

BOTANIC GARDEN CREATION FROM IDEA TO REALISATION

Dr James Furse-Roberts

FRLA

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www.frla.co.uk

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1 Introduction

This paper has been written with three types of reader in mind. The first is someone who has the desire to create a new botanic garden from nothing. The second is someone who is already involved in the running of a botanic garden but who feels that it could do with significant refreshment in order that it may meet the demands of the future. The third is anyone working with a botanic garden as part of a team tasked with looking at its development. The aim of this paper is to describe a process for taking an idea for a botanic garden through to completion or from its existing form in to something better.

It is worth starting by briefly considering, what is a botanic garden? There are many definitions but, for the purpose of this paper, we will consider botanic gardens and botanical collections as being synonymous and defined as any collection of plants with which there is an associated collection of information. These collections will also be used to fulfil one or more of the four main roles of botanic gardens:

- Education
- Research
- Conservation
- Public Recreation

This is a broad definition and, as a result, there are a wide variety of botanic gardens that meet these criteria each focusing on a slightly different combination of these four roles. These roles can be visualised as the four tips of a tetrahedron, so that there is an equal distance between each of them. The botanic garden's focus can be represented by a point plotted within this space, as shown in Figure 1. The closer this point is to one of the corners, the greater the importance of that role to the organisation. Figure 2 illustrates a selection of the key role combinations that some botanic gardens focus on.

This variety of roles and the differences in the gardens that are needed to fulfil them means that a single, detailed, model for developing a botanic garden cannot be produced; however, the process described below is meant to act as a framework that can be adapted to suit your individual situation. Section 2 of this paper describes this process while Section 3 looks at some important principles that should be considered throughout the process.

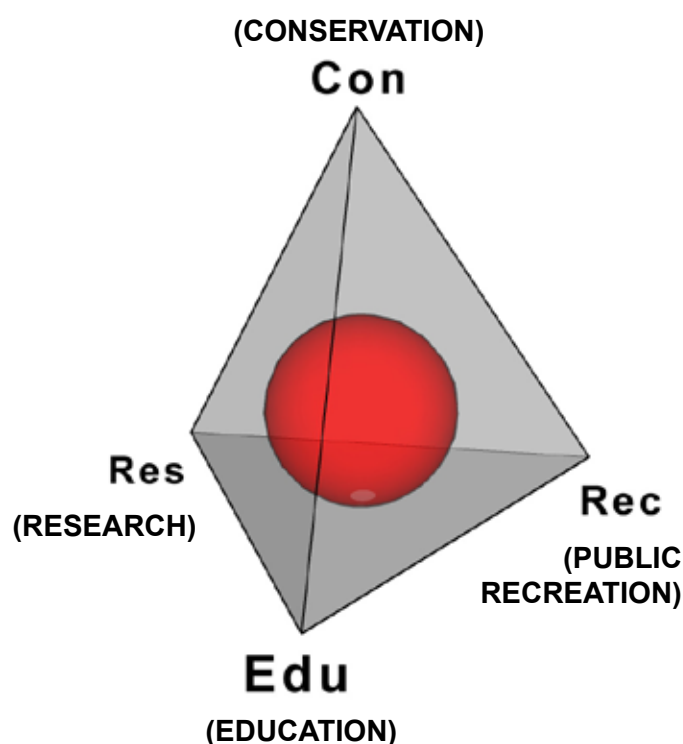
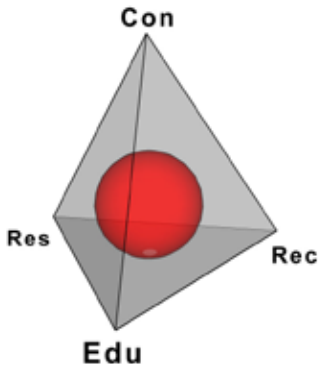
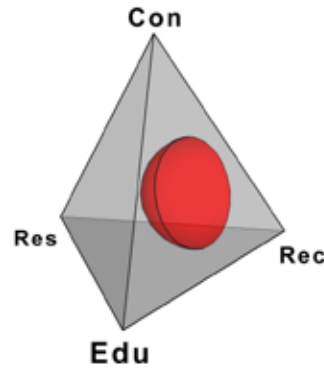


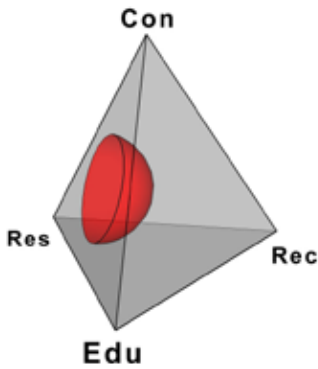
Figure 1 - Tetrahedron representing the possible combinations of the four principle botanic garden roles with a red sphere highlighting a possible focus of a botanic garden



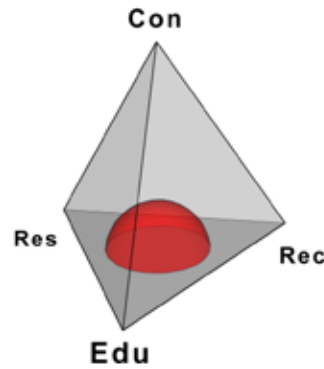
A - A botanic garden, such as many large international gardens, that is active in all four areas is represented by the red sphere placed equidistant between the four roles located at the tetrahedron's corners.



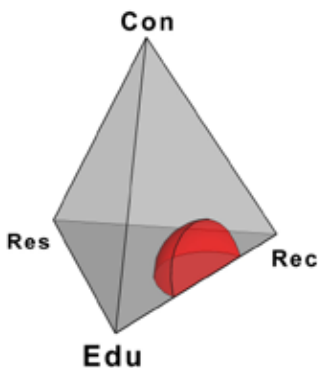
B - Some smaller botanic gardens don't have laboratories of herbaria and therefore may not carry out research work but are still active centres for education, conservation and recreation.



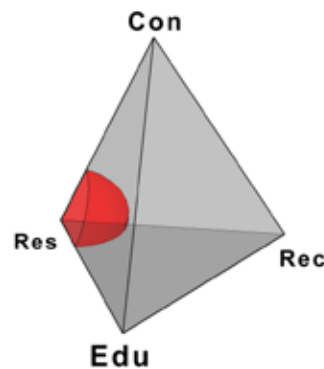
C - Not all botanic gardens are open to the public and therefore public recreation is not one of their remits.



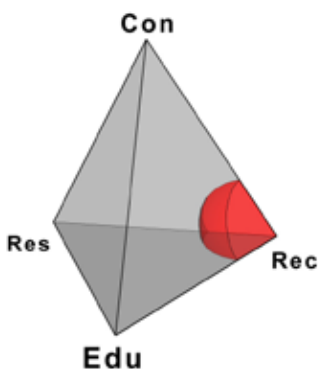
D - The move from recording and understanding the plant world to that of actively working to protect and repair it is a relatively new one that not all botanic gardens have adopted.



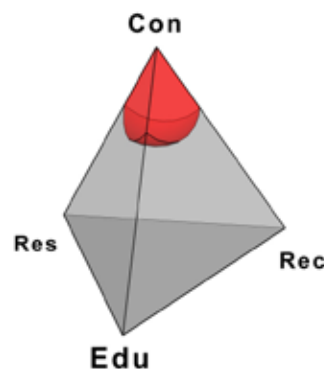
E - Some institutes with botanical collections, such as some schools, don't have the resources to allow them to undertake research and conservation but still use them for education and recreation.



F - Commercial research facilities often maintain plant collections but their use is specifically for the research being undertaken to the exclusion of the other three roles.



G - Lack of resources means that some botanical collections, while still retaining their value as an historic collection, are only actively used for public recreation.



H - There are botanical collections that are held for the express purpose of servicing conservation projects. The nature of these collections, the projects and their location mean that they only fulfil this one role.

Figure 2 - Diagrams illustrating how different types of botanic garden focus on different combinations of role

2 The Process

The diagram opposite, Figure 3, is a graphic representation of a process for taking a botanic garden from its original idea through to realisation of the project on the ground. As can be seen, it is comprised of the following eight stages:

- Ideas
- Feasibility Study
- Master Plan
- Concept Designs
- Detailed Design
- Construction
- Operation
- Monitoring

Each of these stages builds on ideas and information developed during the previous stage allowing the complex structure that is a botanic garden to be created in a logical and controllable manner. Although the initial Ideas and Feasibility Study stages, as described below, will probably only be carried out once for the entire garden, the other stages can be thought of as a cycle that can be used to either trim the direction in which the garden is heading or to address something that isn't working as it should.

2.1 Ideas

All the botanic gardens that exist today have been born from an initial idea coupled with the drive to see it realised. That idea might have been to create somewhere where botany or herbal medicine could be taught. It might have stemmed from an interest in the variety of plants found on Earth or the variety that can be found within one group of plants. Or, it may have originated in a desire to inform and inspire other people about the many stories associated with plants. Whatever the original spark, there follows a natural desire to see the project take form on the ground. There is an eagerness to be walking down paths lined with collections of interesting and rare plants

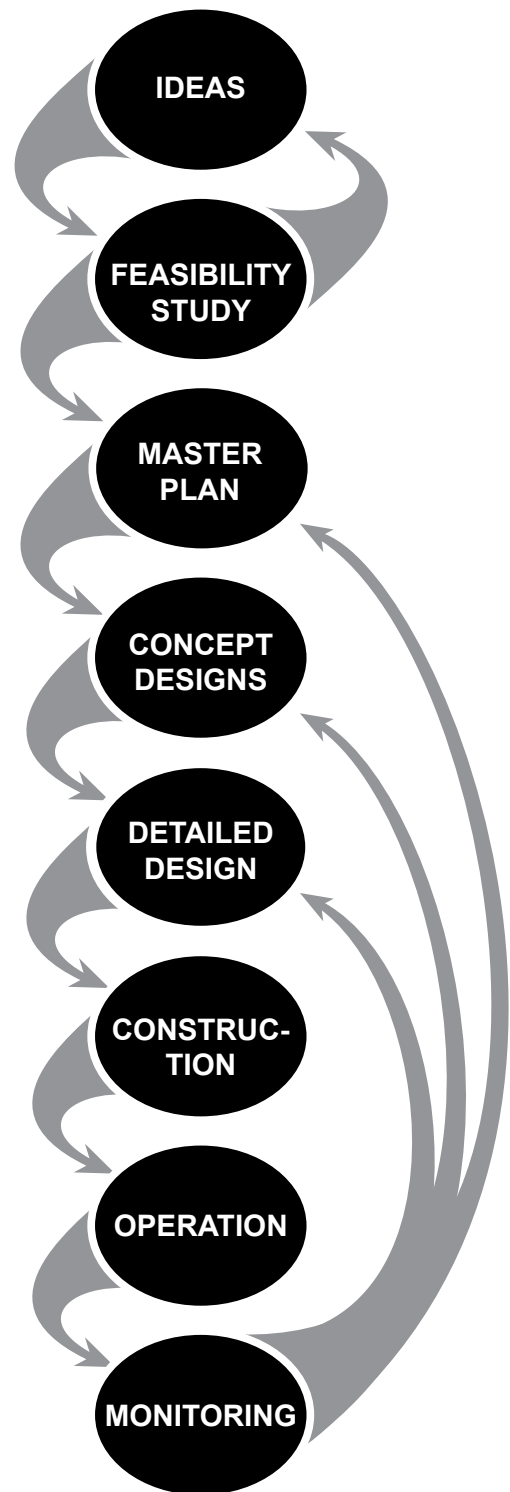


Figure 3 - Schematic of the main stages of the process

or to watch as students or visitors lose themselves in discovering something wonderful about the plant kingdom. However, these feelings are probably also accompanied by a slight feeling of uncertainty about how this vision can actually be realised. A common response to this is to appoint a landscape architect and commission concept designs but before you get carried away with searching for architectural practices to interview, it is worth writing down your idea and the aims behind it and then spending some time considering these. In particular, it is worth considering what other ways these aims might be achieved.

For example, you might start with "I want to build a botanic garden to teach the world about the different plants used in agriculture." If, as stated, the aim is to educate a world-wide audience, then a botanic garden would probably not achieve this as visitors to them come from a limited geographical range. So, if reaching a wide audience is the most important element of this idea, you might decide to build a website rather than a botanic garden. Alternatively, if having a physical garden is important, you may decide to rephrase the statement as "I want to build a botanic garden to teach the people within this region about the different plants used in agriculture."

The Gloucester City Botanic Garden (UK) project is an example of how the aim of a project can be approached from a different angle during the initial stages. See Box 1 for a description of this project.

The end product of thinking about and refining the initial ideas should be one or two sentences that describe the ethos of the project, the reason for its existence. This is often referred to as the garden's "Mission Statement". Here are some examples of Mission Statements from other botanic gardens.

Royal Botanic Gardens, Kew, UK: *"To inspire and deliver science-based plant conservation worldwide, enhancing the quality of life."*

Jerusalem Botanic Garden, Israel: *"Just as biodiversity is a key to a healthy natural world, so human diversity is a cornerstone of a healthy society. The Jerusalem Botanical Gardens promote and encourage both."*

Kirstenbosch National Botanical Garden, South Africa: *"Our mission is to promote the sustainable*

use, conservation, appreciation and enjoyment of the exceptionally rich plant and animal life of South Africa, for the benefit of all people."

Royal Botanic Garden, Jordan, Amman: *"The mission of the Royal Botanic Garden is to conserve native biodiversity at the habitat level, establish a centre for scientific research and environmental education, serve as a demonstration site for sustainable development, and provide a unique ecotourism destination."*

Moscow State University Apothecary Garden, Russian Federation: *"To tell you about the wonderful world of plants and its significance for the Earth and its inhabitants."*

Main Botanical Garden, Russian Academy of Science, Russian Federation: *"The main task of MBG is to preserve the gene pool of plants and development of theoretical principles and methods of introduction and acclimatization of plants for the management of the world's plant resources."*

It can be seen from this small sample that each botanic garden has chosen a slightly different purpose for its collection. The Mission Statement is the bedrock on which all of the garden's activities should be based and, as such, should not be changed frequently. However, as botanic gardens can be long lived institutions, it is plausible that the focus of the collection will need to change over time and the Mission Statement would thus change to reflect this. An example of this is Chelsea Physic Garden, UK, which was founded in 1673 with the three aims of providing a space that could be used to educate trainee apothecaries about medicinal herbs, house the founding guild's boat and act as a base for studying plants in the local vicinity (Minter 2000). In the 340 plus years that have passed since then, things have changed and the garden is now guided by the following Mission Statement: *"The Mission of Chelsea Physic Garden is to demonstrate the medicinal, economic, cultural and environmental importance of plants to the survival and well-being of humankind."* The role of education remains but has been widened to a larger audience while those of boat storage and field-trip base have been dropped.

When devising a mission statement it is worth thinking about where your organisation would be represented

Box 1 - Gloucester City Botanic Garden

Unlike many of the UK's cities, Gloucester doesn't have a botanic garden and thus the advantages that these can bring through recreation and education. The creation of a new garden would require land and money, neither of which the City Council had spare. However, Gloucester City does have a diverse collection of native and non-native plants growing throughout, in odd corners and on the derelict sites awaiting development.

FRLA Ltd re-thought the concept of the botanic garden and created the 'Gloucester City Botanic Garden' project. They imagined the whole city as a plant collection awaiting interpretation. Volunteers surveyed the city to identify sites where wild species were flowering and were positioned well for interpretation. Then, using cheap but effective materials and fabrication methods, small (10cm x 15cm) interpretation panels were produced and installed.

For each species labelled, a QR code provides a link to a web-page where more can be read about that species and the viewer can add their thoughts

and comments about the plant and the project. Although the project doesn't provide the green space that would have come from creating a true botanic garden, it does provide education and engagement in a financially viable manner.



within the 'roles tetrahedron' shown in Figure 1.1. For example, based solely on their mission statements above, the focus of the Royal Botanic Garden, Jordan, is equally weighted between all four roles as shown in Figure 2A; that of the Royal Botanic Gardens, Kew, might fall somewhere between Figure 2A and Figure 2C, while that of the Moscow State University Apothecary Garden would more closely resemble Figure 2E. When trying to establish where your garden will sit, ask yourself, which role is the principle aim of the organisation and how is this going to be funded? Then, will the organisation be involved in any of the remaining roles and, if so, to what extent?

2.2 Feasibility

Once you have refined your idea and know what you want to achieve through the creation of your botanic garden, you need to test whether the idea is feasible. To do this, you will need to find answers to the following types of questions:

- Can it be built?
- Approximately how much would it cost to build?
- How much would it cost to run?
- Where is it located?
- Who are the competition?
- How is our project different from theirs?
- How many people can we expect to visit it?
- How much revenue might it generate?
- What scientific and conservation value would it produce?

Obviously, at this stage there are no designs with which to produce accurate costs but it is possible to make educated estimates for these figures that will be sufficient to establish the scale of the project and to ascertain whether it will be a financially viable venture or not. If the feasibility study suggests that the original idea isn't feasible, return to the Ideas stage and re-examine whether there is another way of achieving your aims within a more practical manner.

If, as an example, we return to the fictional botanical garden that we looked at in the previous section, a feasibility study based on the aim of creating a botanic garden to demonstrate the world's agricultural plants might reveal that this would require extensive glasshouse facilities with all the associated costs of

construction, maintenance, heating and staff, which would be prohibitively expensive for this project. Therefore, the decision might be taken to return to the Ideas stage and again rethink the aims of the garden and perhaps decide on a mission to provide a botanic garden that educates the people of the region about the agricultural plants used by people in similar climate zones around the World, thus removing the need for a costly glasshouse.

2.3 Master Plan

Before you start the master-planning stage you should have a good idea of what you want your garden to achieve and how. You will also have a feel for the scale of the project both in terms of land area and budget. What you need to do now is add detail to this. The term "Master Plan" can be confusing because different people have used it to refer to different things; for example, it is sometimes used to describe a drawing that gives an overview of a proposed landscape design. For the purpose of this paper, a Master Plan is a document that describes each element of a botanic garden and how they are going to work together to deliver the organisation's mission. As such, the Master Plan is the document that will act as a guide to all future decisions, not only during the design and construction but also afterwards during the continued operation of the garden.

As a Master Plan is a description of the botanic garden as a whole it must encompass all the activities that it will undertake. To help organise this information, the Master Plan can be thought of as being comprised of four Plans:

- Spatial Plan
- Business Plan
- Communication Plan
- Science Plan

It should be remembered that these four Plans are intrinsically linked with each other and are only separated to aid writing and comprehension of the whole Master Plan. They should be written corroboratively so the opportunity for cross-disciplinary influence exists. The case study given in Box 2 illustrates how cross-disciplinary working from an early stage on a project can have benefits.

Box 2 - Good Marketing

If there is one recurrent theme of this paper it is that all elements of a botanic garden's operation and management should be started as early as possible and be developed together. For new botanic gardens, this includes marketing. The Eden Project in Cornwall is a good example of a new project that started its marketing campaign early. They did a good job of generating interest before the construction phase and then, during construction, they publicised the fact that they had one of

Europe's largest scaffold constructions on site to build the biome framework. Despite construction sites not usually being visitor friendly areas, they managed to generate enough interest to sell tickets for trips to see the build happening. All this before there was a single plant from the collection to see. This interest in the project continued through to the actual opening, which saw over a million visitors in the first few months.



Figure 5 is a schematic of the Master Plan structure and includes some of the topics that one might expect to find discussed in the different sections of each Plan. As can be seen, each of the four Plans is made up of three sections:

- Reviews
- Strategies
- Guidelines

As its name suggests, in the Review section the current situation is assessed. From this and with the Mission Statement in mind, Strategies are devised that describe the broad aims and approach to be taken in each area. The Guidelines build on the Strategies and ascribe more detail to the approach. It is worth noting that, while these plans will invariably include drawings of the site, the Master Plan does not need to contain designs for the garden or its buildings.

Listed in Figure 6 are twenty of the documents available online from a search for “botanic garden master plan”. For each of these, their contents have been analysed to ascertain how many of the aforementioned plans, reviews, strategies, guidelines and even designs they contain. The results of this are summarised below (Figure 4) and suggest that, unfortunately, it is common for Master Plans to be produced that do not cover all elements of

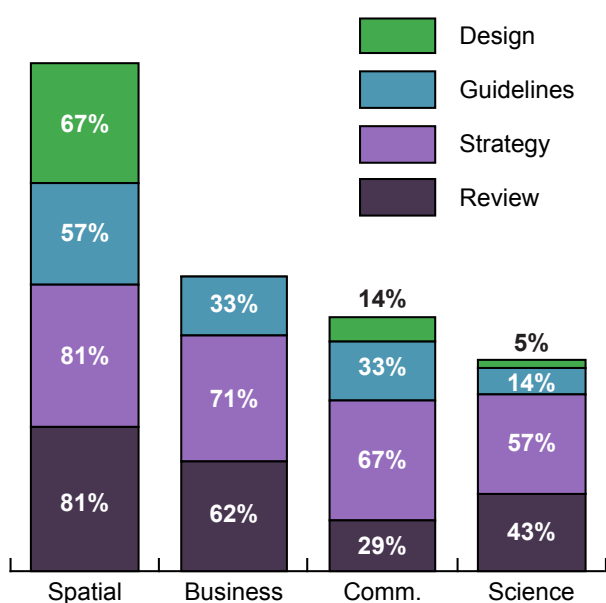


Figure 4 - Analysis of online master plan content

the organisations operation, despite their inter-connectivity. Spatial considerations are most commonly included while the scientific role of the garden is most commonly overlooked. However, issues covered by the Communication Plan are the least likely to be reviewed before a strategy is developed for them. It is also worth noting that a significant number of these Master Plans include design proposals that aren't necessarily required at this stage of the process.

Spatial Plan - This Plan concerns itself with all physical aspects of the site, and the implications this has on its use by us and the other species that inhabit it as well as the cultural significance associated with it. Regardless of whether the Master Plan is being prepared as part of a new botanic garden venture or the updating of an existing garden, a comprehensive review of the site should be undertaken. This might include:

- Topography
- Hydrology
- Soil Type/pH
- Habitat Survey
- Species Surveys
- Landscape Infrastructure/Subsurface Services
- Building Surveys
- Living Collections Map
- Historical Significance

Together, these surveys help shape the Spatial Strategies, which will show how the site is to be used, the facilities that are needed and their location, how visitors will flow through the site, the distribution of habitats and plant collections and how water and other resources are to be managed. These strategies lay down the over-arching principles in these areas in general terms that will ensure their relevance for the next decade or more.

Based on the Strategies, the Guidelines provide more detailed information that will help the development of designs in subsequent stages. These might include massing and adjacency information for buildings, a palette of materials and details of sustainability and access criteria that go beyond the standard building codes and regulations in operation.

MASTER PLAN

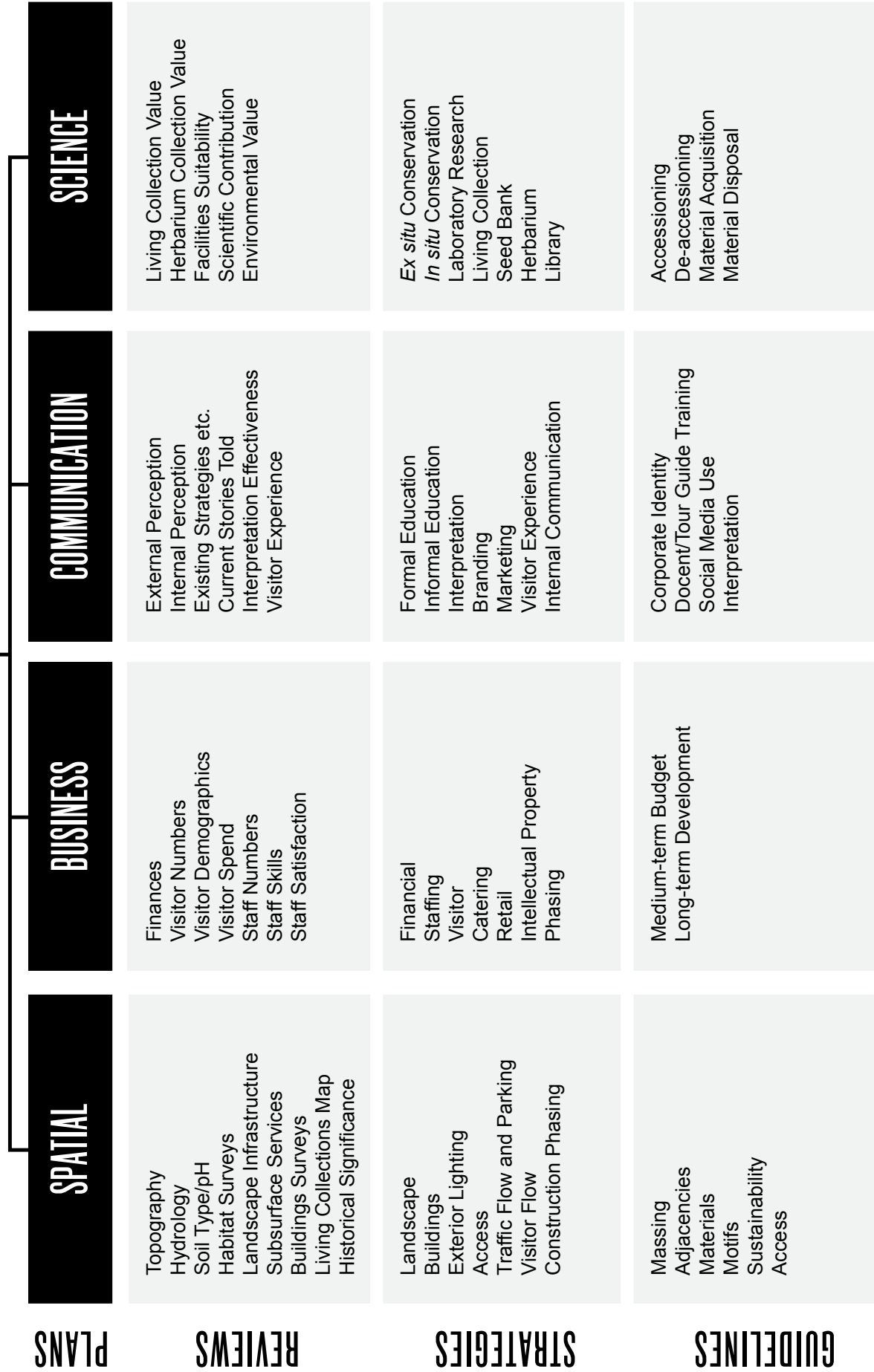


Figure 5 - Diagram showing some of the topics that might be covered by the different sections of a master plan

	MASTER PLAN			
	SPATIAL	BUSINESS	COMM.	SCIENCE
1 Bendigo Botanic Gardens, Australia	R, S, G, D	S	S, G	R, S, G
2 Botanic Garden of Adelaide, Australia	S, D	R, S	S	S
3 Mackay Regional Botanic Garden, Australia	R, S, G, D	R, S, G	R, S, G	R, S
4 Olive Pink Botanic Gardens, Australia	R, S	S	S	S
5 RBG Sydney (Mount Annan Botanic Garden), Australia	R, S, D	R, S	R, S	R, S
6 Dominica Botanic Gardens, Commonwealth of Dominica	R, S, D	R, S, G	R, S, G	S
7 Hagley Park/Botanic Gardens, New Zealand	R, S, D	R, G	S, D	S, D
8 Royal Botanic Gardens, Kew, UK	R, S, G, D	R, S	G, D	R, S
9 St Andrews Botanic Garden, UK		R, S, G	R, S	R
10 Bellevue Botanical Garden, USA	R, S, G, D			
11 Denver Botanic Gardens, USA	R, S, G, D			
12 Fort Worth Botanic Garden, USA	R, S, G, D		S	
13 Houston Botanic Garden, USA	R	R, S, G		
14 Leach Botanic Garden, USA	R, S, G	R, S, G	R, S	R
15 Meadowlark Botanic Garden, USA	R, S, G, D			S
16 Missouri Botanical Garden, USA		R, S	S	
17 Onondaga Botanical Garden and Arboretum, USA	R, S, G, D	R, S	S, G, D	R, S
18 Queens Botanical Garden, USA	R, S, G, D	R, S, G	S	R, S, G
19 Santa Barbara Botanic Garden, USA	R, S, G, D	S	G	
20 University of Washington Botanic Gardens, USA	R, S, G	R, S	R, S, G	R, S, G

R - Review S - Strategy G - Guidelines D - Designs

- 1 http://www.bendigo.vic.gov.au/Leisure_and_Entertainment/Parks_Gardens_and_Reserves/Bendigo_Botanic_Gardens
- 2 http://www.environment.sa.gov.au/botanicgardens/About_us/Development_planning
- 3 http://www.mackayregionalbotanicgardens.com.au/what_can_i_see/masterplan_2010
- 4 <http://www.opbg.com.au/wp-content/uploads/2012/03/OBBG-Masterplan-March-16-2011.pdf>
- 5 http://www.rbg Syd.nsw.gov.au/annan/the_garden/future_planning/masterplan
- 6 http://www.da-academy.org/FINALREPORT_RBGMasterPlan_2006.pdf
- 7 http://resources.ccc.govt.nz/files/HagleyGardensMastPlan2007_ALL-christchurchbotanicgardens.pdf
- 8a http://www.kew.org/ucm/groups/public/documents/document/kppcont_051479.pdf
- 8b <http://www.kew.org/about-kew/our-work/corporate-plan-2009-12/index.htm>
- 9 http://www.st-andrews.ac.uk/~gdk/stabg_new/fbg/images/BusinessPlanFinal.pdf
- 10 http://bellevuewa.gov/pdf/Parks/bbg_master_plan_update_final_report.pdf
- 11 <http://www.botanicgardens.org/our-gardens/about-us/flourish-from-our-ceo/pre-campaign-and-master-development-plan>
- 12 http://fortworthtexas.gov/uploadedFiles/PACS/Parks_and_Community_Services/bgmasterplan.pdf
- 13 <http://houstonbotanicgarden.org/pdf/Houston-Botanic-Garden-Plan-for-Development.pdf>
- 14 http://www.leachgarden.org/index.php/download_file/view/274/200/
- 15 http://www.nvrpa.org/uploads/Files/content/Final%20Master%20Plan%202011_29_07.pdf
- 16 http://www.missouribotanicalgarden.org/Portals/0/Annual%20and%20Financial%20Reports/PDFs/mobot_strategic%20plan_for%20web.pdf
- 17 <http://www.esf.edu/la/carter/mplancombine2.pdf>
- 18 http://www.queensbotanical.org/103498/sustainable/master_plan
- 19 <http://www.sbbg.org/about/plans-for-the-future>
- 20 http://depts.washington.edu/uwbg/about/master_plans.shtml

Figure 6 - Composition of botanic garden master plans available online with associated links (Accessed January 2014)

The Spatial Plan shares strong links with the Business Plan through budget and staffing requirements, visitor numbers and the phasing of the project;. It is linked with the Communication Plan through interpretation and narrative structure, visitor experience and facility requirements; and with the Science Plan through research facility requirements, living collection requirements and habitat conservation requirements.

Business Plan - As with a number of terms that are encountered when discussing the planning of botanic gardens, 'Business Plan' is one that can have a variety of meanings. Within the context of this paper, a Business Plan is a document that concerns itself with all aspects of how the project will function as a viable business. It is the type of document that your bank manager would be interested in seeing prior arranging a loan and would include a comprehensive review of the organisation and its users as well as financial details about the cost of the project and its future operation.

The Review section might include:

- Finances
- Visitor Numbers
- Visitor Demographics
- Visitor Spend
- Staff Numbers and Skills
- Staff Satisfaction

For existing gardens, these data should be readily available or obtainable. However, for new ventures, a more creative approach will be needed to develop a realistic estimation of the visitor numbers, visitor profiles etc.

An understanding of the current or projected visitor numbers, demographics, finances and staffing will help shape the Strategies in this plan. These will set out the overall approach for how the botanic garden will be funded, delivered and staffed.

Based on the Strategies, the Guidelines provide more detailed information that will help the development of detailed policies and budgets in the following stages. These might include a long-term development guideline that lays out phases of development for the garden over the next 10 to 50 years. A medium-term budget would provide a broad over-view of income and expenditure for the next 5 to 10 years.

The Business Plan is strongly linked with the three other plans as all aspects of the botanic garden must consider how they spend money and, in many cases, how they generate it too. In particular, the Business Plan will work with the Communication Plan to establish who is going to visit and the best way to reach them. With the Spatial and Science plans, it will govern the size of projects.

Communication Plan - A number of the documents found online following a search for 'Botanic Garden Master Plan' contain a section that deals with how the organisation is going to communicate with its visitors. However, these sections are usually titled 'Education Plan' or 'Interpretation Plan' and are often focused exclusively on either formal education or the use of graphic panels in the garden. Communication is an integral part of all botanic gardens, whether it is with visitors, scientists or between the gardens' own staffs, and there are a variety of media and channels that can be used to achieve this. Therefore the term 'Communication Plan' has been chosen for this Plan to remind the writers and users of it that its aim is to bring together the often disparate strategies for all these media under one cohesive plan. The Communication Plan concerns itself with all aspects of communication and begins with a comprehensive review of the current situation, which might include:

- External Perception
- Internal Perception
- Existing Strategies
- Current Stories Told
- Current Interpretation Effectiveness
- Visitor Experience

The results of these surveys will help shape the Communication Strategies, which will explain the organisation's approach to formal and informal education, interpretation, branding, marketing, visitor experience and internal communication.

Based on the Strategies, the Guidelines provide more detailed information that will help the development of designs and policies in subsequent stages. These might include guidelines on how to use the corporate identification, how guides/docents are trained and interact with the visitors, how volunteers are recruited and trained, how the garden will use social media, what it will be used for and by whom, as well as the approach to be taken with the site's interpretation.

The Communication Plan shares strong links with the Business Plan through budget and staffing requirements; with the Spatial Plan through interpretation and narrative, visitor experience and facility requirements; and to the Science Plan through its need to collaborate with external organisations in order to achieve its research and disseminate its findings.

Science Plan - Botanic gardens differ from recreational parks and gardens in that they are scientific organisations. That is to say that their collections have data associated with them that make them useful for research, conservation and education. The Science Plan concerns itself with this scientific value of the botanic garden. While the garden's living collection is the most obvious scientific asset, it is possible that botanic gardens also have collections in herbaria, libraries, seed banks etc. as well as the plants and animals that exist on the sites outside of these collections that also have scientific value. As with the other plan sections, the Science Plan should start with a review of these, which might include establishing the:

- Living Collection Value
- Herbarium Collection Value
- Facilities Suitability
- Scientific Contribution
- Environmental Value

Together, these reviews will help shape the garden's approach to the development of these collections and their future scientific use. As with previous plans, a number of strategies may be developed depending on the focus of the botanic garden. These Science Strategies will certainly include a living collection strategy that, depending on the circumstances of the garden, may also be accompanied by strategies for *in situ* and *ex situ* conservation, laboratory research, as well as seed bank, herbarium and library strategies.

From these Strategies, the Guidelines that sit under them will provide more detailed information, such as how the accessioning and de-accessioning of material will be carried out.

The Science Plan shares strong links with the Business Plan through budget and staffing requirements and visitor numbers; to the Communication Plan through interpretation, visitor experience and facility

requirements; and to the Spatial Plan through facility requirements and living collection and conservation habitat requirements.

2.4 Concept Designs

Design is about the constant refinement of an idea, adding more detail at each stage. Concept designs are the product of the initial stages of this process and provide a feel for what might be achieved but not necessarily what will be produced.

It is highly likely that you will have sort outside help from differing sorts of design practice at the master-planning stage. However, if this has not been the case, the transition from master-planning to concept design will invariably require the appointment of designers. The section, 'Procurement and Brief Writing', in the following chapter, looks at this process in more detail and, in particular, how this can effect the product of the following design stages.

Design practices all have different methods of working and you should have an understanding of the process that your preferred choice uses prior to their appointment. As a client, to get the best possible design, it is important that you rigorously critique the concept designs and challenge the designers on aspects of them you don't understand or agree with.

2.5 Detailed Design

If the Concept Design stage is about achieving a broader consensus as to what will be produced, then the Detailed Design Stage is about deciding exactly how the concept is to be realised, how it will be constructed. As with each of the previous stages, there will be a process of estimating how much the different elements of the project will cost and, with the additional information that gets added, this becomes more and more accurate. It is worth employing the services of a Quantity Surveyor (QS) with experience of these types of projects to assist with this. A good QS will be able to provide costings that look at the whole life of the project and not just the initial cost of construction. A whole life approach to design is a much better way of thinking about expenditure as it will allow you to make decisions now that save you money in the future. For example, you may have two options for heating your glasshouse. The cheapest

relies on externally sourced fuel while the more expensive is powered by material that is generated on site. Based purely on the capital cost, the first option would be chosen; however, this would burden the gardens with an annual fuel bill. If the whole life cost for the heating system is used to ascertain which unit should be installed, the second option would be chosen. It is also worth remembering that it is likely to be easier to raise money via grants and donations for a capital project than it is for annual expenditures for items such as fuel.

The result of the Detailed Design stage is a set of drawings and specifications from which the concept can be built during the next stage. Moving from the Detailed Design stage to the Construction stage will invariably require the addition of one or more contractors. Some of the methods for intergrating contractors in to this process are discussed in the next chapter.

2.6 Construction

A strategy for construction will have been established in the Master Plan and refined during the design stages. A phased construction process can allow aspects of the garden to become available weeks, months or even years before completion. This can be

beneficial where the garden is required to generate revenue as construction sites, with a few exceptions (see Box 2), spend money rather than generate it.

Progression from idea to realisation sees responsibility for the project move from one person to many. During the construction stage, you as the client, will still need to keep yourself informed of what is happening on site but the day-to-day responsibility will most probably lie with the contractor and the project manager/architect.

2.7 Operation

Congratulations, you have managed to get your project to the stage where the construction phase has given way to day-to-day operation. However, while it has taken a lot of time, effort and money to get here, the hard work isn't over yet. Your botanic garden is a mere seedling that will need care and careful training to ensure it grows into the best possible specimen. The result of the process to date is a garden and a dedicated staff. In addition to your Mission Statement and Master Plan, which you will be using to steer your operations, you will also be producing other documents that together form a hierarchy of documents with varying life-spans. Figure 7 illustrates these relationships and gives approximate durations for each of the documents.

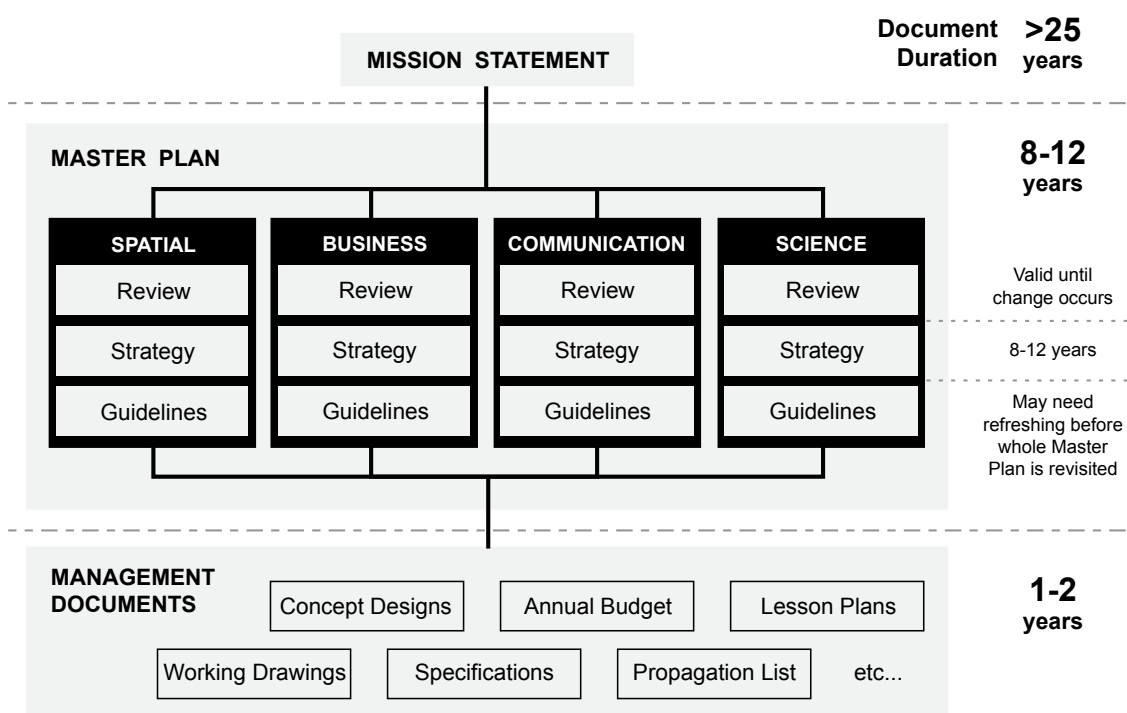


Figure 7 - Document hierarchy and approximate duration

2.8 Monitoring

Although this paper's title, "From Idea to Realisation", suggests a linear path that concludes with a final goal, it should be noted that the final stage of this process links back to previous stages (Figure 8). It is a cyclical process. The creation of a botanic garden can never be thought of as complete as the world in which it operates is constantly changing and it must react to these changes in order to remain relevant. Monitoring allows assessments to be made about how well the garden is progressing towards the destination described in the Master Plan and in the wider context of the world in which it exists.

From the outset, you should aim to not only collect as much information about how your garden is used and by whom but you should also ensure that this information is analysed and used productively. The frequency of monitoring will differ depending on the variables being measured and the methods used. For example, most gardens would probably aim to collect daily records of visitor numbers but modern EPOS (Electronic Point of Sale) enabled till systems can provide minute by minute details of fluctuations in ticket, shop and café sales.

Analysis of the results of monitoring will allow you to identify areas that need attention. These can then be put through the same process, entering at a point that is appropriate for the scale of the issue. For example, monitoring of building maintenance may identify that the toilet door handles keep breaking. This would be a detailed design issue and would enter at this stage where a different type can be specified. However, if it was identified that visitors were not gaining the intended message from a display, this might require a detailed design level change to the interpretation or perhaps a change at the concept level. More information would help ascertain which or these is the better approach. Other, larger scale, issues may need addressing at the Master Plan level. For example, it may be that changes in scientific research means that a section of the living collection and science facilities are no longer being used, refreshing the Master Plan to reflect this may result in decisions being made to concentrate on different areas of research and equip the botanic garden accordingly.

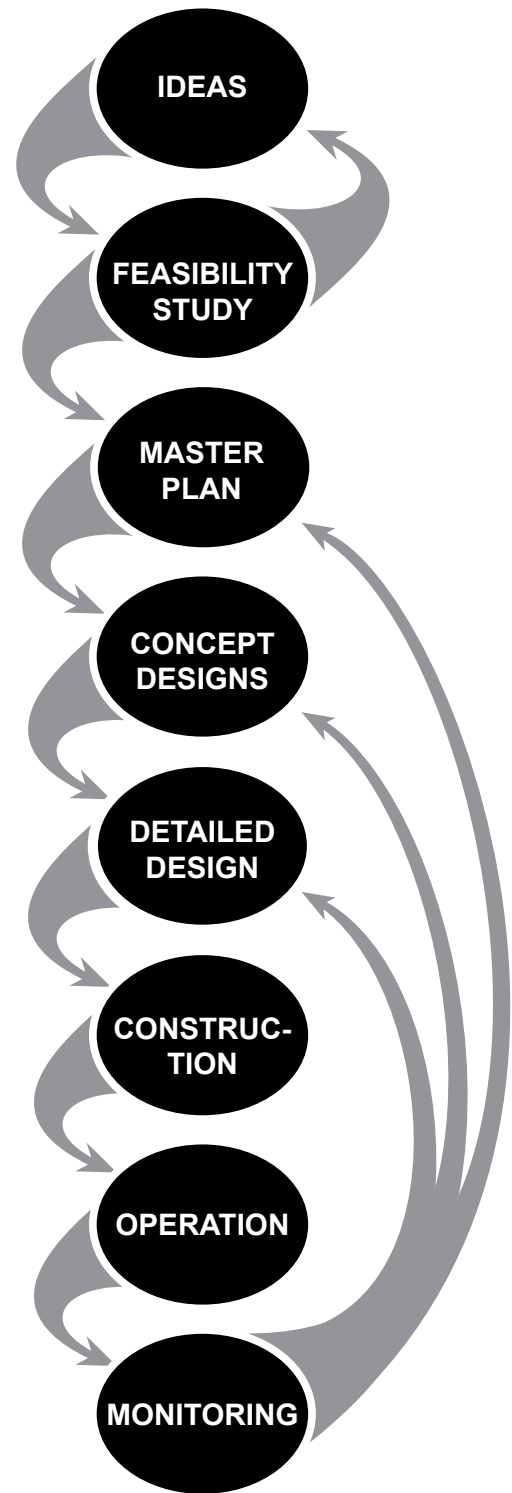


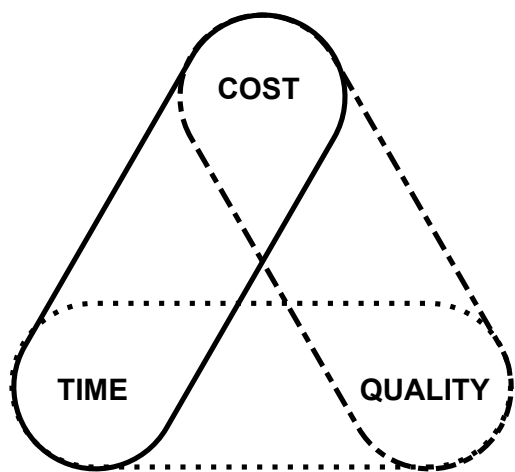
Figure 8 - Schematic of the main stages of the process

3 Some Principles

In the previous chapter we looked at the various stages involved in taking the idea for a botanic garden through to realisation or renovating an existing garden. In this section we shall look at some of the principles that are worth bearing in mind while you progress through this process.

3.1 Cost, Time, Quality

Throughout the process you should be thinking about the cost, time and quality implications of different decisions. Figure 9 is one illustration of a concept often referred to as the 'project management triangle' or the 'cost, time, quality triangle', see. The premise of this is that for every project there are three main elements that you are trying to balance; the cost, the schedule and the quality of the work. However, it is not possible for a project to deliver all three, i.e. good workmanship



- FAST, CHEAP but POORLY MADE
- - - - CHEAP, WELL MADE but LATE
- FAST, WELL MADE but COSTLY

Figure 9 - Cost, Time, Quality Triangle.

delivered quickly and cheaply. At least one of these elements must be sacrificed in order to achieve the other. For example, if you want something built quickly, you will either have to pay more to ensure that quality is not compromised or you can pay the same amount and accept that the quality will suffer. Therefore, it is worth thinking about your project and which of these elements are most important to you. This exercise will help the decision making processes at many of the stages described above.

3.2 Ease of Change, Cost of Change

There is often an understandable eagerness to progress a project to a stage where flower beds can be planted as quickly as possible. This is often coupled with a desire to save as much money for the fabric of the garden that manifests itself as a reluctance to financially invest in the initial stages of this process, which can appear costly with no evidence of progress visible on the ground. However, while not directly resulting in any building work, thorough feasibility and master-planning processes will result in a botanic garden that is better designed and thus more fit for purpose. Especially with projects on small budgets, where the temptation to jump to the design stages is perhaps greater, it is worth bearing in mind the potential cost of correcting mistakes. Figure 10 demonstrates how, at the start of a project, changing ones mind about a design element is easy and cheap because at this stage they are only loose scribbles on a piece of paper. However, as the project advances and more time effort and resources have been allocated to a design, changing it becomes more and more difficult and costly.

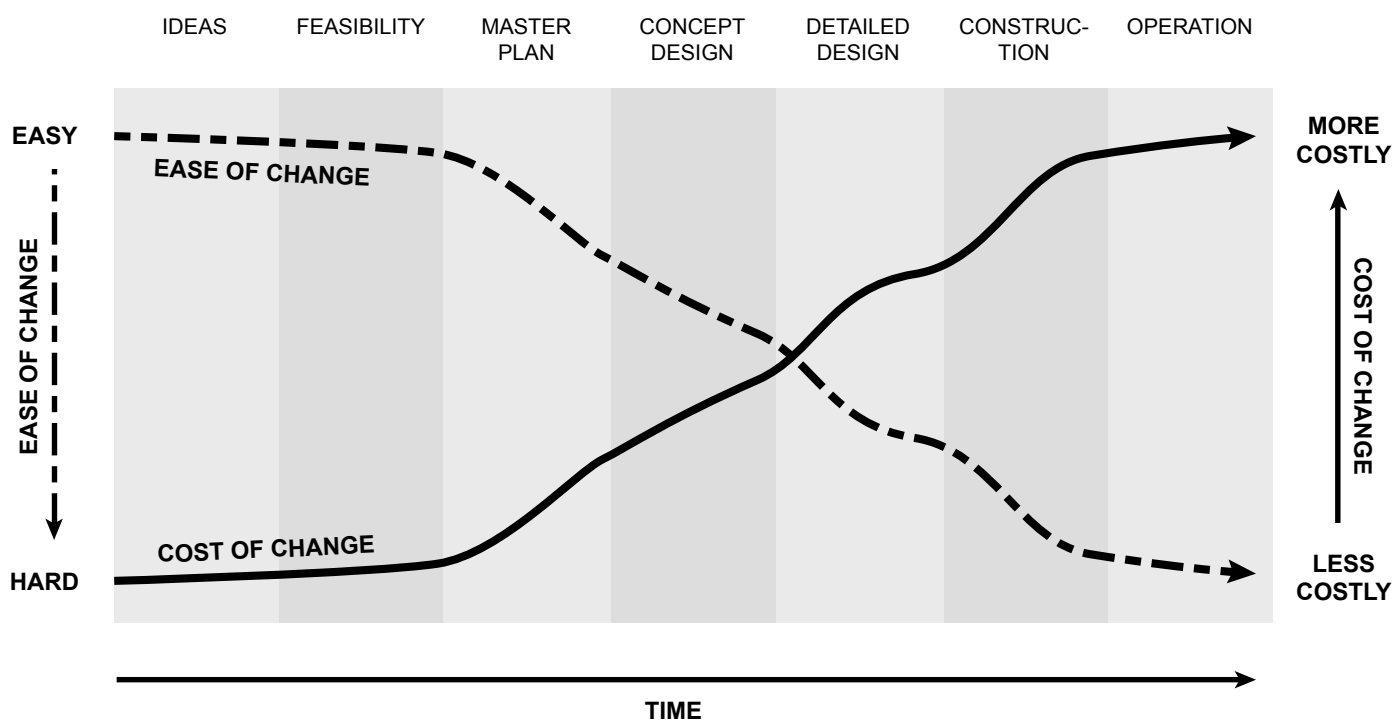


Figure 10 - Illustration of the changes in Ease of Change and Cost of Change over the life of a project

3.3 Building a Team

There will come a time in the project's development when, if the project is to move forward, the originator of the idea will need to involve other people with different skills. The combined skills, knowledge and experience of this new project team will have a great influence on the direction and result of the project so it is worth carefully considering who the team should be composed of and when they should be involved.

Ideally, the Master Plan should be written by a team that has expertise in the full breadth of topics it covers and the different sections should be written together as a collaboration so that each considers and responds to the others. Likewise, the subsequent design stages should also be a collaborative exercise with all elements developing simultaneously. Note that this doesn't mean that all elements start and finish designing at the same time; this isn't possible where the design of one space by one discipline is reliant on the prior input from a different discipline. However, where possible, both these disciplines should be talking before either designs are produced.

An example of why this is beneficial is illustrated with design of interpretation. It is not uncommon to find

that the development of interpretation is treated like set-dressing and left to the last phase of the design process. This means that the interpretation designer is often only appointed when the design of the landscape and buildings is finished and even when they are in the process of being constructed. This means that the designer is forced to design into a space with shape and characteristics he has not had the chance to influence and for which changing at this stage is costly (see the differences in cost between change during the Concept Design and Construction stages in Figure 10). If he had been involved at the same time as the landscape architect and architect, they could have designed a suitable space without the additional costs or reduction in quality that often occur.

As well as the project team, which will disband following the project's completion, the garden will also need staff to operate it. For a new organisation recruiting and training the various members will require a significant undertaking; one that needs to start well before the Operation stage of the process. The knowledge and experience of these people, in particular the senior members of staff who will

have a variety of experiences from other institutions, should be recognised and every opportunity found to incorporate their thinking in to the planning of the garden.

It is also important to remember that your botanic garden is going to interact with people outside of the organisation, providing them with a range of services. Consultation with them from an early stage will ensure that the services they require are met in the way that they want and, as a result, your garden is a success.

3.4 Appointment and Brief Writing

The appointment process is usually the Client's first interaction with the architect, landscape architect or consultant that they hoping to employ. This process sets the tone for the working relationship that follows and, due to this, also influences the final result of the project.

In 2012, FRLA Ltd conducted a survey of the UK's heritage visitor centres to explore the opinions of their staff to the architecture of the centres. The full report can be accessed online (www.frla.co.uk) but in summary it was discovered that, even though 50% of the visitor buildings were purpose built, there was still a lack of enthusiasm for their design. The five most common criticisms were:

- Lack of space
- Poor layout
- Poor visitor flow
- Insufficient facilities
- Insufficient storage

All of these issues should have been addressed at the design stage but, for some reason, were not.

During the survey, staff were also asked which method was used to select the architect for their project. When these data were combined with that of the overall satisfaction scores and operational satisfaction, it was clear that different procurement methods were associated with different qualities of final building (see Figure 11). It would appear that invited competitions and tenders, where only a few preselected companies are asked to tender for the work, produce better results than open tenders and competitions, where anyone can put themselves forward for consideration. This would seem to be counter intuitive; surely the process

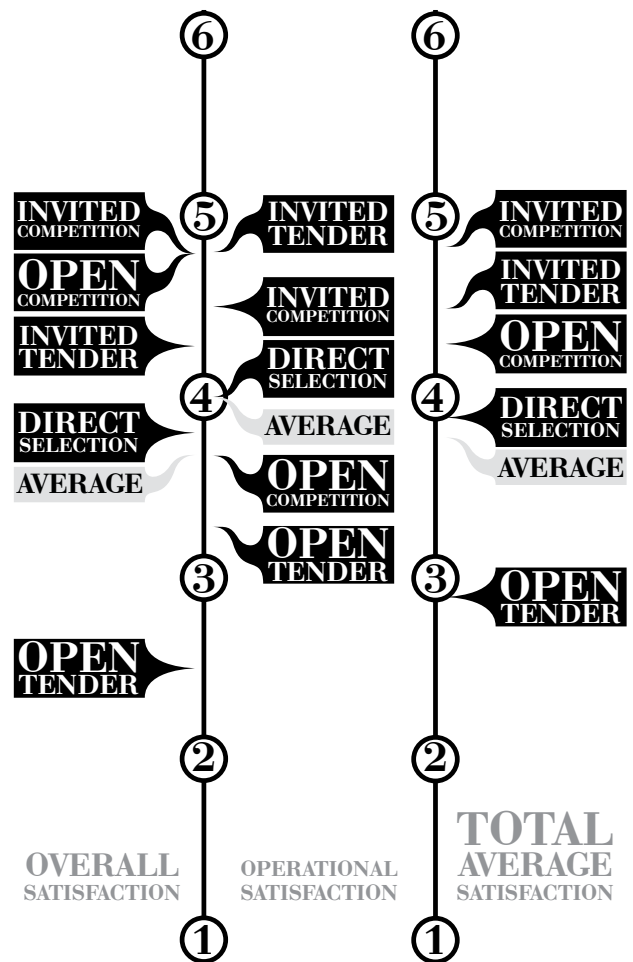


Figure 11 - Average visitor centre satisfaction scores grouped by architectural services procurement type. From FRLA Ltd (2012)

where you are not excluding people has a higher chance of discovering the best practice. Although the survey didn't collect information that could address this conclusively, the probable cause of this is that clients that are unsure of what they want from an architect and how to identify a good practice are more likely to use the open systems and appoint them using a poorly written brief. This poor brief is then the cause of the resulting building with its poor satisfaction score. Whereas, the confident and informed client, who uses the invited processes, will have written a far better brief that, in turn, results in a better quality building. Box 3 illustrates how important issues regarding a design can be considered prior to any concept designs being produced. This information can then be incorporated in to a tighter brief for the architect.

It is therefore clear that a well written brief will result in a better appointment and, as a result, better end product. A good brief will succinctly outline the organisations current situation and where they would

Box 3 - Harcourt Arboretum

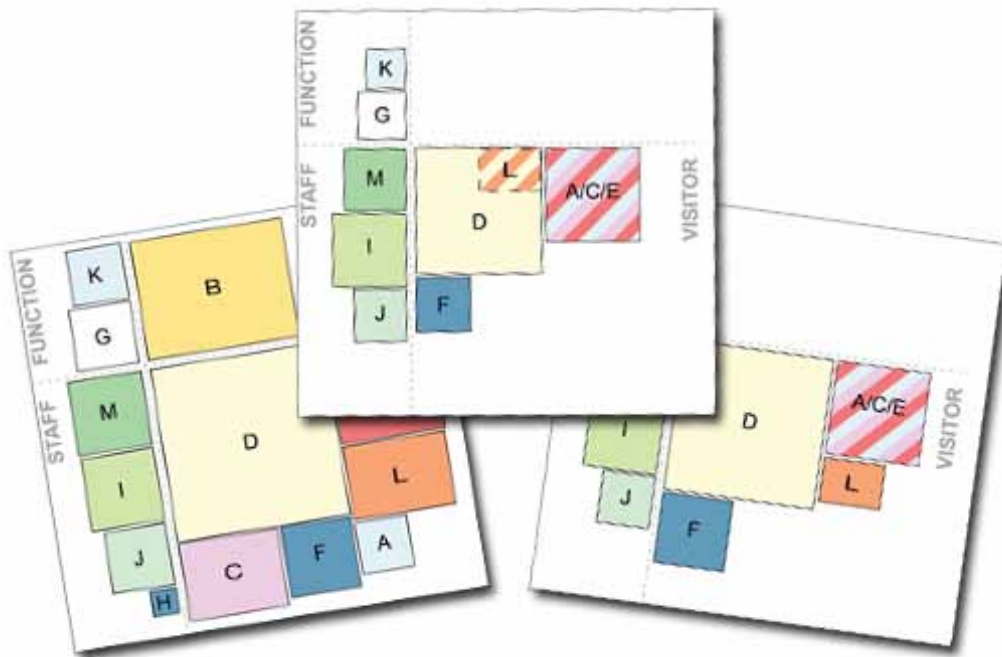
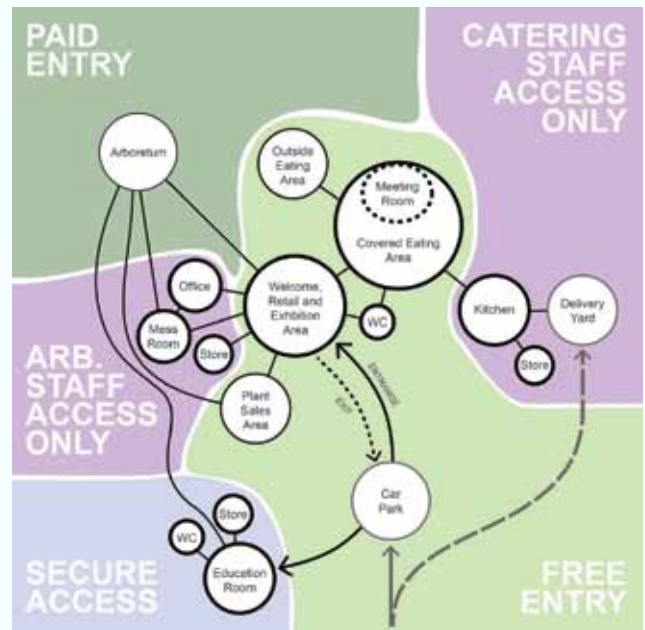
Harcourt Arboretum (UK) is the 130 acre (53 ha) satellite garden of the University of Oxford Botanic Garden. Over the last 60 years, during its ownership of the site, the Oxford Botanic Garden has extended the size of the arboretum; most recently adding 13,000 British native trees. However, the visitor facilities have always been limited to toilets in a small lodge building. Oxford Botanic Garden staff want to increase the number of visitors using the arboretum but realised that new facilities would need to be provided both for the visitors and staff.

Many questions existed about what size facility was required, how much this would cost and what types of spaces it should include. Working with representatives from the Friends organisation and the garden's staff, FRLA Ltd helped them to explore their requirements for the new facilities. Using this list and a database of visitor centre sizes, FRLA Ltd developed schedules of accommodation and adjacency diagrams for three scales of centre

to match different budget and visitor number scenarios. Despite the early stage of the project, benchmarking the three different scales of building against other completed projects allowed a discussion about the potential implications of certain design and project management decisions.

This work was all done prior to any concept designs being produced and, as a result, placed the botanic garden in a stronger position for the next stage, procuring architectural services.

Right - Adjacency diagram showing relationships between visitor centre spaces.
Below - Diagrams comparing different size options for the visitor centre



like to end up. It will define the work that is to be undertaken, including what the appointed consultant/practice/contractor will be responsible for and who will be responsible for those things not in their contract. If the client wishes to appoint on the basis of a fixed fee, they should indicate the scale of the fee they are willing to pay.

Competitions, if used carefully, can be a useful tool for selecting a design practice with which to work. However, far too often they are seen as a way of getting a number of design options produced cheaply. This is naive because the structure of these competitions means that the entrants know that they will be competing with a large number of other practices and that they only have a slim chance of recouping their investment of time and materials. Therefore they will spend as little time as possible tackling the fundamental design elements that effect the scheme's functionality and instead concentrate on producing an attractively presented 'iconic' design that will, hopefully, get them to the next stage. The designs are produced in isolation from the client, as there is often limited time with which to question the client's requirements, and often their quality suffers as a result. The public nature of the competitions means that the winning design is often presented to the public before the Client and the winning practice have had time to discuss whether it actually fulfils the brief and is the best possible solution. Competitions can work well when one design issue is isolated from the whole project and then used as a test-bed for discovering how the practices think.

When making your final selection from your short-list, it is worth remembering that your project is likely to be an unusual and prestigious project for whichever practice you appoint. As a result, some of the practices may have submitted fee proposals that are cheaper than their normal rate or even cheaper than they can deliver the project in order to win the work. While this might seem to be advantageous to the Client, it isn't. Appointing a practice that is aware that they aren't making a profit will negatively effect the quality of the work. In the long run, it would be far better to work with a slightly more expensive practice that are fully committed to giving the Client their full attention.

3.5 Procurement Routes

When developing a new botanic garden or undertaking the refurbishment of an existing one, you are likely to have several groups working on the project including the Client, who commissions the work, the architects and other consultants (Design Team), who advise the Client on what should be done, and the Contractor(s), who undertake the work. Together, these groups will work to realise the project. As described below, there are four main ways that these groups can be arranged and responsibilities distributed between.

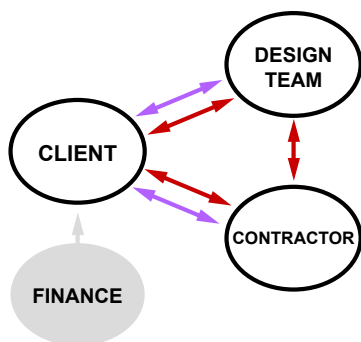
Traditional - The Client appoints the Design Team to produce a worked-out design that is then used as the basis for a tender from which the Client will then appoint a Contractor to build the design. This requires the Client to project manage both contracts and can be slower than other options, such as Design and Build.

Managed Construction - Several contractors are appointed to undertake distinct packages of work. They are contracted to the Client but they are managed by a third party, the Construction Manager, who is also contracted to the Client. This provides flexibility needed for delivering good quality on complex projects but, due to the multiple contracts involved, there will be less certainty over the final cost.

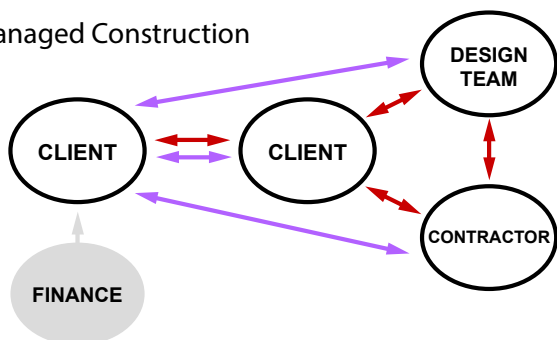
Design and Build - One contractor is appointed to undertake both design and construction. This can work well for small projects where it provides the Client with one point of contact and one fee to negotiate. However, it is not suitable for larger, more complex, projects where quality design is required.

Design, Build and Finance - For schemes where the final product produces an income, it may be possible to enter in to an arrangement whereby the Client leases the buildings from a Special Purpose Vehicle (SPV) comprising of the team that designed, built and financed the project; after a set number of years the buildings then become owned by the Client. This removes the problem of finance from the Client but also reduces the control they have over design decisions.

A - Traditional



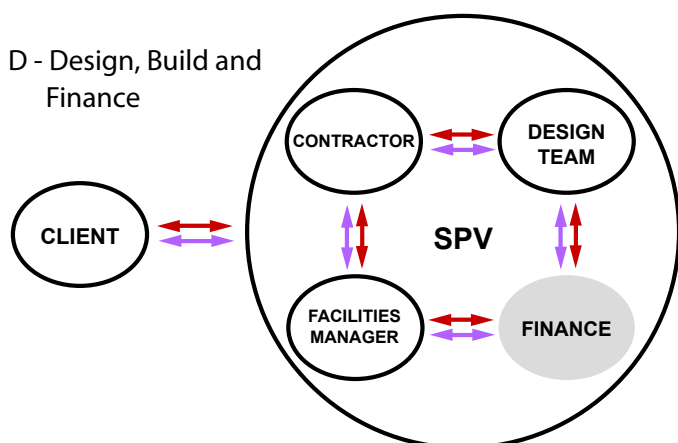
B - Managed Construction



C - Design and Build



D - Design, Build and Finance



- Contractual Relationship
 - Communication

Many variations of these procurement routes have been used in the past and each of them will create slightly different relationships between the parties and will therefore drive them to work in slightly different ways. The best solution for your project will depend on your project's particular situation as well as the culture and law within the country you are based. It would be advisable that you discuss the options available to you with an experienced professional, such as an architect, landscape architect or construction manager, at an early stage.

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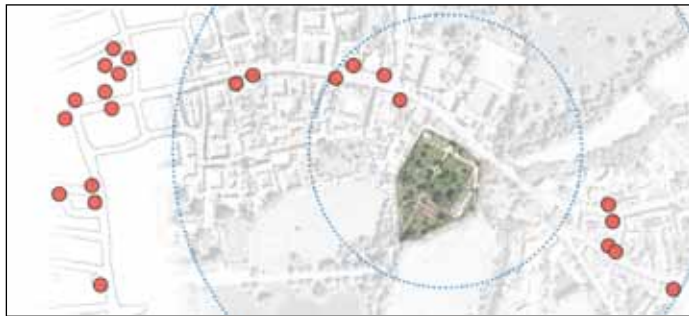
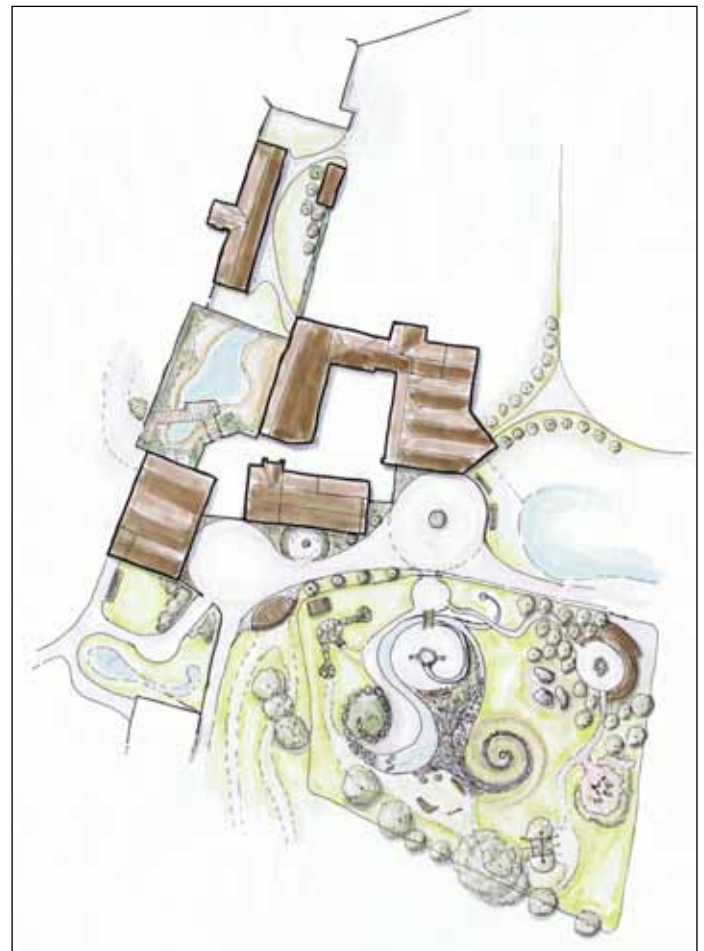
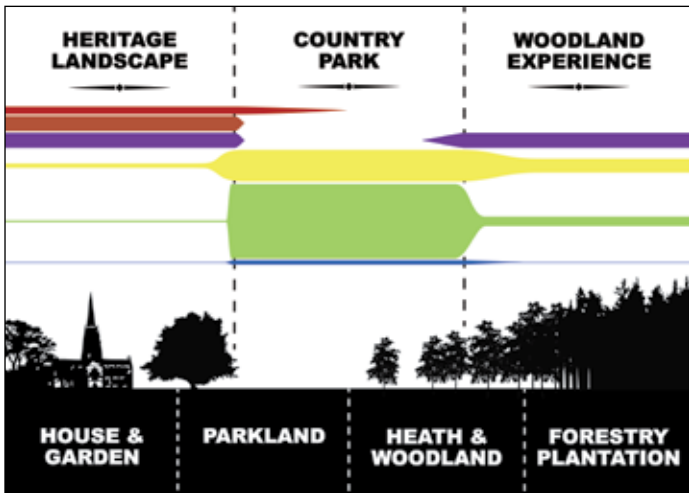
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Figure 12 - Four Procurement Routes



FRLA Interpretation
 Master-planning
 Narrative Spaces
 Landscape Architecture

FRLA is a design practice
 that specialises in working
 with natural heritage
 organisations
www.frla.co.uk

About the Author

Dr James Furse-Roberts is the founding director of FRLA Ltd, a consultancy that specialises in providing natural heritage organisations, such as botanic gardens, with master-planning, interpretation and landscape design services. He trained at the Royal Botanic Gardens, Kew, and has a PhD in botanic garden design and management.

Email: james@frla.co.uk