An evolutionary approach to benchmarking

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Abstract Introduces a framework for benchmarking organisations – “evolutionary benchmarking”. Discusses the concept and operation of the framework, along with its proposed advantages in aiding benchmarking. The benchmarking approach proposed utilises an evolutionary classification method called cladistics. Uses an example classification of automotive assembly plants to show how the proposed framework helps benchmarking in terms of: providing a framework for representing benchmarking information; enhancing the quality and validity of the information according to the classification rules of parsimony, congruence and homology; and providing a comparison that indicates how the practices should be adopted. This framework is considered to be useful to researchers who study benchmarking methodologies and those that categorise the findings of benchmarking studies.

Introduction

Fierce competition, globalisation and the development of new information and communication technologies have forced organisations to continuously search for and adopt new configurations (processes and structures) by which to exist. In other words, organisations are undergoing changes to evolve, survive and compete in their respective industrial environments. The explosion of management tools and techniques in the 1990s to help organisations successfully change is evidence of this situation. Among these techniques is benchmarking, which has proved to be valuable in helping individual companies evaluate their competitive position relative to their competitors. The Xerox Corporation was one of the first companies to develop and apply benchmarking techniques as a legitimate aspect of their organisational quality programme. To this day, Xerox along with many other organisations is still applying and developing benchmarking in order to learn competitive practices from the rich diversity of organisations that exist.

To understand and classify organisational differences, this paper has adopted the theory of organisational evolution as proposed by Aldrich (1999), Campbell, (1969) and Allard (1967). This theory states there are four processes (variation, selection, retention and struggle) and that they accompany organisational change and are responsible for new ways of working, i.e. new configurations or organisational types. To catalogue such diversity and to facilitate learning between different configurations requires a classification of some sort. Therefore, if organisational diversity and the accompanying configurations are due to evolutionary processes, then it would seem appropriate to use a classification that distinguishes between different organisational types according to how they have evolved and developed new ways of working. This classification is cladistics.
Background on benchmarking
Defining benchmarking and its various forms can be a confusing task as both managers and academics tend to create their own definitions according to their perceptions and applications of the technique and philosophy. Allan (1993), among others, defines benchmarking as a technique that helps in measuring and comparing the performance of an existing process, product or service, against that of the recognised best in class, both outside and inside the company. Allan goes further by stating that benchmarking can be seen as one of the quality activities that can be applied to process improvement. Similarly, Shetty (1993) explained that benchmarking is a continuous process of measuring products, services and practices against the best competitors, or those recognised as industry leaders. O’Dell, states in *The Benchmarking Workbook: Adopting Best Practices for Performance Improvement* (Watson, 1992), that benchmarking is a sequential process of learning the recipe for organisational success.

In summary, benchmarking is a process that facilitates learning and understanding of the organisation and its processes. It enables organisations to identify the key processes that need improvement, and to search for applicable solutions from the best in class.

The application of benchmarking varies in terms of purpose and style. Table I illustrates the different types of benchmarking whilst Table II shows that all benchmarking models follow five generic stages:

1. planning;
2. analysis and data collection;
3. comparison and results;
4. change; and
5. verification and maturity.

Among the advantages of benchmarking is its ability to draw on existing knowledge and tools for strategic planning, competitive analysis, process analysis and improvement, team building, data collection and perhaps most important, organisational development. Also, benchmarking provides a high payoff in terms of quality, productivity and customer satisfaction, when linked to a strategic planning framework (Daniels, 1996). Consequently, benchmarking is a technique that helps in the implementation of change.

Equally, benchmarking provides an insight into prevailing business performance, by observing the achievement of other organisations. This information is often obtained through the examination of one’s competitors. Thus,
benchmarking is equally an awareness technique that could help organisations to become familiar with new technological and managerial breakthroughs that other organisations are already using in their processes (Allan, 1993).

In summary, benchmarking has been shown to offer organisations the following benefits:

- It adequately meets end-user/customer requirements in terms of business improvement (Camp, 1989; Shetty, 1993).
- It establishes pragmatic goals based on a concerted view of external conditions (Spendolini, 1992).
- It determines authentic measures of productivity (Allan, 1993).
- It helps to change internal paradigms and “see out of the box” (Spendolini, 1992).
- It supports the quest for a competitive position (Camp, 1989).
- It creates awareness of industry good practice (Camp, 1989; Shetty, 1993).
- It provides significant leaps in performance not always attained by other management techniques (Sedgwick, 1995).

Despite these benefits, and the fact that existing benchmarking literature strongly promotes the advantages, benchmarking like most management techniques has some areas that could be further developed (Wareham and Gerrits, 1999; Bhutta and Huq, 1999; Cox and Thompson, 1998). These areas
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<td>1. Identify the process to benchmark 2. Establish management commitment</td>
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<td>Leadership position attained</td>
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are essentially based on the appropriateness of the information used during the benchmarking study. This paper has categorised these areas using the following headings: static perception, transferability, diversity, lack of direction and reductionist approach. The sections below describe how the classification-based framework proposed by this paper will help to develop these areas or avoid their limitations, whilst facilitating the learning process that is pivotal to benchmarking.

**Static perception**
Organisations exist in an evolving business environment and thus there is a necessity for companies to make decisions using information sources that are always changing. Carroll (1984) suggests that the general trend in organisational empirical research has been focused on static analyses where a temporal equilibrium is assumed. He promotes studies of organisations that use dynamic analyses of longitudinal data. Undoubtedly, this shift has occurred because of the increased attention and development of ecological and evolutionary theories on the processes of business change. The benchmarking process offers large amounts of information, however there is an opportunity for improvement by having a system of organisational information that accommodates the dynamic and evolving nature of the information. This would help to achieve the view that benchmarking is an “ongoing process, not a one-time project” (Freytag and Hollensen, 2001).

Benchmarking is often a static comparison or snapshot of the company and its environment. Although, such snap shots are useful, they can lead to misfits between the reality of the company and the capability of the benchmarking technique. This is considered to be a drawback, as the resulting analysis does not represent the dynamic issues of organisational development. Ideally, benchmarking would consider the environment (industrial sector, niche, market forces, etc.) in which the company exists and competes.

Figure 1 illustrates how the classification process in general is used to understand and formulate rules and models about most problems and entities. This process is central to the learning process that benchmarking seeks to achieve. To explain Figure 1 we will focus on industrial issues and in particular, different types of manufacturing organisation. Stage (i) of Figure 1 represents industrial diversity and contains the rich diversity of industrial sectors and organisational types that all exist to manufacture products. To understand this diversity academics and practitioners have always used classifications, such as job, batch and mass, and make-to-order and make-to-stock and numerous other schemes (McCarthy, 1995). Stage (ii) represents this process of classification, but unlike the ones mentioned above it is based on a formal classification method (cladistics) with rules and guidelines. Once a classification of different manufacturing types has been produced, academics and practitioners observe the relationships between the different types and develop taxonomic rules on how each manufacturing type operates in terms of technology strategies, operational strategies, plant layout, supply chains, etc.
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This is stage (iii) of Figure 1. Academics use these rules for teaching and research purposes and practitioners use these rules to help guide their business decisions. This is a natural cognitive process and it is also central to the process of benchmarking. Therefore, stages (ii) and (iii) are essential elements of the benchmarking process.

In summary, Figure 1 illustrates how the benchmarking process relates to the classification process. In particular, to a classification method that considers the evolving nature of industrial landscapes and the organisations that exist in such landscapes. Also, it is important to note that for existing classifications (such as those listed below), it is almost impossible to integrate them into one universal classification that could serve as a comprehensive system for co-ordinating benchmarking studies. Each of these existing classifications has been constructed and represented using a variety of ad hoc approaches:

- Organisational strategies (Chrisman et al., 1988).
- General organisational classifications (Burns and Stalker, 1961; Miles and Snow, 1978; Mintzberg, 1979; Thompson, 1967; Perrow, 1970; Van Ripper, 1966).

Source: Adapted from Allen (1993)
A cladogram provides a system that overcomes this issue of integration, as it can continually contain and represent different organisational types, regardless of when and how they were formed and identified. One of the greatest strengths of the cladistic approach is that the representation of the classification (the cladogram), illustrates the data, assumptions and results, making all classification decisions transparent.

Transferability

As stated earlier, benchmarking is about "learning" from other organisations, with a view to adopting competitive practices. The key issue here is whether such practices in their entirety can be successfully adopted by the organisation. This is an issue of "transferability" and part of the learning process is to understand whether the identified practices could conflict with an existing organisational culture, management style and structure. This is especially the case when trying to transfer competitive practices across cultures, i.e. between organisations in different parts of the world (Zairi and Ahmed, 1999; Andel, 1999).

If there is a conflict, then the options are: determine if the benchmarked practices could be adapted to suit the organisation, or whether the organisation can change to accommodate the benchmarked practices successfully. This view is reported by Wareham and Gerrits (1999) who suggest that in order to transfer practices or processes from one organisation to another it must be understood that:

- organisations are different;
- organisations are operating in diverse institutional and cultural environments; and
- that sometimes the processes can be tacit, socially embedded or inalienable.

The tacit conditions of benchmarking include:

- It is not a universal yardstick, as it is impossible to establish an absolute measurement in the benchmarking process. Cox and Thompson (1998) commented on this point.
- Transferability, as the adaptation of some processes or practices to another environment is not guaranteed. Processes that operate in a given environment may not necessarily operate in another environment.
- Validation, as a "best practice" is mostly a subjective attribute since there is no single "best practice" (American Productivity and Quality Centre, 1997).

Therefore, in order to prevent cases similar to those reported by Simpson et al. (1999) where organisations start off being very supportive of benchmarking methods, but become disillusioned due to a lack of business change, it is important to assist the transferability process that accompanies learning. To help achieve this, the taxonomic framework proposed by this paper seeks to
provide a system to understand organisational diversity, the accompanying strategies, behaviours and relationships between the different organisational types that may exist due to different cultures and locations.

Diversity
Some benchmarking studies are performed using information from a large number of organisations. For example, the UK government through the Department of Trade and Industry (DTI) performed a benchmarking study to identify competitive practices in the use of information and communication technologies in countries such as France, Sweden, Germany, the USA and Japan (DTI, 2000). Similarly, organisations like The Benchmarking Exchange perform benchmarking studies by analysing hundreds of organisations in each of their surveys (http://www.benchnet.com/). Using a large number of organisations helps to ensure that relevant information is collected and that good practice is identified. It also helps to avoid the drawbacks of one-to-one comparisons that cannot ensure an eventual process improvement, because the sample of companies was too small to identify new and innovative working practices.

In reality, the number of partners involved in a benchmarking study can vary enormously and this is often due to issues such as cost, time and access to partner companies (Camp, 1989). For instance, there are organisations that perform large benchmarking studies using the Internet (e.g. The Benchmarking Exchange http://www.benchnet.com/). Whilst, on the other hand, there are benchmarking studies that are performed on a one-to-one basis such as the original Xerox study and the study performed by the Kodak Rochester plant in the early 1990s (Bhatta and Huq, 1999). Therefore, despite, the recognition that a large study sample helps maximise the benefits of benchmarking, a common problem in benchmarking is the failure to expand the scope of companies studied (Freytag and Hollensen, 2001).

Carper and Snizek (1980, p. 65) argue that: “the most important and basic step in conducting any form of scientific inquiry involves the ordering, classification, or other grouping of object or phenomena under investigation”. In a similar line, Ulrich and McElvany (1990) argue that all successful sciences are supported by a general classification that allows scientific development. The use of formal taxonomies would help benchmarking to avoid one-to-one studies by providing diversity and a sample at the outset. Also, organisational structures and management systems are best understood in terms of overall taxonomic patterns, rather than in terms of analyses of narrowly drawn sets of organisational properties (Rich, 1992).

Lack of direction
Whilst benchmarking informs managers and directors about the competitive gap that their organisations may face, it does not necessarily inform them of the improvement programme needed to bridge the gap. In other words, benchmarking provides a situational analysis, i.e. “Where do you want to go?”
and “How are we doing?”, but it does not automatically provide a strategic roadmap i.e. “How are we going to get there?”. The ability to inform managers about the required organisational changes is crucial to the transferability or implementation aspect of benchmarking, so much so that Freytag and Hollensen (2001) coined the term “Benchaction” to emphasise the need to learn the answer to the question “How are we going to get there?”.

As will be introduced later in this paper, a cladogram not only represents organisational diversity, but also it illustrates the parsimonious paths (change programmes with least effort) between the different types. This is achieved, because the dominant method for constructing a cladogram is the parsimony method. This method selects the classification tree with the least number of evolutionary changes, i.e. the longer the tree length, the worse the fit; and the shorter the tree length the better the fit.

Reductionism approach
Organisations, particularly manufacturing companies, are complex entities that are made up of many interacting components (people, departments, technology, routines, structure, etc.) and as such, they resist a reductionist approach to understanding their behaviour and performance. A reductionist approach to systems seeks to understand them by reducing the whole system (e.g. the whole manufacturing organisation) to manageable individual parts (e.g. manufacturing departments). By studying the individual parts of a system, managers attempt to formulate rules about the behaviour of the whole system. The opposing view (the systemic view) is that the whole system cannot be truly understood by reducing it into smaller manageable units. The whole is made of parts that are self-organising and have rules that are independent of the rules passed down from the whole system. For instance, even though the directors of a manufacturing company will create strategies and rules for the company, its employees and the operating procedures; employees within individual departments always create their own informal rules, based on their knowledge and understanding of the department. Such rules and the resulting departmental systems are self-organising and it is not possible to extrapolate observations about the departments to the whole company (McCarthy et al., 2000a).

The boundaries of a benchmarking study can vary depending on the interests of the organisations undertaking the analysis (e.g. DTI’s Information and Communication Technologies study (DTI, 2000) or the Supplier Management Survey by www.industrymetrics.com). Current benchmarking models can be used to benchmark both single functions and an entire organisation. Nevertheless, in order to maximise benchmarking success, a systemic approach should ideally be adopted (Ackoff, 1993). Therefore, the case study given in this paper is based on a holistic approach to organisational comparison, rather than focusing on one or some of the parts of the organisation.
In summary, benchmarking is a valuable management technique and the motivation for integrating a formal and evolutionary classification method with the benchmarking process, is to help minimise and avoid the limitations discussed, whilst attempting to fully exploit the learning and transferability potential that benchmarking offers businesses.

**Evolutionary benchmarking**

McKelvey (1975) reports that a fundamental issue when performing a formal investigation of organisations is to order and classify them. This argument is based on the fact that a classification enables the storage and retrieval of information, to facilitate learning and the application of generalisations. Rich (1992) describes how the classification of organisations:

- helps to refine hypotheses strategically;
- aids in the validity and utility of existing typologies based on logical and intuitive considerations;
- serves as a basis for guiding organisational decisions on change;
- permits researchers to specify readily boundaries from which their samples of organisations could be drawn.

The cladistic school of classification as defined by Fitch (1984) involves studying the evolutionary relationships between entities with reference to the common ancestry of the group. This is referred to as phylogeny. Evolution provides the classification with an external reference point because lineages do not change with a researcher’s interest in a particular aspect of an organisation. Thus, cladistics attempts to reveal a change-induced structure, and the similarity represented is a similarity of change. This process of identifying ancestral relationships provides a focus by which researchers make assumptions about organisational configurations and the defining characteristics.

As organisations are complex dynamic systems, i.e. evolving and adapting continuously to their environment, it is common sense and almost a necessity to adopt an evolutionary approach to studying them. In other words, using a static framework will not fully capture the essence of an organisation’s evolution. Therefore, the relevance of creating and using an evolutionary classification to analyse good practice, identify the organisational characteristics responsible for such practice and to formulate the most effective development programme would appear to be beneficial.

Using an evolutionary classification system as the basis for benchmarking tackles the problems of transferability and diversity as discussed in the previous section of this paper. In fact, by allowing the analysis to focus on specific groups of evolutionarily similar organisations, the possibility of achieving a smooth adaptation of good practice is enhanced. Also, by using information that relates to the evolution of an industrial sector or a selection of industrial sectors, comparisons can be made using a greater population sample.
Finally, as an evolutionary study exhibits the processes that the desired organisations underwent in their own evolution, a clear-cut roadmap to the desired location can be identified.

A cladistic classification provides a system for conducting, documenting and co-ordinating comparative studies of similar and related organisations. Thus, the value that cladistics offers benchmarking is primarily to the first three stages shown in Table II (planning; analysis and data collection; comparison and results). For illustrative purposes, this paper focuses on manufacturing organisations and the concept of agility. It will show how cladograms can represent the landscape (the diversity of competitive forms) for any industry (or a competitive niche), thus providing knowledge and observations on the patterns of the distributed characteristics exhibited by manufacturing organisations over their evolutionary development.

If we consider manufacturing agility, Yusuf et al. (1999, p. 33), note that “there is yet no company that is truly agile in the sense of having acquired all the essential characteristics identified in the growing body of literature on agile manufacturing”. The use of cladograms for benchmarking agility could provide a framework and information for understanding what agility means for different organisational forms. Such comprehension could not be used to extrapolate the future, but it does inform organisations of where they are and how they got there, and this information is vital for any organisation intending to embark on a journey of change towards agility.

Cladistics — an introduction

For a detailed discussion on the cladistic method readers are referred to: Forey et al. (1992), Minelli (1994), McCarthy et al. (2000b,c), McCarthy and Ridgway (2000). Based on these articles the following is an introductory account of the method.

As stated in the previous section, the cladistic school of classification involves studying the evolutionary relationships between entities with reference to the common ancestry of the group (a phylogenetic relationship). The entities do not have to be biological, they simply have to demonstrate evolution. For instance, if we consider computational devices we can observe an evolutionary path, which includes devices such as the abacus, Babbage’s computing device, Sinclair’s calculator, through to modern computing technology. Similar evolutionary paths exist for manufacturing organisations and thus the application of cladistics to manufacturing organisations is a form of industrial archaeology or technological palaeontology.

Classification methods are assessed on their ability to produce natural and objective classifications, rather than artificial and subjective classifications. Cladistics conforms to both criteria, because it represents a real unambiguous and natural property of the entity (evolutionary relationships) and thus different rational people, working independently should be able to agree on a classification. Any disagreements about the exact nature of organisational forms (technology, processes, structure, etc.) could be addressed because the information (and the
assumptions about industrial reality) is clearly shown on the branches of the cladogram. This tree structure represents the evolutionary history, the diversity and the relationships between the different manufacturing forms. The networks of branches on the tree are the evolutionary paths that have accompanied organisational change programmes. Each path is formed according to the acquisition and polarity of certain characteristics such as new technology, working practices, plant layout or management techniques. Figure 2 shows a group of manufacturing organisations consisting of Just in Time Systems, Flexible Manufacturing Systems, Toyota Production System, Lean Producers, and Agile Producers.

The numbers shown on the branches of Figure 2 indicate manufacturing characteristics (also known as “characters”) that have been adopted in order to survive and compete. Table III outlines a list of these characteristics.

Agile Producers have a position on the cladogram between Lean Producers and JIT Systems. The total defining characteristics of Agile Producers (not just the characteristics which differentiate agile from lean) extend back to the ancestor of the cladogram i.e. Ancient Craft Systems. This evolutionary lineage is represented by a series of branches, which are thicker and bolder. The characteristics on this lineage were found from the defining characteristics of an agile manufacturing organisation as stipulated in the Iacocca Institute (1991) report 21st Century Manufacturing Enterprise Strategy, as well as from Sharp et al. (1999) who compare mass production, lean production and agile manufacturing practices in UK industries.

Source: Taken from McCarthy et al. (1997)
With this introductory account of cladistics, the following section describes the evolutionary benchmarking method. Step 1 of the method describes the procedure for producing a cladogram.

An evolutionary benchmarking approach
The approach consists of seven stages (see Figure 3).

Stage 1. Construct the evolutionary classification. When classical benchmarking is performed, there are several questions that need to be answered before starting. What is to be benchmarked (e.g. the organisation, a process, a product)? What type of benchmarking should be used (e.g. internal, competitive, generic)? Which industry sector to choose for benchmarking? Which company/companies to benchmark against?

For the purposes of this paper and the example that follows, the first stage of the framework is to construct a cladogram that will provide information relevant for the organisation wishing to change. In other words, if a company wants to benchmark manufacturing systems, the taxon (classification group) and the characteristics on the tree must be relevant to manufacturing systems. The cladogram constructed in the example within this paper was the automotive assembly industry. It focused on manufacturing system types and the data that would provide relevant information to help companies achieve a more competitive organisational form.

Once the system to be benchmarked has been identified, an appropriate industrial group is selected, i.e. Is the benchmark against an organisation in the same industry, or is it a different sector. This stage is consistent with classical benchmarking in terms of finding the best-in-class industrial sector to make the comparison.

Once these issues have been addressed, the procedure for creating a cladogram is as follows:

1. **Study group.** The starting point is to define the industrial sector/population of companies to be studied. This is known as the “clade”. Within a manufacturing context the term clade can be defined as:
A group of manufacturing organisations that exist in an organisational environment (market segments, geographical regions, niches, etc.) and includes an ancestral organisational species (McKelvey, 1978). “In other words, a form of organisation that exists through generations which are members of the species” (McKelvey, 1978; pp. 1431). The organisations included in the clade share a set of common ancestry characteristics.

(2) Search and select. Once a study group has been chosen, a number of different organisational types (ways of organising and operating a manufacturing plant) would appear to be members of that group (mass, lean, agile, craft, job etc.), but the complete membership is not known. In fact a primary objective of a cladistic study is to identify all the members of the group. This is a process of “mining for organisational types”, whereby evidence is sought to suggest the possible existence of a particular type of manufacturing organisation. This evidence tends to be in the form of published material or archives, which describe the advent of new ways of working and new breeds of organisation. The overall aim of this step is to determine the different organisational forms, and the organisational characteristics (technological, behavioural, structural, etc.) that distinguish the various forms.
Coding. Once a set of characteristics has been identified, along with the various organisational forms that are a consequence of these characteristics, the relationship between the characteristics and the organisations is examined in order to allow the construction of the cladogram. The coding of a characteristic facilitates the statistical processing of the set of characteristics.

Polarity. Ordering is that property of a characteristic that refers to the possible change sequences that can occur. The characteristic property, direction, refers to the transition between the characteristic states. When the direction of transformation for a characteristic has been determined, it is said to have a “polarised” state.

Conceptual cladogram. The construction and testing of a cladogram is essentially based on its ability to explain the evolution of the clade. With this aim there are two sets of problems:

- The proposed relationships are not acceptable, or are not historically coherent.
- Several conflicting cladograms of the same length are obtained.

Using tools such as the software MacClade™ (see Maddison and Maddison, 1992) a cladogram is constructed according to some simple rules: parsimony, homology and congruence (see Morrison, 1996; Brooks et al., 1984; Wiley et al., 1991). Once a cladogram has been produced, the first step is to map the characteristic changes onto the tree in order to have a global view of the proposed phylogeny. It is common practice to shape test the cladogram by adding additional organisations and characteristics. MacClade™ allows the user to manipulate cladogram structures and characteristic data and to visualise the characteristics on each branch. Finally, MacClade™ provides tools for moving branches, re-rooting clades and automatically searching for the most parsimonious tree.

Working cladogram. This stage involves visiting organisations in order to observe the systems and processes that they operate. This typically consists of plant inspections, discussions with employees, assessment of planning and control procedures and assessment of documentation (annual reports, business plans and surveys, etc.). The study aims to validate the existence of the characteristics identified during the previous stages. It will test the validity of any proposed tree structure by ensuring that the characteristic data matrix is complete (i.e. no important historical events which relate to a characteristic have been omitted) and that the assigned polarity is correct. This stage is to an extent, validation by dissemination, because the factual data will be used to verify the conceptual data. Allocating existing organisations a position on the cladogram will also test the validity of any proposed tree structure.
(7) **Naming.** As with any classification, the identified organisational forms would be allocated names or labels that reflect the “essence” or defining nature of the organisation.

**Stage 2. Locate actual company’s position.** This stage involves analysing the cladogram and relating it to known information about the study company’s characteristics, attributes, strengths and weaknesses. The aim is locate the position of the study company on the cladogram and to confirm that the characteristics on the identified branch represent the company in terms of its organisational behaviour and form. This stage is crucial, because without a successful diagnosis of the current position, assumptions and decisions about the pending organisational development could be invalid. During this phase the temporal and the internal environment are assessed.

In the example given below, it is assumed that the study company is believed to occupy the branch mass producers as shown in Figure 4. The characteristics found are shown in Table IV.

It is important to note that despite containing numerous characteristics and information, the cladogram does not necessarily contain every characteristic of an organisational type. The cladogram is never universal, as the classification process is based on a contingency approach, i.e. it contains only those characteristics that are defining, i.e. they distinguish one organisational type from another.

The activities in Stage 2 of the method are concerned with transferring the information from the cladogram (Figure 4) into what has been called an evolutionary benchmarking matrix (Figure 5). The matrix consists of a number of sections that have been numbered 1 to 7. Two principal sections of the matrix are section 7 “current characteristics” and section 1 “desired characteristics” of the organisation. These are located on the bottom and left part of the matrix. The main body of the matrix is where the comparison takes place. Sections 2 and 3 show which characteristics to keep/remove, whilst sections 5 and 6 prioritise the decisions for developing the organisation.

**Stage 3. Locate goal branch.** The process of constructing a cladogram (collecting information on different organisational forms) helps the company to become more knowledgeable about its landscape and the different strategic opportunities that exist. This process is the basis of benchmarking, as it allows companies to identify a goal branch that represents the fit between the company’s strategy and the evolution and diversity of an industrial sector. As company improvement is usually focused on achieving the best-in-class characteristics, the goal branch is often the most evolved form in the clade, i.e. the most recent branch. Identifying the goal branch is a contextual and objective management technique for comprehending perceived organisational changes and improvement.

In the example, the previous step assumed that the actual company’s current position was the mass producer type. If we also assume that business circumstances have led to the company developing a strategy that focuses on
Figure 4.
Current position and goal branch
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Step 4. Locate the most parsimonious route. This step determines the characteristics that need to be acquired, transformed or removed. The two branches (i.e. the goal branch and the company’s current position) represent the manufacturing change strategy of the company under study. It is important to note that cladograms are constructed according to a number of rules:

- **Parsimony** (a rule where the cladogram with the smallest number of evolutionary changes is the simplest and is the one to be considered).
- **Congruence** (the cladogram is produced to minimise inconsistencies such as parallel evolution where the same characteristics appear twice in the cladogram).
- **Homology** (where groups are formed using characteristics shared by a set of organisational types and present in their common ancestor).

For the purposes of benchmarking, the parsimony rule has the greatest significance. It shows the shortest organisational change path required to achieve the desired manufacturing type along with the defining strategy. Thus, the parsimonious route illustrates the route to the desired manufacturing type, the characteristics of the type (section 1 of the matrix) and the order in which they should be adopted (the marked path in Figure 4). This information is both the strategy and change management plan.

**Step 5. Benchmark the current system against the desired one.** An important step in any benchmarking methodology is the comparison of the characteristics between the companies involved and the subsequent knowledge and application of any good practice processes. With evolutionary benchmarking, the information displayed by the cladogram and the matrix encourage a comparison that involves all the different organisational types.

| 1. Standardisation of parts | 16. Training through socialisation |
| 2. Assembly time standards | 20. Multiple sub-contracting |
| 3. Assembly line lay-out | 32. Sequential dependency of workers |
| 4. Reduction of craft skills | 46. Dedicated automation |
| 5. Automation | 47. Division of labour |
| 13. Large volume production | 48. Employees are system tools |
| 14. Mass sub-contracting by price billing | 50. Product focus |
| 52. Dependence of written rules |  |
Figure 5.
Evolutionary benchmarking matrix
The comparison consists of contrasting the characteristics that were mapped in the previous step, with those characteristics that the company already possesses. Therefore, the aim of this step is to find out which characteristics are absent from the company’s current branch and would if acquired, lead to an appropriate improvement in the performance of the company.

Using the evolutionary benchmarking matrix (Figure 5), the comparison is made by assessing the characteristics listed on the left part (Section 1 of Figure 5), against those that correspond to each category in the bottom part – Section 7 of Figure 5 (e.g. pull production system against push production system). It is important to note that the comparison could only be performed between those characteristics that match and are comparable. Thus, when matching the categories and comparing the different characteristics, it is necessary to follow the row of the mapped characteristics and the column of the actual characteristics. A comparison of matching characteristics is made in the cell where the column and row meet. If the mapped characteristic represents an improvement over the actual characteristic, then a symbol “+” is written in the cell, otherwise the symbol “−” is used. The symbol “=” is used when the mapped characteristic is considered to be the same as the actual characteristic. An illustration is given in Figure 5.

As a result, the prioritisation of the improvement and the planning of changes are complete when the goals, and schedules for acquiring and removing the different characteristics have been established. The result is placed in section 6 of the matrix, located in the far right column of the table in Figure 5.

Step 6. Implement change. Steps 1-5 of the evolutionary benchmarking framework contribute to the analysis, planning and comparison tasks of the benchmarking process. To understand and encourage what has been learnt from stages 1-5, step 6 focuses on the transferability aspect of benchmarking.

Despite the fact that a cladogram is a system that can capture and represent evolving snapshots of a company’s situation, it is vital that the company recognises that it is only a snapshot and that it is up to the management and the employees to change it.

Organisational development is not easy, particularly when existing practices, habits and routines have been in place and have for many years. To help learn new practices and develop a supporting culture, the information in a cladogram can help organisations and individuals “learn”. It also helps to identify conflicts or barriers to change. For instance, if a desired benchmarking scenario stipulates high levels of team working, but the company currently operates an individual-based pay incentive scheme, then this scheme and its resulting culture will be in direct conflict with the practice of team working.

Step 7. Verification of achievements. This step is an assessment of the resulting improvement in business performance. It is consistent with the plan-do-check-act cycle (Deming, 1986) that helps to monitor the development and to stimulate opportunities for further improvement. It is also essential for ensuring operational improvement, as it provides a feedback mechanism to
steps 1-6. This feedback helps guide decisions on the future selection of best practices, assessing the impact of the desired performance and formulating appropriate measures.

Conclusion
Benchmarking is a management technique that seeks to achieve business improvement by helping organisations and individuals learn and develop. To achieve successful business development a good basis for benchmarking is important, in order to address questions such as: Whom to benchmark against? What processes, functions etc. to benchmark? How to perform the benchmarking? It is also vital to the benchmarking process, to provide answers to the questions: Where are we now? Where do we want to be? How are we going to get there?

The term “evolutionary benchmarking” has been used to describe a framework that helps to encourage researchers to find answers to both sets of questions. It is a framework that captures and represents the relevant information for the analysis, planning and comparison tasks involved in benchmarking organisations.

This framework places a greater emphasis upon benchmarking as a serious research methodology, to take its place alongside the cognitive and qualitative processes that are an integral part of classification, and vital to the success of benchmarking and organisational development. By integrating an evolutionary classification method with the benchmarking process it is hoped that such an approach, in time, may lead to a greater degree of uniformity, communication and acceptance of different benchmarking studies.

References
American Productivity and Quality Centre (1997), What is Benchmarking?, APQC Report, Houston, TX.
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Further reading


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Leseure, M. (1998), *Using Phylogenetic Classifications to Understand and Manage the Complexification of Manufacturing Systems*, University of Sheffield, Sheffield.


