Business ecology – A new science

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This paper is a theoretical exposé of the relatively new field of business ecology.

It presents a conceptual model of how the organization interacts with the environment. Although the concepts are well established in ecology, the author demonstrates their business application.

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Hierdie artikel is 'n teoretiese exposé van die relatief nuwe veld van Besigheidsekologie.

Die artikel dui die wyse aan waarop die organisasie en die omgewing op mekaar reageer. Alhoewel dié konsepte reeds deeglik op ekologiese vlak vasgestel is, bewys die skrywer hier die praktiese waarde daarvan vir die sakeman.

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Business ecology – the new science

Sociobiology is defined as the systematic study of the biological basis of all social behaviour. Its focus tends to be animal societies, their population structure, modes of communication and the physiology which underlies social adaptations. It is also concerned with the social behaviour of (early) man including (early) modes of social organization.

A sub-set of this field of research is organization biology, which studies business as an evolutionary form within a socio-cultural framework. It examines the anatomy of social organizations: why primitive (economic) societies develop from 'barter systems' to sophisticated 'credit financing' systems; why there is growth in size – from the sole trader to huge multi-national corporations; how different trading units develop by type, size, frequency, location and trading style; how communications, both internal and external, affect growth; and why change takes place. In short, its concern is organization structure and operational life-style.

This biology (study of infrastructures) takes place within an ecology (study of 'field' relationships) and it is this business ecology which is seen to be of increasing importance to businessmen. See Figure 1.

Various aspects of Organization biology were discussed in an earlier article *(S.A. Journal of Business Management,* December 1982). In that article the author suggested that a business organization was a living organism albeit in a tenuous form, and in particular analysed the characteristics of growth and its applications for management.

1. Is the business organization a life form?

A strong argument can be put forward for the fact that a business organization is a 'life form' with its own biology and ecology. According to Carl Rogers, 'Living things are self-organizing systems, in that a self-organizing system is living.'[1] This does not deny that it has non-living components as shown in Figure 2.

More specifically, Asimov[2] defines the characteristics of life as follows:

- a living thing shows a capacity for independent motion against a force;
- can sense and respond adaptively;
- metabolizes i.e. converts material from its environment into its own substance;
- grows;

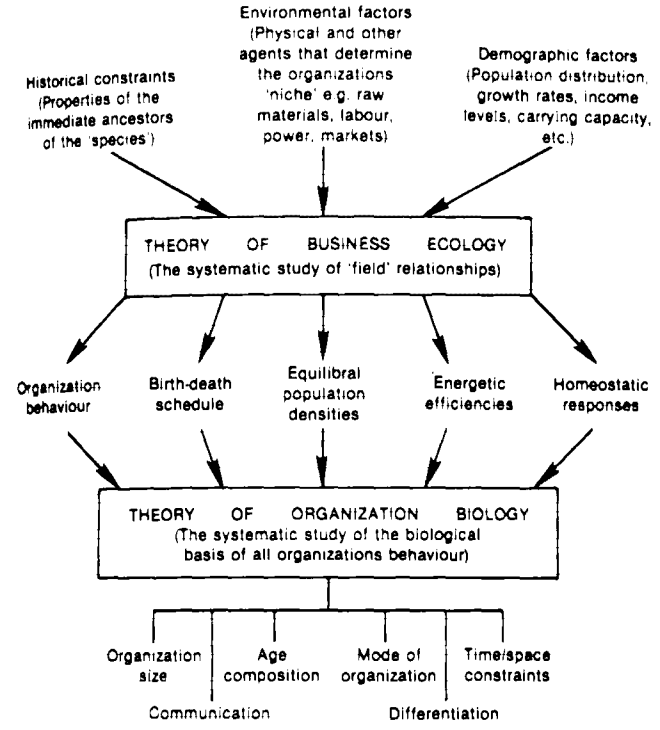


Figure 1 The evolutionary and ecological parameters affecting business form

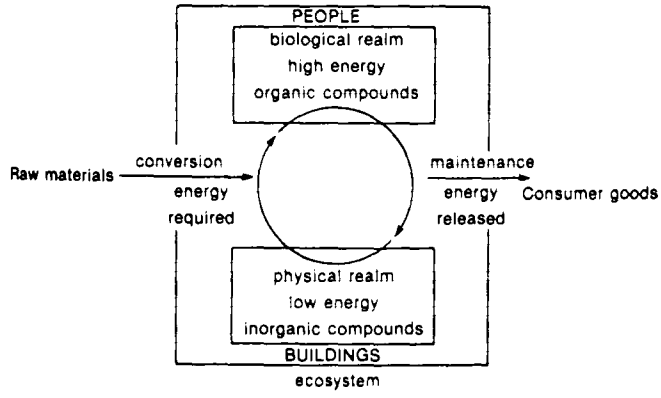


Figure 2 Living and non-living components of a business system

– reproduces.

We shall examine the business organization against these criteria.

1.1 The capacity for independent motion against a force

One of the Laws of Nature concerns entropy. This states that anything left to itself will tend to deteriorate. This statement applies to everything – a building, machinery, or a business organization.

In a hostile environment especially, various forces – political, economic, social – work against the well-being of the company. These might be economic uncertainty, rising costs, scarcity of resources, increased competition, government regulation, political unrest, consumer discontent, demographic changes, etc.

To cope with these, the organization has to make adaptive changes 'for the better'. It improves its operational variables e.g. selling methods, merchandise flow, stock control, cash intake, distributive techniques, operating skills and management, and strategic variables e.g. long-term contracts, forward and backward integration, standardization, structural re-organization, etc., anything to minimize uncertainty, chaos and disorder.

In short, an organization showing life has a capacity for independent motion against the deleterious forces in the economy. It shows 'negentropy' or an increasing sense of well-being and order. The greater the 'health' of the organ or organization, the greater the resistance to the decaying forces of nature.

1.2 Sensing and responding adaptively

Change is a fact of life. Some typical change areas which affect business are shown in Table 1.

Table 1 Some major change areas

Communications – electronic media	Computers – micro-processors
Consumer issues – various	Corporate issues – multinationalism
Demographic data – urbanization	Domestic politics – fragmentation
Economy – ecospasms	Education – computer assisted learning
Employment – job re-design	Environmental issues – various
Institutional changes – role of banks	International relations – expediency and dependency
National resources – utilization	Regulating issues – Law and procedures
Science and technology – numerous	Transportation – containerization
Value changes – punk rock	Social issues – polarization of racial groups
Energy dependence – oil	

An organization that cannot adapt to change faces extinction. Most companies sense (monitor) results to determine what changes are taking place in the environment. Those that fail to heed change find profits eroding and sales declining. Strategic planning, the ability to plan ahead for a future, is a typical coping mechanism by which an organization responds adaptively.

Edgar H. Schein[3] has suggested there are six stages in this adaptive-coping cycle:

(a) Sensing a change in some part of the internal or external environment
(b) Importing the relevant information about the change into those parts of the organization that can act upon it.
(c) Changing production or conversion processes inside the organization according to the information obtained.
(d) Stabilizing internal changes while reducing or managing undesired by-products (undesired changes in related systems which have resulted from the desired changes).
(e) Exporting new products, services, and so on, which are more in line with the originally perceived changes in the environment.
(f) Obtaining feedback on the success of the change through further sensing of the state of the external environment and the degree of integration of the internal environment.

1.3 A living thing metabolizes

In biology, the principal steps in metabolism, i.e. convert-

ing material from the environment into its own substance, are: ingestion, digestion, absorption, assimilation and excretion.

In like manner, organizations need energy to develop and grow and to maintain their business functions such as production and marketing. Energy to support these activities enters the business system in various forms – capital, raw materials, personnel. Primary producers (e.g. mines and manufacturers) convert these imports into value-added goods or services during the production process. The rate at which primary producers convert raw materials into secondary products (semi-processed or finished goods) is called primary productivity.

It is important to realize that primary production underlies the entire structure of the business community. The output made available by primary production drives the machinery of the economy. The flow of energy – capital, goods and services – through populations of wholesalers, retailers, consumers, and other end users, is ultimately tied to the productivity of primary producers.

The basic equation for production includes raw material inputs as well as machinery. However, many business reactions are involved in production and we can summarize production by the general equation:

RAW MATERIALS + MACHINERY →
PRIMARY PRODUCTION + VALUE ADDED
(in the presence of manpower, methods and markets)

There is a parallel between between the energetic efficiencies described in ecology and that in the business environment. This is shown in Table 2 and in Figure 3.

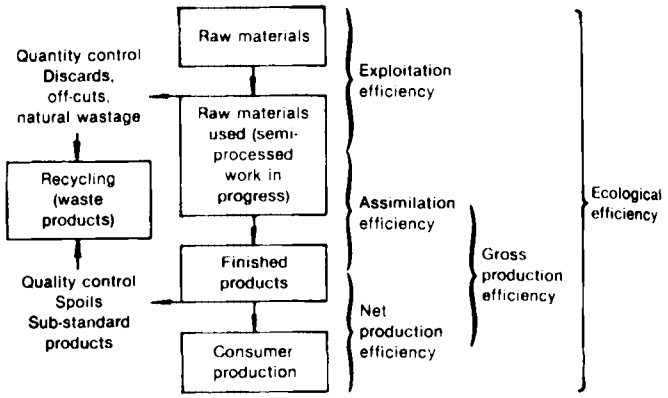
Table 2 Energetic efficiencies

	Business	Nature
(1) Exploitation efficiency	Intake of raw materials / Amount of raw materials processed	Ingestion of food / Prey production
(2) Assimilation efficiency	Amount of raw materials processed / Intake of raw materials	Assimilation / Ingestion
(3) Net production efficiency	Amount of finished products / Amount of raw materials processed	Production (growth) plus reproduction / Assimilation
(4) Gross Production efficiency = (2) × (3)	Amount of finished products / Intake of raw materials	Production / Ingestion
(5) Ecological efficiency = (1) × (2) × (3)	Consumer Production / Amount of raw material available	Consumer Production / Prey Production

Note: The movement of energy through the business community depends on the efficiency with which organizations consume resources and convert them into consumer goods/services. This efficiency is referred to as the ecological efficiency.

1.4 A living thing grows

The resources available to a business will, to a large degree, determine the number of commercial or industrial undertakings it can sustain. All business depends on capital, labour, machinery, materials, power and markets. The number of businesses that spring up and remain operative depend upon the carrying capacity of the environment to sustain economic life.



Note: Energy used for maintenance functions is not shown here.

Figure 3 Business metabolism and energetic efficiencies

Example: wine-producing farm:

Intake of Grapes	(plant processing capacity)	5 tons / 6 tons
Amount processed / Intake of grapes	(some wastage)	4,5 tons / 5 tons
Amount finished products / Amount processed	(some spoilage)	4,0 tons / 4,5 tons
Gross production efficiency	Amount finished / Intake of grapes =	4,0 tons / 5,0 tons
Ecological efficiency	Consumer Production / Amount of raw materials available =	4 tons / 6 tons

Individual businesses interact with one another in a number of ways. They may compete for the same resources or markets (a commensal relationship) or they may work together in a symbiotic (supportive) relationship. These relationships are typical in nature. See Table 3.

Whatever the relationship, there is a limit to the number of businesses of different types that an environment can sustain. The term 'carrying capacity' is used by ecologists to refer to the ability of the environment to support a population. Exactly how large a business community the environment will support depends on its carrying capacity.

It must be mentioned that the events shown in these graphs in Figure 4 occur over time and the carrying capacity of the environment is not always easy to define e.g. how many bakeries, shoe shops, garages, cafes, supermarkets, laundries, banks etc., can a community of such and such size, wealth and location sustain?

Although many factors affect the carrying capacity of the environment, usually just one or two are crucial. No oil – no motor cars, to take an obvious example.

The development of the concept of limiting factors arises from the acknowledgement that there are bottlenecks to growth in every environment. As soon as one 'problem area' is sorted out another one becomes operative. Businessmen are aware of the need to juggle limited resources to get an

Table 3 Typical environmental relationships

Term	Description	Ecological example	Business example
Symbiosis	An association where both parties benefit	Flowering plants and insect pollinators	Newspaper vendors and advertisers
Commensalism	An association where one party gains and the other is unaffected	Mites on mobile bumblebees	Confectioners situated next to a hypermarket
Parasitism	One of the parties in the association benefits (the parasite) and the other is harmed (the host)	Ticks on animals	Trade Unions and Management
Predation	One of the parties in the association benefits (the Predator), the other is destroyed (the prey)	Lion and impala	Business takeovers (forced closures)

optimal result and various techniques such as linear programming and critical path analysis have been developed for this purpose.

The limiting factors can be anything – lack of customers, management skills, capital, production facilities, energy, space. The financial press refer daily to 'restrictions in money supply,' 'shortage of skilled manpower,' 'high energy costs' etc., all of which limit growth. Business growth is restricted by these limiting factors.

1.5 A living thing reproduces

A major characteristic of successful organizations is what may be termed their 'breeding rate': that is, their capacity to produce new customers, new products, new subsidiaries, new retail outlets and new departments.

When the recruitment of individuals into a population and the death rates are equal there is zero population growth. Where 'births' exceed 'deaths' there will be a population increase, and vice-versa. In business, the registration of new companies and closures represents this birth-death syndrome. The total business population is relatively stable with births and deaths fairly evenly matched. Growth often tends to match population growth, and is dependent on resource utilization, standards of living, capital available, etc.

Virtually no business population undergoes long-term exponential growth in size, although certain industries (e.g. electronics) may have a spurt of growth, a short-term adjustment to accelerated demand.

Whether a new business can be successfully introduced into a business community depends upon numerous factors – the absence of competitors, the novelty of the new idea, customers resistance to change, demand factors, management skills and many more. Some environments are hostile to new 'life forms', others benign. The Hypermarket, for example, would be a disastrous failure in an environment, like a small country town, which cannot support mass marketing and volume throughputs.

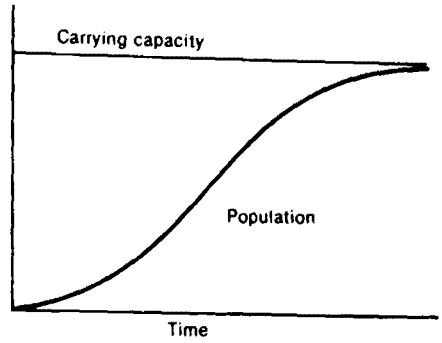


Figure 4.1. shows *growth* being restricted by limitations in available resources, markets, etc. Businesses cannot grow indefinitely in a static market.

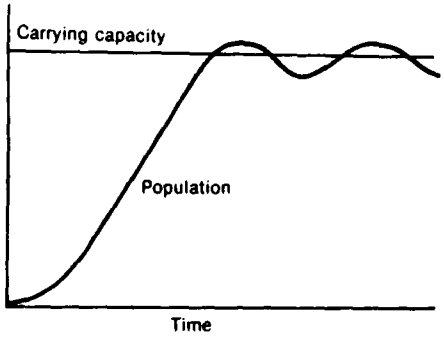


Figure 4.2. shows *maintenance* of an equilibrium state whereby the carrying capacity regulates upward and downward the number of business firms in operation and the most efficient survive.

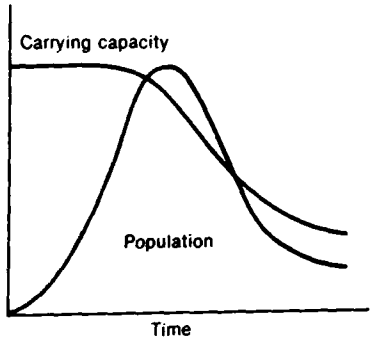


Figure 4.3. shows how a *decline* in carrying capacity e.g. the depletion of raw materials affects the number of businesses the environment can sustain.

Figure 4 Carrying capacity and population

The critical time for most businesses in terms of mortality is the first two years, thereafter the chances of survival are much improved. Figure 5 shows a typical death rate for new businesses. Clearly businesses which survive to year three have a good chance of continual survival.

Ecologists often speak of death rates being density-dependent, which means that the probability of an individual company's death depends on the density of the business population in which it occurs.

The greater the number of competing firms in an environment, the greater stress placed on individual companies (as mortality rates increase). There is some evidence to suggest that, in the animal kingdom, stress accelerates the 'breeding rate'. Whether this is true for the business world the author is not certain.

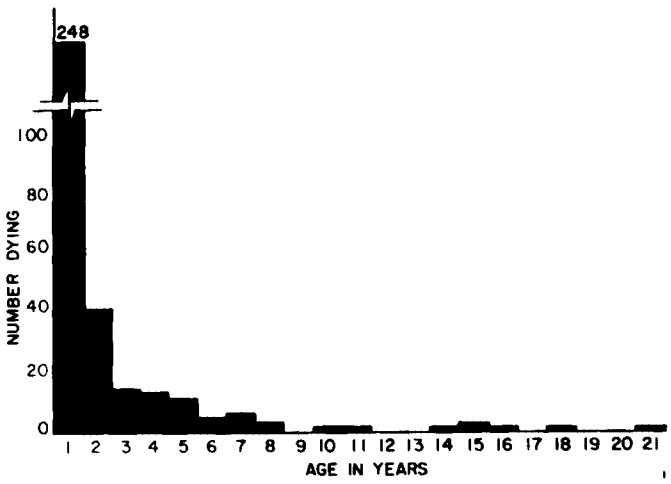


Figure 5 Typical pattern of death rate in relation to age

However, firms are also affected by factors other than population e.g. a shortage of raw materials is not directly related to population variables and in this sense business mortality is density-independent. The full ramifications of these concepts cannot be discussed here.

The interesting observation about points 1.1 to 1.5 is that we are really talking about an ecology or environmental biology, but in the context of the business world rather than plant or animal kingdom. That so many of the ecological concepts and principles hold good, with little or no modification, suggests that the fundamental framework being suggested is solid. Far from romanticizing biology it opens new vistas for business management, and leads to new methods of analysis of success and failure.

2. Discussion: some basic ecological parameters

Ecology (environmental biology) is concerned with the relationship of plants and animals to their environment. Man is part of this animal world and business organizations part of that structure.

By inference, therefore, the regulating mechanisms, principles and laws which apply to nature, also apply to the business world. To prove this, we will examine a number of concepts that occur frequently in ecology, state the underlying principles and relate this to business by way of application. Naturally, in a paper such as this only a few concepts can be dealt with, but nevertheless it is hoped that these few examples will show that we are dealing with an ecological system.

The concepts that we will discuss are business communities – organization diversity – community development – predation. Many others could be discussed e.g. adaptation, succession, extinction, etc. Unfortunately space does not permit such a full treatment.

2.1 Business communities

One difficulty in organization biology is to define what is meant by an individual? From an organization viewpoint, people are simply 'part' of the total organization – workers, organizers, planners, etc., without a distinct identity of their own. When one talks about IBM, Ford Motor Company or General Electric, these are collective terms for thousands of individuals. So in what sense does the individual in the organization have an identity? Is the whole of the business community in some way greater than the sum of its parts?

Clearly these are philosophical as well as semantic questions. A useful biological definition of individuality is that it implies genetic distinctiveness.

What we should bear in mind is that a number of different individuals (firms) make up a 'species' (type) and that these 'species' are present in different quantities in different business communities. These 'species' are not fixed entities but are subject to environmental pressure and evolutionary change e.g. there are ecotypic differentiations between populations, that is, unique adaptations by businesses to the special conditions under which they find themselves.

Typical 'species' might be convenience shops, shopping goods shops, speciality stores, general dealers, department stores, discount stores, chain stores, supermarkets, hypermarkets, etc. It's easy to see that these 'species' (or 'subspecies') are not all the same. However, pending a clear definition of the characteristics of each 'species' there is likely to be considerable confusion and overlap. To the author's knowledge, no distinct nomenclature has been drawn up so that one can say 'that is a discount store . . . that is a chain store' etc.

The maintenance of a business community (structure and functioning) depends on a complex array of interactions. The number of 'species,' number of trophic levels (energy-transfer levels), rates of primary production, energy flow, etc., all determine what that community will look like.

A basic ecological principle is that community efficiency and stability increase in direct proportion to the degree of evolutionary adjustment between associated populations. The key word here is association. If two 'species' (say oil companies and garages) always occur together, their interaction will exert an important influence on the development of each.

Within each community, business development follows a set pattern – usually of primary development (farming or mining) followed by secondary development (trade and industry). Two ecological principles will determine the final 'shape' of the community: (i) ADAPTIVE RADIATION (evolutionary diversification of a 'species' from a common ancestor) e.g. the development of the supermarket, hypermarket, K – Mart, from the bazaar; (ii) CONVERGENT EVOLUTION (the development of characteristics with similar functions in unrelated 'species') e.g. the financing of homes by both building societies and banks.

As a genera rule, these two principles tend to make dissimilar communities more uniform over time.

2.2 Organization diversity

All businesses develop a unique trading pattern. Woolworths is different from Truworths is different from Stuttafords. The way in which a company presents itself and uses the environment to satisfy its needs depends upon its 'marketing style.' The opportunity area it exploits, is called its 'market niche.'

The significant point here is that 'marketing style' (individuality) is normally determined to a large degree by survival and growth opportunities. The Russian ecologist G.F. Gause[4] formulated the proposition that differences between

species (trading units) result from, and are maintained by, competition. Hence similar trading stores strive for different corporate identities and different markets; advertisers of similar products such as beer or toothpaste follow a policy of product differentiation. In this way the total market is catered for. There is a reduction in direct competition and the survival rate is higher.

This pattern of foraging for resources (or markets) in different areas is common in nature. See Figure 6. Different species of fish forage at different depths (from seabed to surface) so that there is less direct competition for resources. And likewise with market segmentation. Each species (trading unit) has its own ecological (market) requirements which differ at least in part from those of related species.

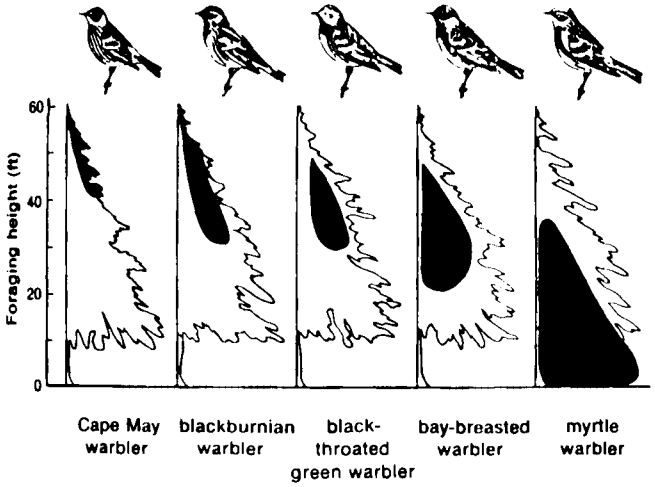


Figure 6 Natural market segmentation

The essential character of a business community depends on the variety of resources it contains. Thus we have 'farming communities,' 'industrial towns,' 'commercial centres,' 'harbour towns' and so on. No two areas are alike (in species-composition) but there are broad trends which can be defined and measured. One way to assess diversity is to make a list and to estimate the relative abundance of the species (organizations) in that community.

In the same way that species diversity increases as one moves from the pole to the equator: that is, there is a greater variety of organism in the tropics, than in the temperate or polar regions, so too is there greater organization diversity as one moves from a poverty culture (under-developed nations) to a wealthy culture (developed nations). Note the interesting parallel – there is a gradient in species diversity correlated with latitude; an organization diversity correlated with wealth. Not that 'wealth' explains all the diversity. See Figure 7.

In every community there will be a few common species (in abundance) and a number of rare species (isolated). Cafes, laundries, banks, and so on, are common; the hypermarket, computer shop, specialist curtaining shop, etc., are rare. A common species in one community e.g. the 'flea market', will be rare in another, and vice-versa. The more species (organizations) present, the greater the likelihood of long-term stability.

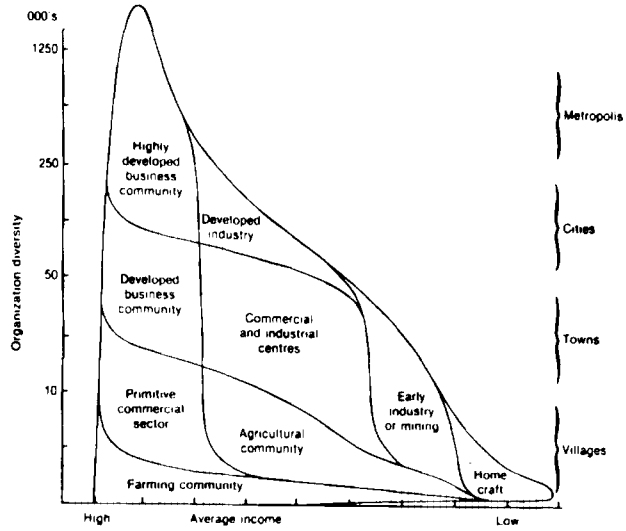


Figure 7 Organization diversity and wealth

2.3 Community development

'The times they are a-changing,' as the saying goes. Organizations die and others are born to take their place. What type of organizations will succeed? Which will disappear? Which organization will be prey, which will be predator? And, at another level, which will act as parasite, which as host?

The general rule is that succession follows the energy chain up trophic levels e.g. sole trader, partnership, private company, public company (or corner grocery store, supermarket, hypermarket).

A word about these trophic levels. The dynamics of any community, business or otherwise, can be measured in terms of resource utilization – rates of energy used and what might be called 'resource transfers' (movement of cash, materials, manpower, etc.) from one organization to another. Each step in the production process represents a trophic level. See Figure 8.

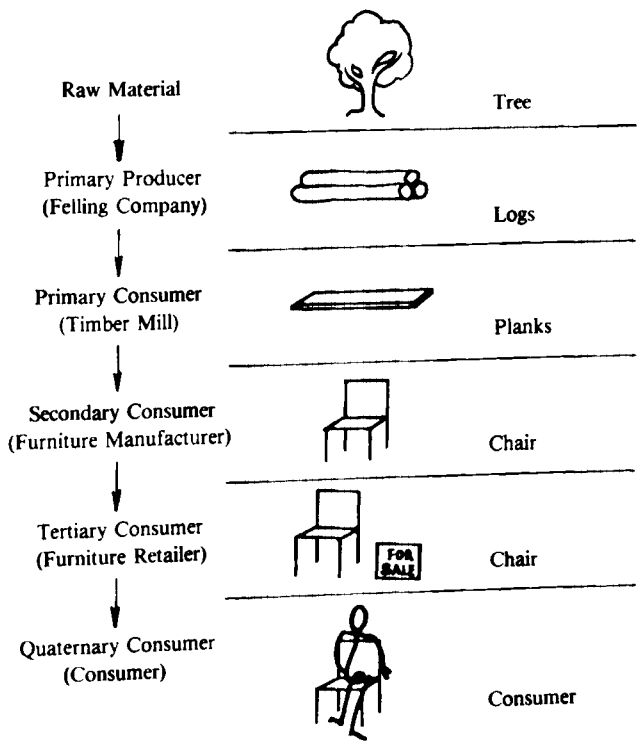


Figure 8 Trophic levels

During the conversion process as illustrated in Figure 8, two things happen. The end-product has 'value-added' – a chair is worth more than plank . . . both in terms of energy expended to make the product and in terms of consumer value. Also, companies tend to deal with others at the next lowest level. Technically, furniture retailers could fell trees and manufacture their own chairs, but in practice this rarely happens. There are many instances in Nature where animals or birds could skip trophic levels but they do not

> 'since the energy value of food eaten must eventually balance the physiological energy expended in obtaining and assimilating this food. Predators generally eat animals in the next lowest size level or so to conserve this energy expenditure.'[5]

With reference to this energy utilization two ecological points are of interest:

- as might be expected, growing animals are more efficient at utilizing the energy of food than adults;
- every time an organism consumes another organism, there is a loss of energy.

Armed with this knowledge we can predict that, if the above statements hold true for organizations, (i) the R.O.I of growing firms (industries) should be higher than those which have reached maturity, and (ii) that every time there is a take-over the chances are that the R.O.I. of the enlarged company will be at a lower rate, than the earlier smaller company.

The last point is quite an astonishing one and has not been verified by the author. It suggests that mergers, take-overs, diversification may not necessarily be the best way to ensure an ever-higher return on capital. Businessmen have come to recognize the dangers of trying to diversify too much. Dr A.W. Rupert (Chairman's Address, Rembrandt Group Limited, *The Argus,* Monday 30 August, 1982) suggests that maximum business efficiency is achieved by 'Doing what you can do, well.' In short, the furniture retailers in our example should stick to retailing.

2.4 Predation

Predation differs from competition in one important respect: whereas competitors exert a mutual influence on each other, predation is one-sided. One benefits, the other is hurt. Take the motor trade, for example. Because of the enormous capital costs, barriers to entry and economies of scale, the motor manufacturers are (relatively) safe from new intruders. These 'giants' which have historically come about by 'swallowing up' smaller companies represent stability in the motor trade population – but is this to the benefit of the community?

Some would argue that the lack of 'free' trade, the improbability of real competitors etc., stifles productivity and results in lower standards.

Others would argue that large predators are territorial. 'I'll look after the Western Cape, you control Natal.' Indeed, research shows that in Nature, antagonistic behaviour, including territorial defense, tends to space individuals evenly over suitable habitats.

However, predation is not necessarily harmful for the community. In Nature, predators feed mainly on the surplus of their prey, capturing the old, the vulnerable, the young, and the displaced, but leaving the reproductively fit untouched. By implication, businesses that are inefficient, outdated or inexperienced deserve to be taken over or to be closed by their more efficient competitors.

On the other hand, some predators feed efficiently on all classes of individuals. The massive hypermarkets and discount warehouses tend to fall into this category. The local butcher, baker and candlestick maker has little chance of survival against mass-marketing giants. In fact, the 'small man' is placed in a position of extreme vulnerability. Extinction is even on the cards. So what, you may argue? Well, ecology tells us that the number of species (firms) in a community respresent the balance between species production and extinction. Reduce the species production (development of new firms) and increase the extinction rate, and interspecific competition reduces. In the long term this may not be beneficial to the community at large. Cartels, administered prices, tacit restraint of trade agreements, and other ploys are all ways in which a few dominent companies could act to maximize their returns and 'manage' prey populations!

3. Conclusion

For each organization there exists some combination of environmental conditions that is optimum for its growth, maintenance, and development. To either side of the optimum, business activity falls off until the organization ceases altogether to be supported by the environment. We see this pattern over and over again, whether we examine the dependence of the firm on customers, or on a continuous supply of raw materials, or on credit facilities granted by bankers, or on the absence of competitors in the environment. Successful businesses require all of these factors if they are to grow and maintain themselves.

We may visualize the general relationship of an organization to its environment on a graph on which we relate rate of business activity (by whatever measure we choose) to a gradient of environmental conditions. This relationship is shown in Figure 9 as a bell-shaped curve (the normal Gaussian distribution curve) although these curves can be asymmetrical.

Regardless of the shape of the activity curve, the ecological distribution of species along the environment gradient is governed by three general levels of tolerance (standard deviations from a norm). First, extreme conditions – a strike, trade embargo, fire – may totally disrupt the business and result in rapid 'death'. Such lethal conditions

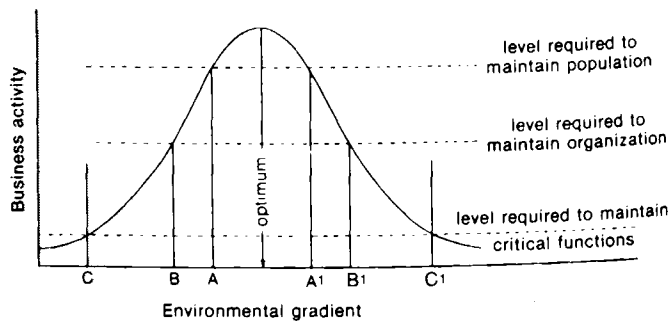


Figure 9 Business activity and the environment

occur beyond points C and C^1 in Figure 9. For example, a lack of working capital brought about by banks calling up overdrafts (often) results in businesses going insolvent.

Second, organizations must sustain a level of activity to maintain themselves in a steady state for long periods. Within points B and B^1 on the environmental gradient, the organization can exist indefinitely. For example, if sales are the key environmental factor, sales within B and B^1 will enable the organization to maintain itself. Sales below B result in profits being insufficient to cover administration and selling expense overheads and an inevitable phasing out of the business. Sales in excess of B^1 could result in inventory stock-outs as a result of rapid sales, or lack of working capital as inventories are rapidly increased to cater for demand, etc. Outside points B and B^1 the organism can only exist indefinitely i.e. the activity level will be either too low to be self-maintaining or too high and over-stretch resources.

The ideal level required to maintain a business population is shown between A and A^1. Here the amount of resources in the environment match the demands made on it. As soon as the narrow limits are exceeded, if there is overcrowding of an environment by competing businesses, some will 'die'. Of course, those organizations which find their businesses becoming unprofitable in certain locations, may simply switch their resources to another area e.g. close a shop in one town or suburb, re-open in another town or suburb. In nature, where the carrying capacity of the environment is less than the population it is trying to support, the only solution is emigration: that is, businesses move to more suitable habitats where they can survive.

Exactly where a business opens (or moves to) depends on the trading pattern of the business community. Some communities have open structures, others closed. For example, a business that caters for the lower end of the trade, say D income group customers, could not survive in a wealthy suburb shopping centre that caters for the middle-to-upper income groups. Reason: the trading patterns of rich and poor are different – especially for shopping goods like cars or home furnishings. So a trader who has lower income goods to sell in an upper income market could well find difficulty selling his wares. In this sense the community is closed.

A hypothetical distribution of species organized into closed communities (above) or open communities is shown in Figure 10. Ecotones between communities in the upper figure are indicated by arrows. The reader can supply his own boundary parameters — income, race, geography, etc.

Most business communities are open and cater for all sectors of the buying public. The downtown areas often fall into this category. Certainly, within the Central Business District (CBD) you may find trading pockets which cater to a particular class or income group e.g. New York has its Negro, Peurto Rican, Latin American, German and Swiss communities who tend to buy specific goods in selected areas, but, by and large, most towns are 'open' business communities.

The edge of any community is called on ecotone. Ecotonal boundaries usually occur where there is an abrupt change in socio-economic environment (e.g. do you live above or below the railway line? in the Northern or

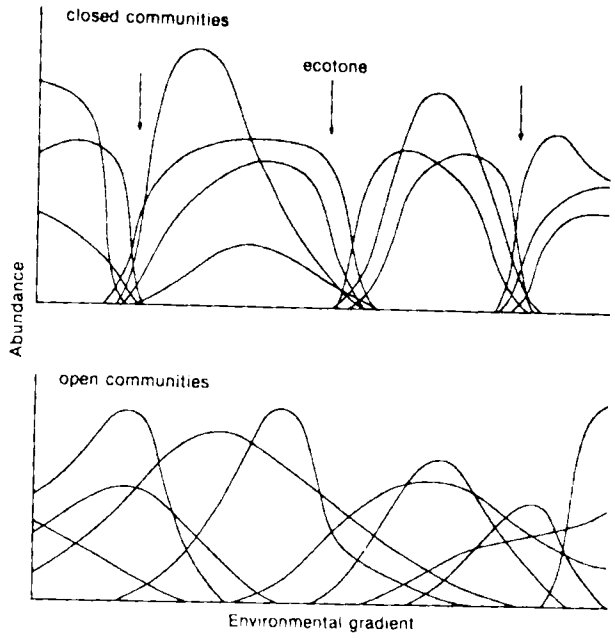


Figure 10 Open and closed communities

Southern suburbs? etc.) or where one 'species' of life so dominates the environment (e.g. black ghettos, shanty towns, etc.) that the edge of its range signals its distribution limits. Sharp physical boundaries often create sharp ecotones (e.g. the black settlement areas).

Business communities often change over time. For example, in an old town, the original 'upper class' suburbs are within a short riding distance of the city centre. But, as the town develops, its centre expands, new 'upper crust' suburbs spring up on its outskirts, and those to the centre fall into decay, and indeed the housing there often becomes occupied by the lower income groups. Then, over time, the decayed city centre gets a 'face lift' and becomes modernized, the inner ring suburbs are purchased by investors, done up and modernized, thus rising in value. The previous occupants move out under the pressure of high rentals, a new 'species' of houseowner takes over, and the cycle continues. Defining ecotones is thus a continuous process.

For many readers, this paper may represent a first acquaintenance with *Business Ecology*. In a short paper such as this, the discussion must be brief and only the ecological basis of business behaviour can be hinted at. The few points raised are, at least, controversial, and to many, tendentious. None the less, the author would maintain that *Business Ecology* is here to stay. What is perhaps surprising is that it has so little formal recognition. It is hardly, if at all, mentioned in the text books. Yet Ecology concerns conditions that make up the struggle for existence, and in this regard the study of business ecology must pay handsome dividends. Any business organization or individual businessmen interested in sponsoring doctoral research into organization biology and business ecology are invited to contact the author.

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Acknowledgement is made to Robert E. Ricklefs' *The Economy of Nature*, Cheron Press, Inc., Portland, Oregon, 1976 which was used as a basic source document for this paper. Figures 2, 6, 7, 9 and 10 are adapted from that text. Also to D.F. Owen's *What is Ecology?* (2nd edit.) Oxford University Press, 1980, for figures 4 and 5. Readers may be surprised to know that the original caption of figure 5 relates not to new business mortality but to the death rate of North American great blue herons in relation to age.