

Sustainability Innovation

Designing An Aesthetic And Pragmatic City Garden

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Grant of License

Summary

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 [PDF of summary.](#)

Identify the Challenges

The cost of building a city garden:

In many cases, in order to keep the landscape of the community greening, the maintenance expenditure has exceeded the benefits the gardens could bring us. And the carbon emissions of the maintaining process are even more than the system can absorb. In addition, as a result of the obstruction of paths and buildings, most city gardens' ecosystem are divided into several smaller systems. The communication of different species among the small systems are very limited, so that these relatively unitary ecosystems are far from self-sufficient. It is a vast cost to ensure the stability and ornamental value of the weak greening.

Biodiversity:

Shenzhen is often under the attack of typhoon, and the city gardens suffer great destruction. Lots of money and labour is required to do the repairing. We need to ensure the diversity of creatures, including the insects and the plants, and their environment to achieve the basic requirement of the micro-ecosystem, so that the urban gardens will have certain self-adjusting ability. And we need to choose proper plants that can adapt the weather and environment of our city, Shenzhen, which is subtropical monsoon climate. And they can grow well without too much caring from human and the nutrient from the environment is sufficient for their growth and they do not need extra fertilizer.

Residents' feeling:

The number of insects and animals living in the city gardens should be controlled. According to our investigation about several city gardens (Xiangmihu I, UpperHills, XiangshiMeilin), Osmanthus is a very popular plant. However, the sweet scent of the flower attracts many bugs and mosquitoes. Tasteful designs such as shady lane and parterre are gathering placed for insects as well. Instead of resting casually or appreciating the beauty, people worry about being surrounded by bees and bugs. Residents feel uncomfortable when they walk around the garden. Frogs are often placed to eliminate mosquitoes but the noisy croaks are a great disturbance at night. Besides, the cleaning of the pools where the frogs inhabit is difficult and the water is sometimes smelly.

Residents' feeling:

The traditional design of flagstone pathway should be modified. This kind of pathway is made up of paralleled flagstones which are separated with each other by a few inches. Grass can grow in the gaps and the pathway has a classical

beauty. But it is inconvenient to walk on the road as kids cannot manage to step on the next stone by one stride and adults' stride is a bit large for stepping on one stone a time and a bit short of crossing two a time. So many residents complain that they cannot avoid stepping on the gaps and it is bumpy for young mothers to push their baby carriages.

Ornamental value and practical use:

Some trees that provides shade for people also have prosperous root system that will damage the ground and make it rugged. The roots are hard to clean up and the repaired surface of the road cannot last for a long time. However, it is not wise to plant small saplings along the pathways since resident will not be protected from direct sunlight.

Ornamental value and practical use:

The irrigation of the garden is also a crucial matter. Regular watering is needed to keep the plants in a good condition. Traditional artificial irrigation is relatively low-efficiency and the labor cost is high. The automatic flooding irrigation system is highly water-wasting and water may spray on the passers-by. It is also a common phenomenon that the ground is wet and there is standing water in lower places after the irrigation.

The Participation of the local residents

In an age where environmental issues are becoming more and more serious, the importance of environmental education has become significant. Citizens should know more about the local environment so that they can be aware of the problems that we face and learn to take on the responsibility to protect the ecosystem. Ideally, community gardens are a suitable place to conduct these educations as they are close to where people live. However, the gardens that we have now lack the participation of the residents, many pavilions which are built for people to sit and relax are idle, not to say getting close to their surrounding greening.

When designing gardens for the community, designers often tend to plant trees that are aesthetic, even though the trees cannot adapt the city's subtropical climate. These trees are often fragile under the local climate and they cost a lot of unnecessary money to be taken care of. Planting trees that aren't suitable for the climate will become a liability for sustainable gardens.

Participation of the local residents

It is common that residents complain about some of the designs in the community garden. Designers cannot always consider every part of the garden thoroughly so that it has ornamental value and meanwhile facilitates people's life. Though professional, the designing group's intelligence is limited and they might not be aware of the obvious problems in their designs since they do not live in the residential garden. Thus, their design could be idealistic. There may be

constructive suggestions from residents that will improve the condition significantly. However, we are lack of a platform for residents to give opinions and participate in designing their own living place.

Identify a Root Cause

Besides that there are still room for enhancing the comfort of residents and the possibility that the city gardens can be turn into a platform where people communicate and gain knowledge, what arouse our awareness is that the benefits the gardens bring us always fail to match the cost to construct it. To pursue aesthetics, designers neglect to combine with local climate and biodiversity. Delicate yet frail bonsai require intensive human care and the gardens are so vulnerable in front of natural disasters that considerable amount of money is devoted to repairing and maintenance.

Generate Solutions

Design an area in the garden where people, especially children and the elders, can grow their own fruits or plants. In the past few decades, thousands of families moved from other cities to Shenzhen. Many of the adults invite their parents to Shenzhen once they settled down in this city, to look after their children and sometimes do chores for the family. However, the elders often feel bored as they often have nothing interesting to do. So designing such a place in a community garden could make them feel less bored and more satisfied. It could also educate the children more on growing vegetables/plants and develop a sense of achievement. The fruit or vegetables that they grow could also supply to the local community.

Only grow trees that can adapt to the local climate. Through this approach, we could reduce the cost of nurturing plants which belong to other climates. A sustainable garden should not disobey the nature of organisms for the purpose of aestheticism. This is the only way to ensure that the trees grow strongly and that the community gardens functions well

Plant choice: Palmae trees

Palmae tree has no taproot and its fibrils are relatively shallow, which will avoid damaging the ground. It is very economical and aesthetic. The fan-like leaves possess a special tropical rain forest beauty and palm is considered to be one of the most popular plants in gardening. Palm tree is an evergreen plant and origin in southern China so that it adapts the climate in Shenzhen. It has strong resistance to air pollution and strong viability. (But it cannot provide thick shades)

Plant choice: Cinnamomum camphora

In order to guarantee the garden's self-adjustment, we need to make sure that the conservation capacity reaches sub-forest level. When there are rainstorms or floods, the average conservation capacity is poor and the soil is not able to maintain stability. Cinnamomun camphora has deep and complex root system which can hold about 1 litre water per tree. It can significantly improve ambient humidity and air quality in dry weather. In addition, it can provide habitat for about 34 insects, which improves biodiversity and anti-disaster ability.

Since the separate ecosystems must be fragile, we cannot make sure that they are stable and self-sufficient. If connecting the ecosystems can improve this ability, the ideal condition is that the pedestrians are built in mid-air like the jungle bridges. In this way the greenbelt can fully spread across the community

and the housing is interspersed in it. This improves the environment and guarantee aesthetics simultaneously. In addition, we can build several small platforms under the overhead pavement for residents' entertainment. The platforms can also be multi-functional, people can grow plants by themselves and hold some environmental activities.

The flagstone pathway can be replaced by cobbled road. The stone should be small and fragmentized so that it is relatively flat and gives people identical sense when walking on any part of it. The shape of the road is also more flexible. Grass can grow in the narrow gaps between the stones and it will not be as abrupt as building a concrete road in a garden. Meanwhile, cobbled road has a very long history in Chinese gardening and possesses a classic beauty.

Plant choice: myrtle

Myrtle is originated from southern China and is very commonly seen in Guangdong province. It is a fast-growing evergreen plant, resistant to infertility and stress, and the plant shape is compact. The color of the flower various from white to red in the same plant and it blooms long. Therefore, myrtle has high ornamental value. Besides, it can preserve water and soil and its scent does not attract bugs. The fruit of myrtle is also a natural food resource for birds and this contributes to maintaining biodiversity.

Irrigation methods: Micro-spraying irrigation

Micro-spraying irrigation uses micro-sprinklers to spray water droplets onto branches and leaves. As the frog-drips are tiny, it has little percussive impact on plants and therefore will not harm seedlings. The water flow is small so that it is water-saving and will not soak the sidewalks. Micro-spraying can not only increase soil moisture, but also improve air humidity, and play a role in regulating the micro climate.

Irrigation methods: Drip irrigation

Drip irrigation is a highly water-saving way of irrigation. Because drip irrigation moistens only the soil near the root of the plant, the soil moisture content in other areas is low, so it can prevent the growth of weeds and therefore reduce the weeding cost. Each irrigation lasts for a relatively longer time so that the range of change of soil water content is small. This can significantly reduce the occurrence of pests and diseases, and then can reduce the amount of pesticides. Water sinks into the soil slowly and evenly, so that the soil structure is well protected and the aeration is fine. (But the irrigator is easy to be blocked)

Mid-air water storage

After simple purification and disinfection of the used water from residents, the water will be guided into a broad reservoir above the ground ecosystem, and use the collected water to irrigate the plants. When there is a heavy rain, the reservoir

can also improve draining capacity and save water resources. This can increase the utilization rate of water and help the garden guard against extreme weather.

Identify the Criteria

Compare the cost, including the money for construction and operation, with the benefits, including ornamental, environmental and bio-diverse contribution, is the money worth to spend?

Though the garden should be designed to be pragmatic, aesthetics is the fundamental norm of a city garden. Is this modification conducive to beauty?

The main purpose of building a city garden is to serve people, so the satisfaction of residents is vital. Will people feel more comfortable and want to spend more time in the garden if this idea is carried out?

A city garden is supposed to adjust and improve the environment around it, and it should not break the original ecological balance. Is the modification environmentally friendly?

The accident rate must be minimized. For plants, the aroma cannot do harm to our health; for architectures, the possibility of people tripping or falling off should be eliminated. Does the modification guarantee safety?

Evaluate the Solutions

We have attached a PDF of our evaluation, please check!

 [Evaluation](#)

Make an Action Plan

We have attached a PDF of the action plan

 [Action Plan](#)

 [concept image of the mid air pathway.](#)

Prototype and Test

| Feedbacks learnt from users

please check the attachment

 [PDF of our project prototype](#)

| Improvement for next iteration

In a nutshell, we discovered that people between 31 to 60 cared more about the conditions of the community, compared with other age brackets. We underestimated the enthusiasm and willingness of people to join the community activities, and most of them complaint about the lack of activities in community. Most of the people wanted to plant ornamental plants indicates they care more about the appearance of their living area. In the comments, interviewees complaint more about the surroundings of the community which involves cases such as disturbance from ongoing constructions. In general, feedbacks of questionnaires lead us to reconsider our focusing points. Besides its efficiency, we may care more about the ornamental value of garden and pay attention to the effects that surroundings exert on community members.

Appendix

| Presentation File

 [Designing an aesthetic and pragmatic city garden](#)

| Team Credits

Qianshan Weng

This project of ours contain a variety of work which is evenly assigned to each group member.

Among the five members of the team, Ruoqi Yuan plays the leading role, she is in charge of reminding the members about the work that needs to be done and ensuring every task is being finished on time. She, along with Qianrui Li, devised the criteria of the solutions and evaluated each solution accordingly. In addition, she also handled some of the writing of the challenge and solutions.

Qianrui Li contributed a lot of effort in researching the current situation of the community gardens. She is present in every investigation and managed to conclude many challenges we are facing. She was one of the writers of the challenges and solution, and generated the criteria and evaluation with Ruoqi. She also drew the concept images of our designs.

Feiyang Huang took part in writing the challenges and solution. He provided the team with many resources, allowing the team to investigate in some private gardens and collect sufficient results. He also wrote the first draft of the survey questionnaire and assembled some of the meetings.

Zhuoyang Hu had been very innovative throughout the project and presented many valuable ideas to the team. Even though he didn't write as much as the others, he is very passionate about the team's investigation and survey. With his knowledge in urban planning, he contributed a lot when it comes to identifying challenges and giving solutions. After Feiyang wrote the first draft of the questionnaire, he and Qianshan Weng edited it and gave out the second draft.

I, Qianshan Weng, took part in generating challenges and solutions, and is the writer of the Action Plan and Summary. Throughout the project, I helped to arrange group meetings and contributed many thoughts to the action plans. With my writing skills, I did a lot of writing works in the group.

The challenges, root cause and solutions are generated by group meetings, the content that the team presented contains the thoughts of every member.

Ruoqi Yuan

1. Having good drawing skills, Li Qianrui took charge of sketching a blueprint about the general idea and structure of our design. She was engaged in the investigation of the community gardens. She gave two current problems about the city garden and raises two corresponding possible solutions. Li completed the text of the PPT we showed in the final report.

2. Weng Qianshan was also involved in the investigation and solution generation. He checked and modified the questionnaire and posted it online. He was the writer of our Action Plan and help did the double check of our online report. He was the key speaker of our presentation.

3. Huang Feiyang organized the offline meeting and provided perfect meeting environment. He investigated the community gardens and generated problems and solutions. He designed the first draft of the questionnaires.

4. Hu Zhuoyang was involved in the investigation and provided innovative ideas for our garden design. He analyzed the data we collected from the questionnaires and made statistical graphs. He modified the questionnaires and he did the type composing of the PPT.

5. Yuan Ruoqi concluded the challenges and solutions, came up with the criteria and the evaluations. She was responsible for the overall checking and modification of the online report. She did the text part of the PPT and was also engaged in the investigations of the community garden.

Qianrui Li

Based on the different skills of the team members, each of them did diverse work in the project in last several months. Li Qianrui is good at drawing and communicating with others, so she drew the panorama of the city garden and visited many city gardens in Shenzhen with other teammates, which provided the background of the project. Since Yuan Ruoqi do well in writing, She wrote the challenge solution. Besides, she is responsible for all of the writings, including composing and checking. And it is what we demonstrated finally, which is the most important part of the item. Wen Qianshan wrote the whole action plan. In addition, he also improved the questionnaire and issue it, which showed the designed to the residents and got the feedback, so that we could improve our design. Hu Zhouyang wrote the first draft of the questionnaire. He is really creative, therefore, he provided most ideas of designing. He also did the analysis of the data of questionnaire and draw pictures of it, which made it more visualized. What' s more, he did the Composing of our final Power Point. Huang feiyang wrote the first draft of the questionnaire and organized the meeting. All of our members provided ideas of the challenges we faced and the solutions. We

can not finished the projected so well without any of our team members. Overall, everyone did a good job.

Feiyang Huang

Ruoqi Yuan is the leader of our group who generated the challenge solutions given by her groupmates. Also, she will help refine the document of the group and make sure every document is handed on time.

Feiyang Huang is in charge of the schedule and plans of the group who help organize the people in the group to hold meetings. And he is in charge of the design of the question sheet delivered to the interviewees.

Zhuoyang Hu is in charge of the data analysis and the production of powerpoints that are used to demonstrate our works. He also provided irradiative concerns about our project which lighten the path of the group. He is engaged in the improvement of the question sheet

Qianshan Weng wrote the action plan of our group and help with the demonstration of our group. He is also engaged in the improvement of the question sheet.

Qianrui Li is in charge of the framework of our thoughts and always participate in the inspection of local garden. She has great aesthetic evaluation towards gardens

All of our group members participate in the investigation of the local gardens.

Zhuoyang Hu

Li Qianrui is mainly responsible for the work related to painting in the group and she showed great enthusiasm towards investigations. She participated in every single field visits. She also raised several questions about the city communities and gave out several solutions.

Weng Qianshan is the chief copywriter in our group, he improved and rewrite the first draft of questionnaire and sent it to several residents' WeChat groups. He is also the main writer of the action plan and some other documents while also helping other group members correct the grammar mistake. He also involved in most of the field investigations.

Huang Feiyang wrote the first draft of the questionnaire and provided some good ideas of this projects. He is also the one who organized and held the meeting. He took part in most of the investigations.

Hu Zhuoyang helped the improvement of the questionnaire, and was responsible for data analysis. He also designed the presentation' ppt. He provided many novel and interesting ideas and gave out many innovative solutions. He participated in most of the field investigations and helped the writing of many documents.

Yuan Ruoqi is also one of the main writer of many documents. She is the main writer of challenge, solutions and summary. She has the ability to work effectively and made the manuscript of presentation. She also involved in most of the field investigations.

Judge Comments

" General comment: How to design, maintain and put to use urban green space is an important question. The observation of a trade-off between aesthetic and functional use is very interesting, and this trade-off will have its impact on how urban green space can be maintained and used. This is why it would have been interesting to know if different urban green space uses and user groups relate. Are different kind of residents involved in urban farming in comparison to the aesthetic use of a garden? And do we need to undertake different measures to motivate these different user groups to maintain urban green space?

Comments on the presentation: The problem analysis in the presentation to some extent asked for a solution that looks at how different users will make different use of a community garden, - the survey data collected would have allowed for such a data analysis. It is not clear why the survey was not used to understand what different groups of residents want, but rather was used to understand in how far residents would agree to a solution provided by you (please also note: the fact that 94% of the respondents come from one age group only can of course be attributed to the fact that it encompasses an age group of 30 years).

The report mentions costs as the main challenge, - also against this problem analysis, the survey could have been carried out earlier in the research process and could have also included cost effectiveness considerations: Under which conditions would residents like to be involved in maintaining urban green space? Now, residents are asked to assess pre-given options. Even if they like the option, they may still not be enthusiastic in maintaining the garden, which would be different if they had been involved in designing a solution. In fact, part of what you mention under "Improvements" in the end of the presentation could indeed already have been included in the research itself.

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" Very interesting project and one that is relevant for a huge number of city dwellers all over the world. The scope of the project is manageable and the solutions that the team has generated are practical. For a student led project, I am quite impressed with the quality of research. I would encourage the project team to broaden their scope of enquiry beyond simple financial cost-benefits. Research shows that gardens and natural landscapes have a profound impact on human well being and health. There are ways to estimate and quantify these non-monetary benefits as well.

Good integration of feedback from residents. In the choice of plant species, in addition to aesthetics and usefulness, I would recommend considering native and local plants as they have adapted for the climatic conditions over millennia.

Finally, my advice would be to strengthen your research add citations and sources to your paper as you go along.

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" Overall, this was a very well structured project in its approach, analysis, and proposed solutions. Congrats to the team in putting this together.

(i) A systematic approach to identifying aspects of the solutions (suitable species, irrigation options, paving options etc) would be very helpful. For example :- What are the pros and cons of Palmae trees. What are other comparable trees? The report occasionally gives the suggestion that the tree was first selected for singular reason and then the benefits of the already selected tree(s) were listed out. The team has done a good job of thinking about the user experience – what are the residents saying they want.

(ii) Root cause analysis could be strengthened. While all surveyed would have improvements they would like to see, do they help the garden achieve its originally intended purpose? What is the original function/benefits of the garden? Are they being met adequately?

Will the changes suggested improve the expected benefits of the garden? Some questions to ask to answer this further are (i) Will the changes increase the amount of time people spend in the garden or the number of people who will use the garden? (if not, maybe the aesthetic changes are not justified) (ii) Will it increase overall environmental awareness in the community? How can you measure that? (iii) Will it reduce the overall costs to the city over a period of time? (including in purchasing new additions and the operational costs)

(iii) Citations and references where available will strengthen document. As an example, aesthetics has been mentioned as the fundamental norm of a city garden. It appears that this finding comes primarily from surveys of garden users? Greenery in urban areas provide many additional benefits including cooling benefits, air purification, ground water purification, habitat maintenance etc. Expanding survey groups will give different answers. Some analysis of scientific literature will also strengthen these findings.

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