, it opens the 'Pandora's' black box of the firm, introducing more complication but generating hope of more insights at the same time. Above all, it stimulates rigorous inquiries into an indispensable aspect of the firm as an economic organisation, namely the issue of *exchange* or *transaction*. Looking at firms from a "contractual" viewpoint leads to numerous illuminating riddles that provide a rich ground for investigation, not the least of which is the first look into the many facets of the firm's internal dynamics. Orchestration of the many "contractual" relationships via internal hierarchical structure is arguably the core of this internal dynamics from TCE standpoint; hence, the title 'the administrative firm.' Related to this is the emphasis on the behavioural aspect of the firm. TCE reveals that human behaviour can have decisive economic consequences, and studies of the firm may not be able to avoid taking into account this consideration. More, the critiques on its pessimistic stance on human further help to illuminate the fact that a more realistic deliberation of human behaviour must balance the negative traits, such as opportunism, moral hazard, and so on, with the positive one, such as trust, altruism, and so forth. Indeed, the interplay of these dual traits of humanity is what makes the matter complicated as well as intriguing.

Resource-based school of thought: "the competent firm"

Compared to TCE, the resource-based school of thought (RB) has a more optimistic view of humanity. It could even be argued that, man is at the heart of the matter under this view, because human resource stands at the centre of the resource-based main conceptual thrust: firms' *resources*. The resource-based school of thought is unanimously agreed to have as its very origin Penrose's classic text on the growth of the firm (Penrose 1995), although recent scrutiny by Foss (1996a) argues for a "conflicting" legacy of Demsetz (Demsetz 1973; 1988) as well. The term "resource-based" and a presentation of this concept in a distinctive manner must, nonetheless, be attributed to Wernerfelt (1984) while Rumelt's work (Rumelt 1984) which appeared in the same year equally contributes to the major line of argument to be later recognisable as characteristic of the resource-based school. This school of thought is motivated by the intriguing diversity of firms as they exist in the real world. Wernerfelt (1984) neatly linked the concept of products and resources as "two sides of the same coin" for firms, to wit a firm is distinguishable because of its unique products whose uniqueness comes about only as a result of the firm's distinctive resources. Rumelt (1984) coined the term "uncertain imitability" for the same concept. Both explored this in light of strategy and argued that management of resources could be paramount to a firm's competitiveness in the marketplace.

At its core, RB view of the firm shifts the focus from administration to resources. (Conner, Kathleen R. 1991; Conner, K. R. and Prahalad 1996; Peteraf 1993; Teece and Pisano 1994) In Penrose's own words, "a firm is more than an administrative unit; it is also a collection of productive resources the disposal of which between different uses and over time is determined by administrative decisions." (Penrose 1995, p. 24) In economic term, heterogeneity and imperfect mobility of resources create an opportunity for a firm to generate "economic rent" from the distinction of its resources. It is quite obvious that, in RB analysis, the term resources denote more than the neo-classical "land, labour and capital." Indeed, RB pays more

attention to intangible resources, including human resources and intellectual capital or knowledge, than the tangible ones. Yet while resources are *stock*, capability is *flow*; and to turn stock of resources into a flow of distinct capability is what sustains a firm's competitive advantage. It is this unrelenting cultivation of resources that defines 'the competent firm.' Cultivation implies constant searching, acquiring, generating, developing and harvesting of resources. This multifaceted implication points directly at the numerous aspects of the firm's internal dynamics as well as its interaction with external environment.

Arguably, RB has gathered its momentum equally in both economic and strategic discourses. The proliferation in the recent years of publication related to this tradition both in economic and management disciplines defies any attempt at comprehensive examination here. It should be noted, though, that RB is where economic and management really come extremely close to each other. The "core-competence" movement in strategy study is debatably the management version of RB thinking (Barney 1991; 1995; Hamel and Heene 1994; Heene and Sanchez 1996; Mahoney and Pandian 1992; Wernerfelt 1995). An obvious affinity between the current "knowledge management" movement and RB must also be noted. (Conner, K. R. and Prahalad 1996; Liebeskind 1996; Winter 1987) In fact, as Foss (1996b; c) argued, the inclination of RB scholars to imply that the concept of knowledge sufficiently defines the concept of the firm may have been carried too much in the extreme. Nonetheless, knowledge is invariably recognised as one, if not only, among firms' resources.

For our purpose, RB school brings forth significant aspects of firms which have hitherto been subsumed or neglected in earlier discussion. Chief among these is of course a more sophisticated look at the 'input' side of production. By looking at firms' resources in a broader and deeper fashion than mere land, labour and capital, RB view opens up a range of issues and insights essential to understanding of firms' internal dynamics. RB emphasis on heterogeneity among firms, both in their resource endowment and

cultivation, is crucial to the inquiry into the relationship between a firm and its environment, i.e. competitive marketplace. Finally, by linking firm resources to competitiveness via the apparatus of "competence" or "capability building," RB points a way to a view of the firm as a progressing entity, whose growth and development is very much a function of its adaptive or learning propensity.

Evolutionary economics: "the entrepreneurial firm"

As a chief contending view to mainstream economics, evolutionary economics has arguably been 'around' for quite some time and arguably deserves more attention than it has to date received. (Boulding, Kenneth 1981; 1991; Dosi and Nelson 1994; Foss 1991; Hodgson 1992; Metcalfe 1998; Nelson 1995; Schumpeter 1934; Veblen 1898; Witt 1992) For our purpose, what is meant by evolutionary economics is the school of thought that follows the Schumpeterian tradition. This definitely includes the Austrian school and a few other scholars in other spheres. In the discourse on the theory of the firm, thought, credit is due to Nelson and Winter in their landmark work (Nelson and Winter 1982) and subsequent efforts. Nelson and Winter (1982) has inspired current revival of the evolutionary tradition in economic theorising and it remains to be seen how the discourse will evolved.

In evolutionary economics view, the firm is essentially an engine of innovation in the larger picture of economic evolution. Not unlike the neo-classical, the evolutionary school also has its main interest in the 'overall' economy, and the consideration of the firm is simply to serve this main purpose. Unlike the neo-classical, though, the firm in this story is given more character and takes a leading role. Firms' innovation is what drives the whole evolutionary progress. What explains firms' drive for innovation, in turn, is the logic of social Darwinism, which accounts for firms' instinct to survive, at the very least, and outwit challenges from rivals as well as environmental disturbances, at the very best. In this evolutionary process,

disequilibrium as a result of creative destruction is not only inevitable but also welcome, because only through this very mechanism can economic progress be realised.

Unlike neo-classical economics and TCE, evolutionary school is not deterministic in its analysis. Evolution by its nature is a perpetual, not eventual, phenomenon. The most that evolutionary analysis can 'predict' is that the future hinges somewhat upon the past, the so-called "path-dependence" hypothesis. This in no way implies that the past can fully determine the future. What helps to illuminate the understanding of the firm then is not a search for static outcome but an attention to firms' internal dynamics, particularly the innovation process. Evolutionary school, like RB, also recognises the implications of heterogeneity among firms. Heterogeneity from evolutionary view is explained basically through the concept of "organisational routines" which represents genetic imprints of a particular firm. (Nelson 1991; Nelson and Winter 1982) Firms develop and employ their capabilities and routines in the same way that an individual develops his or her skills. This is a perpetual learning process that defines, and re-defines firms. To quote Nelson and Winter, "the heart of [evolutionary] theoretical proposal [is]: the behavior of firms can be explained by the routines that they employ. Knowledge of the routines is the heart of understanding behavior. Modeling the firm means modeling the routines and how they change over time." (Nelson 1991; Nelson and Winter 1982, p. 128) and how the routines 'changes over time' is what explains firm innovation, the very core of evolutionary economics.

As is rather obvious, RB and evolutionary economics share a number of affinities in their views of the firm. Both pay great attention to the issue of competition and its implication to firms. Competence and knowledge also figure prominently in both views. However, while RB points to resources, evolutionary view emphasises more the outcome of the cultivation of those resources, that is, changes and innovations. This is indeed the most exclusive contribution of evolutionary economics to understanding of the

firm. Without the notion of entrepreneurship and innovation, a picture of the firm would be missing a crucial piece and far from completed. More, because innovation in Schumpeterian tradition encompasses a broad range of concepts, from technological to organisational innovation and from radical change to adaptive adjustment, the concept itself can be used explain a wide variety of firms' internal dynamics. Evolutionary economics also introduces a long-term and dynamic perspective of firms—a perspective which injects more insights into the analysis. Finally, the tendency for heuristic rather than deterministic analytical fashion will also figure prominently in our integrated system view of the firm, as will be elaborated in due course.

Summing up the legacies

It is clear by now that economic theories of the firm, though full of controversies, provide a rich ground for further theorising efforts. On a practical front, each of the above four school of thoughts has continuously been influential to management thinking and practice. We have mapped these possible links in Appendix A: Diagram 2 to illustrate the observation. For the sake of brevity, we leave out further elaboration on this issue.

The last item on Appendix A: Diagram 1 provides a rough evaluation of how each of the four views of the firm contributes to the understanding of pertinent aspects of business firms. We argue first that, five dimensions of the firm are indispensable for a thorough insight into the nature and working of business firms. These are issues concerning the firm's existence, internal dynamics, boundary, growth and development, and its relationship with external environment. How each of the four schools of thought helps in the advancement of these issues are rated on a crude scale of 'substantially' (✓), 'very little or not at all' (✗), or 'discernibly' (~). Since our objective is actually not to evaluate or critique these theories per se, as already pointed out, this scale is meant to denote only the extent each of the four views touches upon the five aspects. The debate on how and how well

they do so is a matter that would require a whole new discourse and will therefore not be taken up here.

Thus far, we have surveyed prior theories of the firm and identified several legacies that are attractive for harvest. We are certain that a holistic view of the firm cannot be derived without the consideration of its four main constituents: production, transaction, resource and innovation. Other crucial concepts and issues contributed by these four schools of thought are also candidates for adoption. Section 3 on system view of the firm will elaborate this further. But first, general system theory needs to be expounded to prepare the ground for our proposed model.

2 General system theory (GST)

This section discusses the fundamentals of general systems theory (GST). The discussion begins with a historical background of its origin and signification, followed by a fairly detailed exposition of its central concepts. A methodological approach common in application of GST paradigm is then outlined. The section ends with a brief note on the merits of GST as a paradigm for formal theorising in scientific enquiry.

Origin and signification

Although certainly more than one scholars have contributed to the development of GST, its birth must be credited to one of the greatest thinkers of the 20th century: Ludwig von Bertalanffy (von Bertalanffy 1949; 1950a; b; 1962; 1969; 1976).[5] Following is a brief historical sketch of the origin and significance of GST.

[5] In addition to von Bertalanffy, Kenneth Boulding (a prominent economist) is also well-recognised as the other founder of GST. Other noteworthy contributors to further development of GST, to name but the most eminent, are: Russell Ackoff, William Ross Ashby, Bela Banathy, James Miller, Ervin Laszlo and Anatol Rapoport. Readers may wish to refer to the reference for a list of selected work from these authors or visit the home page of the International Society for the System Sciences, available from: *http://www.isss.org/index.htm*, for extensive and on-going sources of more information on the history of and current development in GST.

Since his conception of GST, much has been understood and misunderstood about what is meant by the term. In essence, GST is not a theory about general systems, but is fundamentally a 'meta-theory'—a paradigm—which may be taken as a guide to a wide range of theoretical and empirical enquiries. In his foreword to a collection of von Bertalanffy's essays, Ervin Laszlo gave a precise interpretation of the meaning and significance of GST:

> ... [W]hen von Bertalanffy spoke of Allgemeine Systemtheorie [General systems theory] it was consistent with his view that *he was proposing a new perspective, a new way of doing science*. It was not directly consistent with an interpretation often put on "general system theory," to wit, that it is a (scientific) "theory of general systems." To criticize it as such is to shoot at straw men. *Von Bertalanffy opened up something much broader and of much greater significance than a single theory* (which, as we now know, can always be falsified and has usually an ephemeral existence): ***he created a new paradigm for the development of theories.***
>
> ...
>
> ***Von Bertalanffy gave us a new paradigm for transdisciplinary synthesis***. Given the fact that many of our intellectual and almost all our practical problems have to do with systemic phenomena (system design, system management, system development, and so on.) we should look upon general system theory as a fruitful new research program ... an essential component in the growth of scientific knowledge, and not as another finished theory to be verified or falsified, and fitted either into the spectrum of valid scientific data or placed on the shelves of the history of science to gather dust.
>
> Ervin Laszlo
> Foreword to von Bertalanffy (1976)
> (emphases added)

Or, in von Bertalanffy's own words, the subject matter of GST "is the formulation and derivation of those principles which are valid for 'systems' in general ... irrespective of whether they are of physical, biological or sociological nature." (von Bertalanffy 1969, pp. 32 & 33)

GST has indeed proven to be a robust meta-theory, attested by incessant, ubiquitous, and successful applications of it in myriad disciplines and scientific enquiries, from biology (where the paradigm originated) to economics, from computer science to psychology, from physics to communication, from mathematics to management, to name only a few.

Central concepts

The central concepts in GST are best comprehended along two referenced dimensions: 1) content explication, and 2) analytical pivot. Appendix A: Diagram 3 summarises key concepts of GST along these two foci. A brief discussion of these ideas, anchoring on the analytical dimension, is in order.

Components

Put simply, a system can be defined as '*a collection of elements which interact with each other in order to thrive as a whole under a given environment, with which the system itself may also form an interactive relationship*'.[6] As such, the first step in understanding a system is to identify its three basic components: 1) system elements, 2) its environment, and 3) the boundary which delineates the two. This identification is relative to the subject of investigation and its chosen unit of analysis. To give a simple example, a university can be defined as a system, with myriad departments as its basic elements. Depending on the inquiry perspective, the environment of a university may be a particular academic community, society, country, or even the continent in which it resides. The boundary of a university can then be identified along a combined criteria: physical (its campus), structural (its faculty, staff, and students), orientation (its philosophy and focus), and so on. The implication of this identification is an underlying principle of hierarchy that is fundamental to GST conceptualisation: an element of a system is often a system itself, with the flip side being that any system under consideration is usually an element of a larger system. A department in a university is itself a system while a university is indeed an element of a nation's education system, which itself is an element of a more general societal system, and so forth. Given this, the meaning and success of any enquiry that applies GST hinges upon an appropriate identification of a system to be studied. This identification then

[6] Although this definition is not a direct quotation from any particular work, it certainly benefits from reading of several seminal work on GST, all of which are provided in the reference. Many variations of the definition of a system abound and readers are welcome to adopt his/her preference, although the definition given here naturally governs discussion in this paper.

defines the scale, scope and direction of the entire investigation and hence is an essential trick of GST to simplify complexity—an enduring characteristic of any system worthy of investigation.

Dynamics[7]

Once system components (elements, environment and boundary) are identified, its dynamics, or behaviour, can be duly examined. Three fundamental concepts in system dynamics, to borrow Rapoport's categorisation, are: organisation, goal-orientation, and identity (Rapoport 1986, p. 29ff).[8]

Organisation looks at the relationship and interaction among system elements *and* between the system and its environment. It is this relationship, interaction and process that defines the dynamics of a system and distinguishes a system from a mere collection of entities. At the most basic, a system interacts with its environment by taking in 'input', processes that through interaction among its elements, which results in certain 'output' that can be rendered back to the environment.[9] One measure of how well a system functions is thus the '*throughput*' which takes into account both the quantity and quality of its processing capability. Throughput in the simplest term is thus the ratio of output to input, a measure that indicates quantitative as well as qualitative capability of a system.

Von Bertalanffy summed up the concept of *organisation* by referring to what he described as a "somewhat mystical expression," which is: "the whole

[7] It may be useful to point out that the concept of 'system dynamics' is different from that of 'dynamic systems'. The former refers to an analytical focal point which looks at the behaviour of a system while the latter is a name given to one specific type of systems (as opposed to "static systems"). All systems have their particular dynamics regardless of whether they are dynamic systems or not.

[8] Although our interpretation may not exactly follow that of Rapoport's, the basic ideas are practically identical, particularly in identifying these as the fundamentals in system dynamics. It must be noted that the adoption here of the term 'goal-orientation' instead of Ropoport's choice of "goal-directedness" is a matter of pure preference.

[9] The importance of and degree to which a system interacts with its environment determines its relative 'openness'. Although closed systems do exist, few are entirely independent of its environment. It is thus more useful to focus on the relative 'openness' rather than on absolute classification of a system as mere 'open' or 'closed'. Most systems of interest, particularly social systems, are invariably very open and their relationship with the environment takes on substantial significance.

is more than the sum of its parts". (von Bertalanffy 1969, p. 55) In other words, what signifies a system is the very fact that its entire existence results in more than a mere additive outcome of its elements—"the non-summative character" to use von Bertalanffy's terminology (von Bertalanffy 1969, 67). For the whole to be more than the sum of its parts, there has to be total synergy at all levels. Again, von Bertalanffy expounded this best as follows:

> ... the behavior of an element is different within the system from what it is in isolation. You cannot sum up the behavior of the whole from the isolated parts, and you have to take into account the relations between the various subordinated systems and the systems which are super-ordinated to them in order to understand the behavior of the parts.
>
> (von Bertalanffy 1969, p. 68)

This leads to the next subtly important implication: for a system, what is good for a part may not be good for the whole. A system thrives as a prolific whole only when its parts work 'together' towards the same destiny. In addition, as implied in the above quotation, the principle of hierarchy dictates that beside synergy within itself, a system also needs to sustain synergy with its environment. This means providing output that nurtures the environment, which in an essential way helps to insure future quality input for the system itself. Underpinning the concept of organisation is thus the notion of "feedback". Simply put, synergy is achieved through constant responses to feedback mechanism among all elements—a crucial communicative mechanism to send and receive pertinent information needed to sustain synergy.

With the above in mind, the notion of *goal-orientation* follows quite naturally. This refers to the idea that a system exists for a purpose; it moves with a certain sense of destiny and destination. Whether this sense is borne out of instinct for survival and growth, derived from conscious deliberation, or both, varies from system to system and is a point to be observed. Whatever is the purpose of a system, its movement can be characterised along time dimension. *Static systems* do exist; these are systems for which time has no effect on its destiny. Systems of equations are good examples for

these; for example, final results of the equation: $E = MC^2$ remain the same for any values of M and C regardless of whether it is solved now or a century earlier. The majority of systems, however, are dynamic systems, whose behaviour takes on meanings when observed over time. The concept of time bears two crucial consequences on dynamic systems. First, time is usually crucial for throughput measurement, certainly quantity-wise and arguably quality-wise as well. A dynamic system that deliver more and better output given the same amount of time is usually regarded as a more efficient system than one that would take more time for the same quantity and quality of output. Second, time denotes change and change denotes uncertainty. How a system behaves and whether or not it still thrives in the midst of change and uncertainty is the second measure of its performance. This brings us to the next concept of identity.

Rapoport (1986) defines *identity* as "stability within change". To appreciate the subtlety of this definition, we need first to understand the notion of 'system state'. There are three basic states that a system can be in. 'Initial state' is when it first starts off towards achieving its current desired destiny. 'Transient state' is when a system undergoes change and transformation. The change and transformation may be a result of external changes and disturbances, or even shocks, or of internal process necessary either to survive or to achieve its goal. 'Steady state' is when a system constantly sustains a condition that satisfies its desired destiny. A steady state is **not** a static state. Rather, steady state denotes the concepts of stability and sustainability. There are always motion at steady state; indeed it is the very motion that sustains a system in its steady state, very much like an acrobatic act of walking on a rope. Also, steady state does by no means implies lack of progress. Once a system achieves its steady state, a new destiny may emerge that moves it to a new initial condition for a development towards a new steady state that satisfies a new goal.

The notion of identity thus brings out three more implications. First, each particular instance of a system class has its own 'identity' which is

determined by the properties of its elements and environment. For example, although Oxford and Cambridge are each an instance of a university, they are by no means the same. Second, for a system to achieve its identity, it needs to have the capability to learn, adapt, and respond to changes and/or shocks and demand from external environment as well as to internal disturbances and goals. Learning and adaptation must as such be a constant task. Any system that fails to learn, adapt, and respond well will at best perform poorly, at worst cease to exist. The third and last point of observation is that another key measure of system performance lies in its *quality at steady state*. This not only implies that a system has achieved a destined steady state, but also that it can sustain that state in the midst of uncertainties, changes and disturbances, until the time when it needs to move towards the next order of destiny. Quality at steady state can thus be measured in terms of the system potential for *survival, robustness, sustainability* and *progress*.

Appendix A: Diagram 4 captures the conceptualisation of system dynamics as discussed above.

Methodology

Given the above concepts in GST, the next step is the application of such concepts to an inquiry at hand. For this, a few variations of methodological approaches have been developed, most of which follow more or less a general approach that serves as a standard methodology for system enquiry. The common approach comprises three simple analytical stages of: 1) system modelling, 2) system analysis, and 3) system design. This standard methodology is explained below.

System modelling

The first major task in system inquiry is to identify pertinent system components (elements, environment and boundary), the key word here being *pertinent*. It is practically inefficient and virtually impossible to include all

aspects of system elements and its environment in an enquiry. The main consideration is thus to include only those aspects that *are relevant to the inquiry at hand*. The purpose of modelling is to simplify complication in order to have a lucid picture with just the right amount of complexity to aid an inquiry. Modelling is thus an art as much as it is a science. Good modelling results in a model of a system that includes only the aspects needed for the inquiry. Two crucial considerations to aid in good modelling are: 1) identification of specific objective(s) of the enquiry, and (2) articulation of practical assumptions. Together, these help determine system boundary and those aspects of system elements and environment that need to be included in or may be excluded from the model, as well as how the model itself should be presented and comprehended.[10] A final note on system modelling is that it is definitely not a one-off task. A model needs to be constantly adjusted for changes that emerge as a result of variation in the objective(s) of inquiry or new insights into the system as gained in the process of the very study itself.

System analysis

While system modelling concentrates on identifying and selecting pertinent system components, system analysis completes the picture by examining system dynamics. The analysis starts off with the basics of system dynamics already propounded, including system desired destiny at time of investigation, system states and their nature, and the mechanisms involved in internal and external interactions. With the basics in place, it is often useful to classify the type of system we are dealing with. At the very least, the knowledge whether the system is of a static v. dynamic, and closed v. open type helps to direct further investigation. Quite a few useful classification schemes for system types have been developed but the issue

[10] A classic example of modelling may serve to illustrate the above. A map is a simple yet effective model of geographical or transportation systems. The basic assumption for any map is the scale to which it is related to the real system. The particular purpose for making and using any map dictates what to be included and excluded in the final pictures. An atlas of the whole world illustrates all continents and oceanic divisions to provide a holistic picture of the earth physical layout. A map to aid people in finding their way through a city usually includes details of street and place names and the like without having to put down details of every houses or trees the city has. A good map is the one which gives a simple, clear, and easily-readable picture of what it sets out to show for a particular purpose.

goes beyond the scope of this paper.[11] Suffice to say that it is more than useful to be familiar with possible schemes in order to select and apply the most appropriate one for the study at hand.

Obviously, system analysis goes deeper than knowing a system's basics behavioural mechanisms. It involves further rigorous scrutiny into the questions of how, why, when, and how well the system behaves as it moves towards its goal. Particularly for the last question, the measurement of performance need to be devised to the extent that exact measures (in quantifiable units and/or qualifiable properties) to gauge system performance are made available. The exact performance measures naturally follow the two criteria of system performance already introduced, that is, its throughput and quality at steady state.

Two major approaches for system analysis are *scrutiny* (of which mathematical analysis is a formal form) and *experimentation* (of which simulation is an extreme form). Each of these approaches has its own advantages and disadvantages, vis a vis ease of execution, freedom of control and validity of findings. All of these approaches, in theory at least, can be performed either directly on an existing real system itself or on a model of it. Although the latter generally provides more control for the study, it can be either impractical or impossible for a variety of systems which cannot be easily fabricated, quantitatively or otherwise. The choice of which analytical method to employ and on which unit (real or modelled) is usually dictated by the nature of the system itself. In particular, social systems, which invariably involve human beings and social institutions, are extremely difficult or virtually impossible to fabricated and themselves not likely candidates to be experimented or simulated on. As such, in study of social systems, to which theories of the firm belong, we are often left with observation of the real system itself as the only practicable method. Unfortunately, this, from a scientific perspective, is a relatively tedious and

[11] For a quick review of system types, please see Banathy (1998). A more comprehensive survey, however, requires extensive reading of the literature on GST, most eminent of which are listed in the reference.

less powerful option—a challenge all social scientists must contend with. Yet, at the very least, even a descriptive but well-formulated model of the system must be decently contrived, and, as von Bertalanffy put it: "[a] verbal model is better than no model at all, or a model which, because it can be formulated mathematically, is forcibly imposed upon and falsifies reality."[12] (von Bertalanffy 1969, p. 24)

Regardless of the choice of approach, a model of the system in one form (conceptual, mathematical, physical or otherwise) needs to be constructed—hence the necessity of system modelling as the first task. For scrutiny approach, a model is needed to simplify and direct the what, when, where and how to observe. For experimentation, a model itself can serve as the central apparatus for the experiment.

The end results of system analysis are insights into the nature and working of the system being studied. These insights form the foundation for the next and last phase of system enquiry.

System design

Most scientific enquiries are conducted under the assumption of desire for betterment. Rarely do scientists satisfy themselves with gaining insights for the sake of knowledge, although such cases may well be possible. Given that, system enquiry proceeds to its last stage of system design, the sole purpose of which is to provide a framework for effective management and positive intervention to direct and enhance performance of the system of interest. This is particularly true for all social systems studies, regardless of how "betterment" is defined.

The key in system design is twofold. First is to identify aspects which can hamper a system from performing at its best possible potential. Second is to identify aspects which offer room for improvement that will elevate the

[12] Indeed, it can be argued that this is one of the rationale why the neo-classical view of the firm (and its variation) attracts criticism as a model of the firm. Having reduced business firm into a mere "production function," the model itself does not carry enough representative power to characterise the firm the way it must be in most analyses.

system to outperform even its current best. The first identification points out room for corrective intervention; the second enhancement directive. These two tasks can be readily accomplished by insights gained from system analysis which provides framework for examining system behaviour and gauging performance measures.

Finally, system design obviously assumes existence, or possibility, of authoritative mechanisms for manipulation and intervention. Most social systems, of which a business firm is a prime example, satisfy this assumption.

Merits of GST

To end our section on GST, some words on the merits of this paradigm seem appropriate. Put simply, GST is a powerful and robust paradigm that can be applied to a wide range of scientific enquiries. This can be attributed to its two features. First is its power to simplify complication at little cost to complexity. Given that most systems worthy of investigation are complex systems, this feature is indeed attractive. Second is its total flexible generality which makes it a true transdisciplinary meta-theory. Ingenious applications of GST have proved to bring out insights and findings which may not easily emerge without its aid. Particularly for our purpose, GST has been, either consciously or unconsciously, applied to the study of firms both within economic and management disciplines.

Which brings us to the very task of looking at the firm under the guiding light of GST.

3 System view of the firm: a synthesis

It would be presumptuous to pretend that we are ushering in a revolutionary undertaking here. In both economics and management, the influence of system thinking can be traced far back in time and in more ways than one.

Indeed, the term 'system' is scattered throughout past and present literature in both fields. Yet, there lies the jeopardy of presumed understanding. To talk of a system is, unfortunately, not a reliable indicator of conscious application of GST. It does not help either that the term 'system' itself is also perfectly legitimate as a general choice of diction. In this context, then, what we attempt here is a *punctilious* application of GST, particularly as elaborated in Section 2 above. More, we seek to apply GST as an analytical tool to explain the concept of the business firm. Needless to say, beside GST in its original sense, our exercise benefits a great deal from prior 'system thinking' efforts.[13] At the very least, the following system view of the firm is but a *formal synthesis* of these previous deliberations.

Appendix A: Diagram 5 summarises a conceptual explication of the proposed system view of the firm. The following discussion elaborates on the issues outlined in the diagram, within the methodological framework of system modelling, analysis, and design.

Model of the firm

As already emphasised, any system study must start off with the specification of *the objective of the enquiry* itself. This is straightforward enough in our case, since we have already traced the efforts in theories of the firm and formed a preliminary conclusion on the issue. To put it formally, we argue for a 'holistic' theory of the firm which puts together insights harvested from scrutiny made from different perspectives in order to account for a model of the firm that explains both the *nature* and the *working* of a business firm as a social and economic entity. With reference to the last item of Appendix A: Diagram 1, a holistic model of the firm must be able to provide *simultaneous* insights into the following five pertinent dimensions of a business firm.

[13] In particular, we are much indebted to the following work: Ackoff (1971); (1974); Ackoff and Emery (1972); Anderson (1999); Banathy (1997); Boulding (1956); Checkland (1999); Dooley and Van de Ven (1999); Flood and Carson (1993); Gharajedaghi (1999); Morel and Ramanujam (1999); and Senge (1994).

- Existence: the model must give a *definitive* answer to Coase's question of "why firms exist at all?" By definitive is meant a unique identity that define firms as distinct from and irreplaceable by any alternative entity, from whichever perspective. This addresses issues such as: "why firm and not market"; "why firm and not non-profit organisation"; "why not just one big firm"; and other disputes of similar nature.

- Internal dynamics: the model must be able to provide robust platform for inquiry into relevant internal dynamics of a business firm. This addresses directly the working of the firm—the issues of what, how, *and* preferable how well, a firm does what it does.

- Growth and development: the model must provide apparatus for analyses of a business firm's progress through time. We denote progress as growth and development—a related but not synonymous measures of progress. Following Ackoff's posit, we argue for distinction between growth and development. Growth is an "an increase in size or number" while development is "an increase in capability and competence." (Ackoff 1999, p. 44) Growth is relatively quantitative; development qualitative.[14] As Ackoff argued, growth and development can be mutually exclusive, although for a number of circumstances, they are very much inter-related. How, how well, and even how far firms grow and develop are issues relevant to any study of a business firm.

- Boundary: the model must provide a set of mechanisms that assist in drawing the boundary of a business firm and discerning the meaning of such a boundary. This, in a sense, is the flip side of the question of existence. Without boundary, firm's existence is rendered rather meaningless. The concept of boundary, in

[14] Of course, this can be taken as a matter of mere definition; many scholars use growth to denote what must be development in our terminology. We beg readers' tolerance for a rather stringent use of the two terms in our discussion. This is done more for the purpose of clarity than rhetoric.

addition, provides essential analytical apparatus to investigate firms in relation to its environment. Firms are usually viewed as existing as part of an industry, which in turn exists as part of the larger economy and society. Delineation of the firm from its multifaceted environment is the first crucial step in further investigation into issues such as vertical or horizontal integration, outsourcing, or supply chain management, to name but the most obvious.

- Relationship with external environment: this is an issue that follows naturally from the previous one. Firms do not exist in a vacuum and myriad questions emerge that call for an understanding of the external dynamics of firm and its environment. The model of the firm must provide venue for conceptualisation and analysis of the many aspects related to the relationship between firms and its environment.

In brief, we seek a theory of the firm that addresses in a coherent fashion *all* of the above five issues. Our review of theories of the firm in Section 1 concludes that prior views of the firms do address one of more of these issues, but none actually encompasses all five in a truly congruous manner. We argue that a system view of the firm as presented here is a potential model of the firm that accomplishes the stated five-dimensional objective of the inquiry.

***Definition*: 'the firm' as a system**

With the above objective in mind, the (business) firm is defined as 'a system of productive functional elements that thrive together by processing resources—essentially input from the marketplace, and deliver market offerings of economic value—as output back to the marketplace.' The gist of this definition is in defining the firm as *a system* in a strict GST sense. Given that, the rest of the above short definition must be interpreted in accordance with concepts and implications rendered in GST. A full interpretation of the

definition results in a model of the firm as a complex dynamic system expounded in the rest of this section.

***Components*: elements, environment and boundary**

Our initial model of the firm is a conceptual one, although it is expected that this initial conceptual model, or certain parts of it, may well be developed further into some other forms of modelling, if and when appropriate. Admittedly, the model is by no means a final version of a system view of the firm. It is proposed here essentially in search for further discourse that will help refine it further. The conceptual model is depicted in Appendix A: Diagram 6. Explanation of the model follows.

We identify six essential ***elements*** of the firm as a system: resource, operation (production), transaction (exchange), innovation, management, and leadership. Not surprisingly, the first four of these elements are harvested from economic theories of the firm as earlier reviewed. The last two elements benefit evidently from the discipline of management. It must be emphasised that these elements are selected based on a *functional* perspective of the firm. There are of course many uncountable ways to define elements of the firm, depending on the objective of the enquiry.[15] As clarified, our objective is to understand the firm as an economic and social entity and so it follows that elements of the firm that are relevant to our objective are those that is scrutinised via the issue of what functions are necessary for a firm to thrive as an economic and social entity. We believe that the six *functional* elements identified are paramount to the firm. A brief clarification of the relevancy of the elements follows.

- Resource: is essentially all the inputs a firm *acquires* from its environment, *allocates* to other functional elements for actual *utilisation*, and simultaneously *cultivates* for future allocation and

[15] To give an example from a layman view of the firm, for most people who work in or with a business firm, the most usual elements are defined according to departmental designation (accounting, human resource, logistics, information systems, and so forth. Such taxonomy, although perfectly useful for many purposes, is not very effective for our investigation.

utilisation. Tangible as well as intangible resources must be considered. The most essential classes of resource that are needed for a business firm are *physical capital*, *financial capital*, and *intellectual capital*. These three classes of resources initiate and permeate all other elements of the firm. Acquisition, allocation, utilisation and cultivation of resources constitute an essential part of the internal dynamics of a business firm. Insights provided by resource-based school of thought together with the emerging core-competence argument should be a good starting point in further investigation related to the issue of firm's resource.

- Operation: includes that functional element which performs a particular operation on certain set of resources in order to create specific market offerings. In the old days of early industrialisation, the term 'production' and 'products' may suffice. However, in the current economy, operation is better suited to describe the activity in a firm that churns out market offerings in the forms of products or services, or both. While resource is the essential input from the firm's environment, market offerings is the essential output from the firm into its environment. Although neo-classical treatment of production function within general equilibrium analysis provides substantial insights into operation that yield market offerings mostly of tangible sort—which is characteristic of the industrial economy, much remained to be probed in order to understand operation that yield market offerings of intangible, or mixed, sort—which increasingly better describes the current economy.

- Transaction: refers to the act of exchange, both internal and external, that must be carried out in order to orchestrate the flow of resources and market offerings. Analysis of transactions that take place within the firm, and between the firm and outside entities in the environment can start off with insights from diverse

theoretical and empirical efforts from the transaction-cost economics research tradition.

- Innovation: is, as attested by the evolutionary economics school, the function critical to the firm's survival and progress. Innovation encompasses all facets of entrepreneurial undertaking that seek to change or improve characteristics of existing firm's element as well as the manner of the firm internal dynamics in the hope to sustain competitive advantage within the marketplace. This includes, for starters, innovations of the type commonly identified as product or process innovation (technological innovation), as well as those which have only recently stirred attention, namely organisation innovation. Needless to say, evolutionary economics school, with its unrelenting championing of entrepreneurship, is the most logical place to start any investigation into the issue of the firm's innovation.

- Management: is the element which acts like a glue to bind all other elements, and sub-elements, together so that they all act as a whole. This includes, no doubt, traditional management functions of planning, budgeting, staffing, organisation, co-ordination, supervision, controlling, and evaluation. Management, in other words, brings order into the complicated web of elements and breaths harmony into the chaos of elements. It is management which pre-empts the 'parts' from putting its priority against that of the 'whole'. History of management thought is a rich ground to further investigation into the role of management in the firm as a system. (Wren 1994)

- Leadership: is the element that relates directly to the firm's progress. We argue for the difference between management and leadership, although many may see the two as practically synonymous. For the firm as a system, while management binds elements into one integrated whole, leadership moves that

> integrated whole toward a specific goal as one entity. As such, leadership has less to do with organisation and co-ordination and more to do with motivation and strategy. Management takes the horse to water; leadership makes him thirsty and drink it. Because of this distinction between management and leadership, each of the two elements needs special scrutiny vis a vis its functional purpose in the firm. Again, study in leadership provides a rich ground to investigate this concept. (Bass 1990; HBR 1998; Northhouse 2000)

The firm as a system then must have the above six elements working together as one. The concept of hierarchy, in GST terminology, implies further that each of the above main elements itself may be seen as a system. Hence, each functional element can be defined as a sub-system of the system of the firm. This offers an opportunity to focus, re-focus, and de-focus the analysis in accordance with any specific set of enquiry, without losing the sense of relativity. In other words, it lets us sense the forest while looking at a tree.

Having thus identified the firm, we move on to define its ***environment***. Given that our objective is to look at the firm as an economic and social entity, the firm's element can be define *broadly* as the economy and society in which it is a part of, and for the purpose of convenience, this environment is given a broad name of '*the marketplace*'. The marketplace simply denotes the environment from which the firm draws its collection of resources and to which it delivers its collection of market offerings. Note that the firm itself is now a sub-system of a larger system—again, following the logic of hierarchy. More, this very same conceptual apparatus also reminds us of the possible multifaceted characteristic of the firm's environment. Once again, our analytical lens can be focus according to a specific set of enquiry. The firm can be seen as a sub-system of an industry, an economy, a society, or other larger systems, depending on whichever perspective provides the best view for the analysis at hand.

Finally, to complete the analysis of the firm's component, the issue of ***boundary*** must be outlined. Here we must tread somewhat into the twilight zone. At the very least, the firm's boundary can be traced based on the internal dynamics among its elements, namely, those elements and sub-elements that are working *together* under the sense of the *exact same purpose*. This vague boundary is arguably a double-edged sword. On the one hand, it is rather fluid and hence difficult to tackle. Yet, the fluid character also offers flexibility to adjust the boundary to fit a specific enquiry. In general cases, the above faint boundary as defined by the binding of the six pertinent elements should provide sufficient guideline for analysis. In a number of more complicated situations, the faint boundary renders itself to appropriate adjustment. For example, for the emerging issues of inter-firm relationship such as strategic alliance, networking, outsourcing, or supply-chain management, it is surely tempting to re-define the boundary of the firm in a more sophisticated manner.

Dynamics: the motion—properties, goal, organisation, and identity

It must be pointed out that a major motive in looking at the firm as a system is our hypothesis that it is the concept of *motion* that is key to a true understanding of the nature and working of the firm. It is the analysis of the *dynamic interplay and interrelationship* and *not* of *static outcome* that provides richer and more meaningful insights. This, of course, is feasible via the conceptual apparatus of system dynamics. Analysis of the 'dynamics' of the firm will be briefly introduced here. Predictably, this is the area where further discourse and development will most likely reside.

Before the issues of goal, organisation, and identity (in GST context) can be expounded, we must first seek to identify system properties of the firm. Following is an outline of the most relevant properties of the firm as a system.

- Of type social system: this simply means that the firm is not a natural system, such as biological systems, but rather one created

by men. As a rule, social systems are systems formed in human society, the 'design' of which can either be by evolution or intention, or both. It can be argued that the firm is more of a hybrid social system between conscious design and evolution, a property that can be of significance in many analysis.

- Evolutionary and non-deterministic: denotes the fact that the design and progress of the firm, as a social system, are heuristic rather than formulaic because both are essentially governed by the law of evolution, together with the principle of equifinality of open systems (to which all social systems belongs). The implication of this is two-fold. First, insights from the evolutionary economics school are paramount in any inquiry about the firm. Secondly, the design and progress of the firm cannot be predicted or pre-destined with absolute certainty but only with probabilistic qualifier.

- Open: this denotes high degree of interactions and inter-dependencies between the firm and its environment as well as its pursuit of 'steady-state', not static equilibrium. Because the firm is an open system, analysis of it must always take into account the implications of the interplay between the firm and its multifaceted environment. More, as an open system, the firm's progress, as expounded by von Bertalanffy, (von Bertalanffy 1969, pp. 39-41) follows the law of "equifinality" rather than equilibrium. This will be further explained in a later discussion regarding the firm's identity.

- Complex and dynamic: this is a property recognised by numerous serious scholars of the firm and is an issue that demands great care and insights in analysis. (Anderson 1999; Beinhocker 1997; Dooley and Ven 1999; Gharajedaghi 1999; Morel and Ramanujam 1999; Rosenhead 1998; Senge 1994; and Waldrop 1992).

- Inherently unbounded: this emphasises the fact that the firm, as an open evolutionary system, is forever evolving, which in turn constantly re-defines its boundary. This cautions investigators to take boundary, or the line between the firm and its environment, with certain degree of reservation and flexibility.

Having thus identified system properties of the firm, the issue of ***goal orientation*** is next in order. Much has been argued as to the objective of the firm. Profit maximisation, as the neo-classical economics attest, is suffice to describe the firm's goal orientation Management professionals would argue otherwise that the firm' objective is realistically more intricate than pure profit seeking. Looking at from GST perspective, it is argued that profit is but one indication of goal-orientation. At a higher level, *the firm's primary goal as a system is to sustain and advance its competitive advantage in the marketplace*. Profit is often necessary but not sufficient for a firm to realise this goal. This is because competitive advantage as a high level goal can be translated into many lower level, instance specific, objectives—profit is obviously first among which, but market share, corporate image, market value, and so on, are equally legitimate candidates. As an evolutionary entity the firm needs to not only survive but thrive and advance in the marketplace competition. Competitive advantage, and the many facets it can be translated into, has long been upheld in strategic management discourse (see in particular, Ansoff 1965; Barney 1991; 1995; Galbraith 2000; Grant 1991; Lado, et al. 1992; Peteraf 1993; Porter, Michael E. 1985; Porter, Michael E 1987; and Schneider 1996) and it is challenging to glean from this rich ground relevant insights that can be applied to the issue of firm's goal orientation behaviour as proposed here.

For a firm to realise and maintain its goal, the ***organisation*** or motion of its internal dynamics must manifest sustainable harmony and direction. It is proposed that two groups of theoretical constructs are crucial to orchestrate such internal dynamics. The first group is universal to all systems, that is, interaction and synergy—in other words, it is the motion

that keep up the harmony, as earlier described. Particular to firm as a competitive economic system in a marketplace is the second group of constructs. For firm to keep its balance and motion in a marketplace, it must rely on effective strategy. A strategy is only effective in relation to the changing internal and external circumstances—hence the necessity to apply "critical success factors" concepts. Critical success factors or CSFs as an analytical tool is so widely upheld and applied within management community that it has become another taken-for-granted term. One simple but succinct definition of it is: CSFs are "key areas of activity in which favorable results are necessary for a company to reach its goal." (EC Media Group, WWW glossary page)[16] CSFs first help focus attention only to the dynamics of factors that are critical to reach the desired goal, and hence pre-empt the danger of analytical overload. Even more importantly, the actual process of identifying the CSFs for a particular instance itself demands constant alignment of the firm's elements, its dynamics and its goal. For a firm to maintain its synergy of interaction, both internal and external, constant defining and re-defining of strategy vis a vis the firm's goal and its associated CSFs is crucial. This is simply because, as already argues, the higher level goal of competitive advantage has numerous and indefinite variants, each of which is only suitable for a particular state of the firm at a point in time. Which brings us nicely to the last issue of identity.

In any study of the firm that takes up a particular firm in combination with a particular issue, the concept of ***identity*** must be distinctly addressed at the onset. Obviously, the state of a firm is relative to its current specific lower level objective and vice versa. For example, for a first-mover firms, its current objective is to sustain its first-mover advantage and fence of challenges from any follower-competitor. Its identity, then, is simply of that of first-movers. For the same scenario, if our focus is more on the follower-competitors, the identity of the firms under scrutiny are naturally different.

[16] It is interesting to note that the concept of CSFs is very much akin to an important tool in the discipline of operations research or management science—that is, the PERT/CPM method. PERT/CPM is designed to help management of a project by basically focus attention to the 'critical path' along which things must go right in order for the project to be completed as planned. (Wren 1994, p. 397)

The identity of a firm, once defined, provides an analytical path to qualify its relevant initial, transient and steady states. Such qualifications may be used as a basis for further analysis. What is most important in the analysis of the firm's identity, however, is to keep in mind the fact that the principle of "equifinality", rather than equilibrium, governs its progress from state to state. This principle is forwarded by von Bertalanffy (1969) as follow:

> ... In any closed system, the final state is unequivocally, determined by the initial conditions: e.g., the motion in a planetary system where the positions of the planets at a time *t* are unequivocally determined by their position at time t_0 ... If either the initial conditions or the process is altered, the final state will also be changed. This is not so in open systems. Here, the same final state may be reached from different initial conditions and in different ways. This is what is called equifinality.
>
> (von Bertalanffy 1969, p. 40)

We have outlined above only general and basic issues germane to dynamics of the firm as a system. This outline, indeed, only provides a mere skeleton of the framework to be applied in any specific analytical undertaking.

Analytical issues

In line with the objective of enquiry into the nature and working of the firm as stated earlier, this section touches briefly upon the five dimensions of the objective in modelling the firm.

System view of the firm explains the *existence* and *boundary* of the firm using GST philosophy of the whole and the parts. The firm exists in the form that its exist because its six essential elements must come together to work and be more than a mere sum of the six parts. It is what the firm actually is that is more than the sum of its parts that distinguishes it from other social entities or systems—the market, non-profit organisation, or what have you. In brief, the firm—its elements, environment and dynamics—has internal and external dynamics, properties and output that are not replaceable by any other social system.

Next, we argue that what most distinguish the firm from other social systems are its *internal dynamics* and its *relationship with external environment*. It is the motion itself that is of utmost importance and hence must be the gist of the analysis. As mentioned earlier, the first basic element of the firm: resource, permeates its other elements. This provides for the flow of analysis of the firm's dynamics. To wit, it is not the resources that are importance, but rather the *act* of acquisition, allocation, utilisation and cultivation of these resources—into capabilities and competence, and hence competitive advantage, that are the heart of the matter in understanding the nature and working of the firm. Hence, we extends the resource-based school's posit and maintain that analysis of the firm must first and foremost follow the *flow* of resources in order to gain insights into the true dynamics of the firm. In tracing this flow, the notion of feedback can be a useful analytical apparatus.

Finally, assessment of the firm's *growth and development* can be defined and analysed via key determinants of the firm's performance, which are: 1) its internal and external synergy, and 2) its learning and adaptive capability. These two constructs of the firm's performance can, in turn, be operationalised into various 'surrogates', a subject of many current management discourses, particularly in the topics of intra- and inter-firm relationship, and organisation learning. These two determinants of the firm's performance, and their appropriate surrogates, can be assessed vis a vis how they relate or contribute to the firm's performance measures, identified in accordance with GST, that is: 1) quality of the firm's process, particularly its 'throughput', and 2) the firm's total quality at steady state—its survival, robustness, sustainability, and progress.

The previous paragraph is clearly an underdeveloped area and is in need of better and more rigorous explication. Hopefully this is viewed more as a challenge rather than a drawback of our proposed view of the firm.[17]

[17] This is, in essence, the main task of the author's PhD thesis.

Design Issues

For a business firm, leadership and management very much encapsulate 'system design' task, the essence of which lies in the concept of strategy. This brings in myriad of complications that must be pointed out. It can be argued that most social systems, of which a business firm is our prime example, can be seen as evolutionary in its nature (a property of the firm as already described) and thus inherently path-dependent. Yet, to repeat an earlier argument, path-dependency does by no means denote pre-destination. It only implies interdependency in the chain of events—in lines with von Bertalanffy's "equifinality" principle cited earlier. As such, social systems path is essentially probabilistic. This makes room for conscious 'design' or 're-design' effort that aims to 'direct' or 're-direct' the trajectory of the path, indeed the very task of leaders and managers. Such ambition is subject to the following caution, though. Given the probabilistic nature of social systems such as a business firm, its design is a heuristic and not formulaic exercise. The design task must first and foremost be context specific. Put simply, what works in firm A may not work, or may work differently, in firm B, no matter how similar the two firms may be in many dimensions. The key implication of the above is that strategy formulation and implementation is as much an art as it is a science. The task requires naturally-endowed intuition and hard-earned experience, while its success cannot be absolutely guaranteed. This may explain why many strategic exercises have turned out to be at best good learning experiences, at worst total disasters. No wonder many regarded strategy formulation and implementation a challenging task that demands great expertise and prudence, as well as, to put it dramatically, pure 'guts'. This may be part of the reason why chief executives of high-stake corporations are rewarded so outrageously highly for their efforts. In a sense, a case can be made that these executive are selling their talent in a no less dangerous fashion than those of talented Formula One drivers!

WE have surveyed earlier theorising efforts on the theory of the firm, resorted to GST as a meta-theory, and built a model of the firm as a unique complex dynamic system. It is believed that, even in its crude form as presented so far, the system view of the firm benefits from insights in prior research traditions and renders itself a potential for a coherent synthesis of the various views of the firm. This synthesised view, or model, of the firm carries a promise to help simplify the complication associated with an intricate concept of the firm, while offering a set of ingenious analytical apparatus of system thinking to assist in dissecting the complexity and making sense of it. It is our ambition that the system view of the firm may attract enough scholars and professionals to join in further refinement and testing of it. And there we must rest our case.

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Appendix A: Diagrams

Diagram 1: Economic theories of the firm: four schools of thought

	SCHOOL OF THOUGHT			
EXPLICATION	**Neo-classical**	**Transaction Cost**	**Resource-based**	**Evolutionary**
Context	☞ industrial period	☞ dissatisfaction with neo-classical view of the firm	☞ intrigued by idiosyncrasies among firms	☞ contending school to mainstream economics
Acknowledged origin	☞ Marshall ☞ Neo-classical school	☞ Coase ☞ Williamson	☞ Penrose ☞ Demsetz ☞ Wernerfelt ☞ Rumelt	☞ Schumpeter ☞ Austrian school ☞ Nelson and Winter
Main conceptual thrust	☞ production	☞ transaction	☞ resource	☞ innovation
Key assumption	☞ perfect competition	☞ market failure ☞ bounded rationality ☞ opportunism	☞ heterogeneity & imperfect mobility of economic resources	☞ Social Darwinism
Key analytical scheme & its *nature*	☞ price theory ☞ marginalism ☞ equilibrium ☞ optimisation ➥*static*	☞ agency theory ☞ asset specificity ☞ moral hazard ☞ + common neo-classical tools ➥*relatively static*	☞ unique resource as economic rent ☞ competition vis a vis internal capability ➥*relatively dynamic*	☞ disequilibrium ☞ creative destruction ☞ path-dependency ☞ organisational routines as genetic imprints ➥*dynamic*
The firm is …	☞ a production function … ☞ under the law of profit maximisation	☞ a nexus of contracts … ☞ serving as exchange governance mechanism, alternative to market	☞ a collection of productive resources … ☞ whose existence hinges upon successful cultivation of those resources	☞ an engine of innovation in economic evolution … ☞ whose main goals are survival and progress
… thus:	**"the representative firm"**	**"the administrative firm"**	**"the competent firm"**	**"the entrepreneurial firm"**
Firm primary objective	☞ profit maximisation	☞ profit maximisation	☞ sustaining competitiveness	☞ progress in the midst of change
Addressing /explaining economic nature & function of firm?✪	✗ existence ✗ internal dynamics ✗ boundary ~ growth ~ external environment	✓ existence ✓ internal dynamics ✓ boundary ~ growth ~ external environment	✗ existence ✓ internal dynamics ✓ boundary ✓ growth ✓ external environment	~ existence ~ internal dynamics ~ boundary ✓ growth ✓ external environment

Note: ✪ Meanings of the notations are as follow: ✓ = 'substantially' , ✗ = 'very little or not at all' , and ~ = 'discernibly'.

Diagram 2: Economic and management views of the firm: a simple link

ECONOMIC SCHOOL OF THOUGHT	**FOCAL VIEW OF THE FIRM AND ITS IMPLICATION TO MANAGEMENT PRACTICE**	**MANAGEMENT SCHOOL OF THOUGHT**
neo-classical	a black box—a production function ➥ *drive for efficiency in production*	scientific management: Taylorism
transaction-cost	a nexus of contracts ➥ *drive for efficiency in administration* *"the visible hand"*	the "administrative school"
resource-based	a collection of productive resources ➥ *drive for organisational competence / capability*	behavioural science; core-competence school; knowledge management
evolutionary	an engine of innovation in economic evolution ➥ *drive for competitive advantage*	system thinking; contingency models; interactionalism

Diagram 3: Central concepts in general system theory (GST)

		CONTENT EXPLICATION	
		Constructs	**Implications**
ANALYTICAL PIVOT	**(I) Components**	• Element • Environment • Boundary	• Identification of systems and sub-systems defines scale, scope and direction for an inquiry.
	(II) Dynamics	• Organisation: ➥ interrelationship & synergy: ◦ Among elements ◦ With environment • Goal-orientation: ➥ destiny & destination ~ time • Identity: ➥ states & conditions: ◦ Initial state ◦ Transient state ◦ Steady state	• The whole is more than the sum of its parts. • What is good for a part may not be good for the whole. • Dynamic behaviour over time characterises dynamic systems. • Each instance of a system class is uniquely characterised by the properties of its elements and environment. • Learning & adaptation are key engines of performance. • Performance can be measured in terms of: ◦ quality of system process: i.e. input — *throughput* — output, ◦ quality at steady state: survival, robustness, sustainability, and progress.

Source: Author's synthesis integrated from various sources (provided in the reference list). The three categories for the concept of system dynamics (i.e. organisation, goal-orientation, and identity) follow Rapoport (1986).

Diagram 4: Conceptual model of a general system

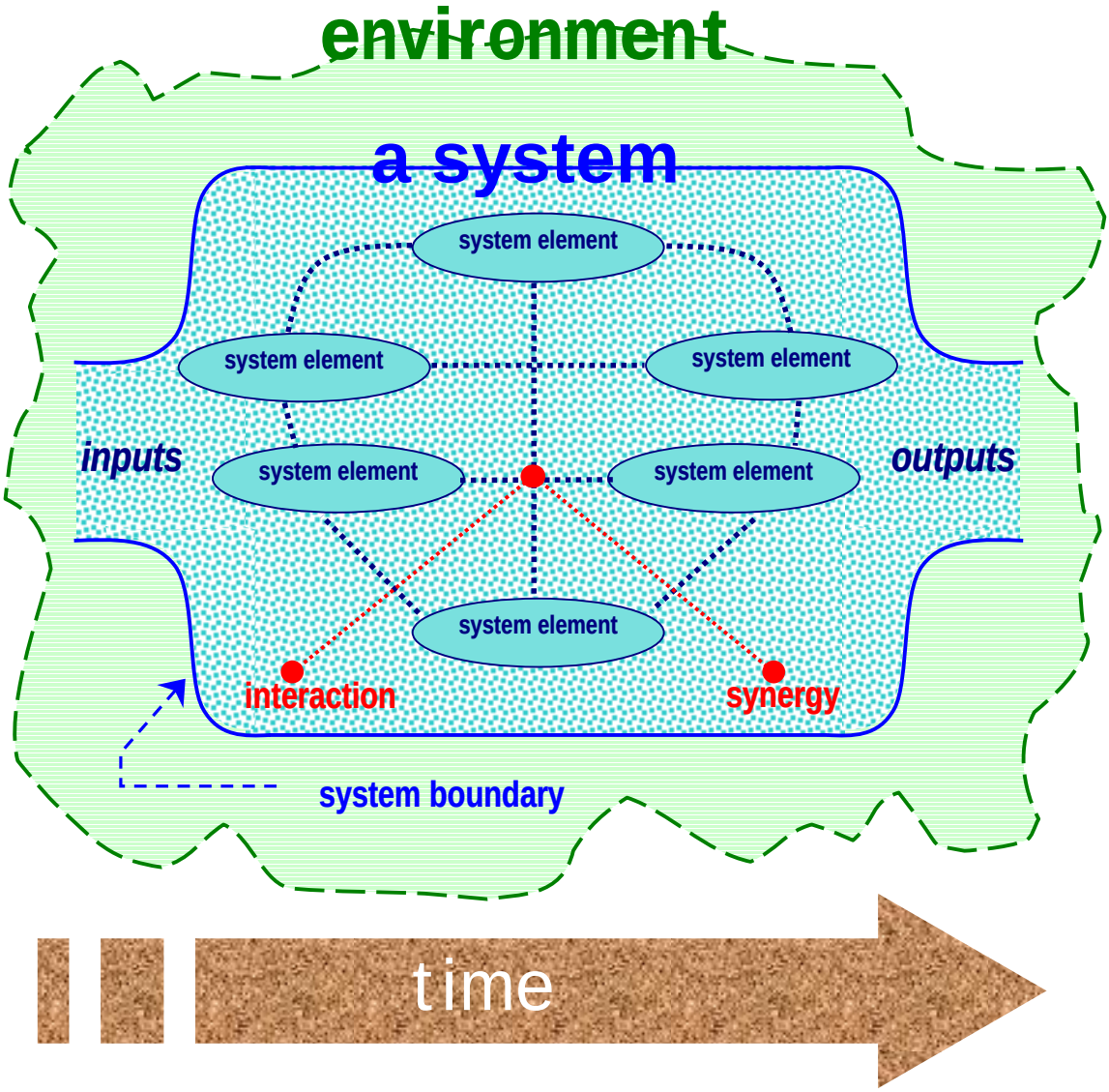


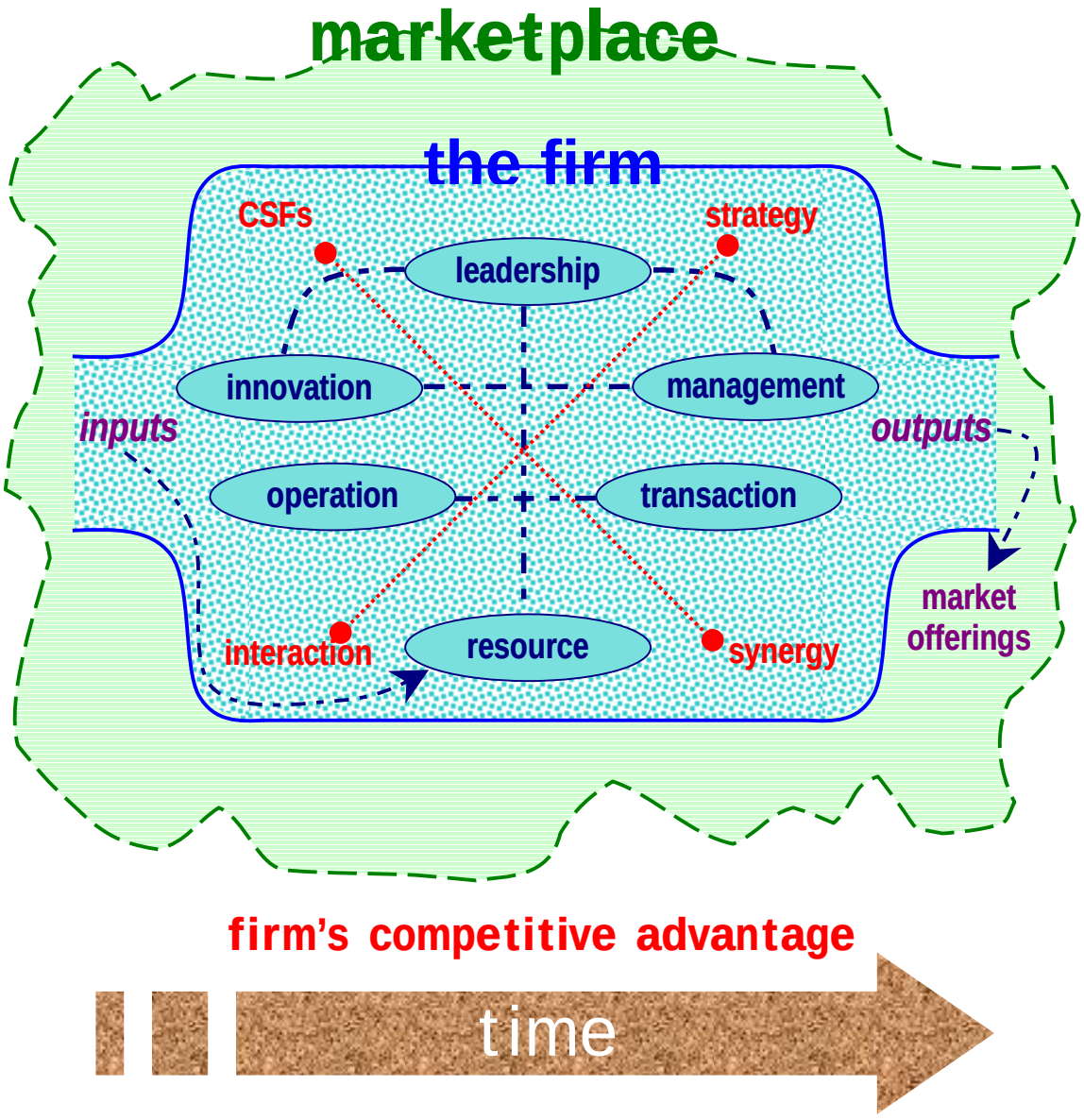
Diagram 5: Central concepts in system view of the firm

	Constructs	Analytical implications

(I) Components	• Element: defined from '*functional* ' perspective:
	  ◦ resource
	  ◦ operation (production)
	  ◦ transaction (exchange)
	  ◦ innovation
	  ◦ management
	  ◦ leadership
	• Environment: *multifaceted* but can be focused vis a vis objective of enquiry. For economic analysis, '*marketplace*' is the relevant environment.
	• Boundary: *fluid* but identifiable vis a vis firm's dynamics and objective of enquiry
		• Objective of the enquiry is to gain 'holistic' insights into the nature and working of the firm, particularly in five pertinent dimensions:
		  ◦ existence
		  ◦ internal dynamics
		  ◦ growth and development
		  ◦ boundary
		  ◦ relationship with external environment
		• The (business) firm is defined as: 'a system of productive functional elements that thrive together by processing resources—essentially input from the marketplace, and deliver market offerings—as output back to the marketplace'.

(II) Dynamics	• Goal-orientation: firm's primary goal is to sustain and advance its competitive advantage in the marketplace
	• Organisation: analysis of the organisation of the firm's six elements under a *combining* light of two groups of major theoretical constructs:
	  ◦ interaction vis a vis synergy
	  ◦ strategy vis a vis critical success factors (CSFs)
	• Identity: states & conditions of a firm to be analysed vis a vis its status in the marketplace *and* the economy
		• The firm, as a system, has the following properties:
		  ◦ of type social system
		  ◦ evolutionary and non-deterministic
		  ◦ open
		  ◦ complex and dynamic
		  ◦ inherently unbounded
		• Existence and boundary of the firm is explained via the concept that "the whole is more than the sum of its parts."
		• Internal dynamics and relationship with external environment are the most important analytical focus.
		• Growth and development can be defined and analysed via key determinants of the firm's performance, which are:
		  ◦ internal and external synergy
		  ◦ learning & adaptive capability
		• The firm's performance can be measured in terms of:
		  ◦ quality of system process: i.e. input — *throughput* — output,
		  ◦ quality at steady state: survival, robustness, sustainability, and progress.

Diagram 6: Conceptual model of the firm



Appendix B: Author's biography and information on PhD thesis

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Biography:

Ms. Kwanjai, originally from Thailand, joined UNU/INTECH as a PhD student in the MERIT–UNU/INTECH Ph.D. Programme in Economics and Policy Studies of Technical Change in September 1997. Prior to that, her work experiences have been mostly within the information and communication technologies (ICTs) industry, both in research and general management. Currently she is working on her PhD thesis, entitled "Intellectual capital and economic performance of firms in the knowledge-based economy: a close look at evolution of modern enterprises." Ms. Kwanjai expects to complete her PhD thesis at the end of 2001 and will henceforth seek to develop a career in teaching and research. Her main academic interest will most likely evolve around the broad field of business policy and strategy, particularly in light of the changing 'new' economy.

Information on PhD Thesis

Title: *Intellectual capital and economic performance of firms in the knowledge-based economy: a close look at evolution of modern enterprises.*

Date started: May 1998

Promoters: Friso den Hertog and Luc Soete (Maastricht University)

Progress to date: Currently writing up chapter 1 to 4; currently compiling database for chapter 5; survey for chapter 6 planned to be conducted 2nd quarter of 2001; chapter 7 and 8, reporting results of the study, to be written after survey results are available.

Expected contributions: Expected contributions fall into three areas: 1) strengthening the unification between the disciplines of economics and management; 2) contributing to theorising effort on the theory of the firm; and 3) adding insights into the current transformation process of the modern firm and the knowledge-based economy.

Description of Thesis:

The thesis undertakes theoretical and empirical investigation into the changing role of intellectual capital and economic performance of firms in the knowledge-based economy. Essentially, the study takes up the business

firm as its central concern. It seeks to understand the nature and function of the business firm first as it is theorised by economic and management scholars. It then synthesises these existing views into an integrated 'system view of the firm' which serves as the core analytical framework. Base on this framework, a critical review and survey are conducted on selected enterprises, aiming at gauging the awareness and opinion of management professionals on the role of intellectual capital and its relation to firms' economic performance and how this issue can be related to the strategic management of modern firms as they evolve in the contemporary 'new' economy.

The thesis adopts an inter-disciplinary approach, essentially cross-fertilising economics with management. The focus of analysis is strongly biased towards that of strategic management, while the devised 'system view of the firm' serves as the core analytical paradigm for the entire investigation. The study is now on-going and expected to be completed at the end of the year 2001.