The Effect of Environmental Engineering on Existing Venues and Operation Management: A Case Study of Minxiong Township

Chou-fu Liang¹, Xin-yu Li², Tzu-Yun Lin³ and Hsiao-Hsien Lin⁴*

¹Professor, School of Environmental and Life Sciences, Nanning Normal University, No.175 Mingxiu East Road, Nanning, Guangxi, China, 530001
²College students, School of Environmental and Life Sciences, Nanning Normal University, No.175 Mingxiu East Road, Nanning, Guangxi, China, 530001
³Graduate School of Leisure and Exercise Studies, Yuntech, 123 University Road, Section 3, Douliou, Yunlin 64002, Taiwan.
⁴*Director, Tourism Management, Athena Institute of Holistic Wellness, WuYi University, No 26, WuYi Avenue, Wuyishan, Fujian Province, 354300, China.

Abstract. This study investigated the effect of environmental engineering on existing venues and fields and operation management. By using a literature review, questionnaire, and qualitative methods, we interviewed 9 residents and collected 420 questionnaires. Subsequently, the collected data was analyzed using multiple examinations and discussed. Environmental engineering can promote economic, social, and environmental development. However, a lack of consensus regarding numerous challenges among decision makers and businesses can reduce the number of visitors and affect the efficiency of facility management. Challenges include reducing dust emissions, revising fence planning, adjusting transportation lines, improving site survey accuracy, and reducing construction errors. These problems can affect visitor numbers and operation management even if businesses are effective in operation, marketing, and management and maintain professional teaching and service quality.

1. Introduction

National public construction revitalizes the economy and improves development status [1-2], increases job opportunities, and promotes universal health [3]. On the basis of the “One Town One Product” policy in Taiwan, various public construction projects such as stadiums have been proposed. This provides safe and suitable recreational environments for the public, thereby enhancing overall public construction development. After public construction, facility management requires professional cooperation, but Taiwanese government agencies lack management talent, and numerous venues and fields have been idle since widespread public construction.

To resolve the problem of idle buildings, government agencies have planned to outsource business processes to trustees to create a win–win situation for the government and businesses [4-6]. However, most public construction projects lacked reasonable planning policies and have failed to consider three aspects, namely systems, implementation, and professionalism [7] because the regulating authority lacks professionalism and human resources and has poor operating ability [8]. Therefore, the government intends to attract professional teams and businesses to use and revitalize idle venues and
fields by outsourcing. Businesses that manage these properties should have enthusiasm and corporate social responsibility to earn consumers’ recognition [9-10]. Moreover, these two characteristics help businesses obtain lucrative opportunities, operate smoothly, and create a win–win situation for the government, venues and fields, and the general public, thereby achieving sustainable development. Therefore, efficient goal attainment must be enhanced for construction projects.

Minxiong Township of Chiayi County is an old Taiwanese village with rich historical culture and agricultural industry resources. Because of its aging population, the village’s economic development has been hindered, and its available human resources for environmental maintenance have decreased. The local government formulated the Minxiong Forest Plan of Minxiong Township of Chiayi County, the goal of which is to improve the cityscape and residents’ quality of life and start construction to revitalize the old downtown area [11]. The initial proposal failed because numerous local public facilities have been poorly operated and have been idle for several years. A renovation project subsidized with $216 million was approved after said facilities were successfully revitalized after improvement [12-13]. Over 3 years from 2018 to 2020, the subsidized project has reconstructed all existing parks except for those that were successfully revitalized by outsourcing management. The aim of this project is to create inclusive and compound landscapes for playgrounds and sports fields [14]. To meet industrial safety requirements, construction fences were installed. However, continual construction errors have caused problems such as water and power outages that affect facility maintenance and management, which reduced visitors to swimming pools by 200% [15]. This indicates that major construction plans and management systems in Taiwan lack care consideration. Specifically, Taiwan’s professionalism in constructing and implementing projects lacks communication and progressive, integrative, and comprehensive ideas. Construction plans remain in a top-down administration and management process [13]. Without comprehensive planning and consideration, conflicts between project promotion and facility management can occur, and the project would fail to meet its goals [4, 16]. Therefore, this study investigated the effect of environmental engineering on current venues, fields, and operation management. This can elucidate the effect of public construction and implementation conditions on current venues, facilities, and businesses operators, and will facilitate decision-making.

2. Materials and Methods

We investigated current venues, facilities, and business operation conditions in the Minxiong Forest Plan of Minxiong Township of Chiayi County to reveal the effect of environmental engineering on these venues and their business operations.

Figure 1. Research framework

We conducted field observation, collected data in person, and edited our interview and questionnaire topics on the basis of relevant studies [1-18]. A pretest was conducted using 200 questionnaires in June 2019 [20-21], and items with correlation coefficients greater than 0.4 were adopted [21]. The standardized Cronbach’s $\alpha$ was 0.978 for all questionnaire items; Cronbach’s $\alpha$ for each item ranged from 0.978 to 0.976. Subsequently, we collected 420 valid questionnaires from July to October 2019 and analyzed them on SPSS 22.0 (Table 1). Nine participants were interviewed, including business operators, scholars, and residents, for their opinions [19] (Table 2). Finally, we compiled and discussed the data by using multiple examinations.
Table 1. Interviewee information

| Respondents Code | Identity      | gender | Years of swimming | job title          |
|------------------|---------------|--------|-------------------|-------------------|
| A                | scholar       | male   | 20                | lecturer          |
| B                | scholar       | Female | 42                | lecturer          |
| C                | residents     | male   | 40                | elder             |
| D                | residents     | Female | 15                | commissioner      |
| E                | residents     | Female | 39                | -                 |
| F                | Pool Operator | Female | 35                | coach             |
| G                | Pool Operator | male   | 40                | lifeguard         |
| H                | Pool Operator | Female | 42                | supervisor        |
| I                | Government engineer | male | 5            | engineer          |
| J                | Government engineer | Female | 3                | engineer          |

Table 2. Results of reliability test and factor analysis

| issue                                                                 | M    | SD     | Cronbach’s α |
|-----------------------------------------------------------------------|------|--------|---------------|
| Entrance signs and parking planning                                   | 3.79 | 0.886  | 0.978         |
| Traffic flow planning in venues and fields                            | 4.06 | 0.762  | 0.977         |
| Poolside space planning                                               | 4.24 | 0.703  | 0.976         |
| Resting and storage space                                             | 4.17 | 0.756  | 0.977         |
| Swimming pool water quality and temperature management                | 4.26 | 0.686  | 0.977         |
| Design of poolside area, sewer covers, and stairs                    | 4.05 | 0.885  | 0.977         |
| Shading and ventilation planning                                      | 4.02 | 0.868  | 0.976         |
| Toilet equipment                                                      | 3.89 | 0.897  | 0.977         |
| Willingness to revisit the swimming pool                              | 4.00 | 0.804  | 0.976         |
| Current signboard placement                                           | 3.86 | 0.821  | 0.977         |
| Print advertisements in venues and facilities                         | 3.91 | 0.759  | 0.977         |
| Current Internet marketing management                                 | 3.92 | 0.829  | 0.977         |
| Current life guards’ professionalism and responsibility              | 4.21 | 0.755  | 0.977         |
| Current reception staff’s professionalism and responsibility         | 4.27 | 0.775  | 0.977         |
| Current swimming coaches’ professionalism and responsibility         | 4.35 | 0.774  | 0.978         |
| Influence on teaching environment and quality                         | 4.27 | 0.775  | 0.977         |
| Influence on consumption environment and quality                      | 4.26 | 0.751  | 0.978         |
| Willingness to revisit the swimming pool                              | 4.29 | 0.674  | 0.977         |
| Planning of current teaching sites                                    | 4.24 | 0.766  | 0.977         |
| Planning of available teaching content                                | 4.36 | 0.757  | 0.976         |
| Current teaching environment and facilities                            | 4.41 | 0.803  | 0.976         |
| Current teaching staff and professional technology                    | 4.38 | 0.907  | 0.976         |
| Willingness to participate in swimming activities again                | 4.30 | 0.877  | 0.976         |

3. Results and Discussion

A total of 420 questionnaires were distributed at the venue, and most participants were women (75% women and 25% men). This suggested that most visitors to the swimming pool are families because in Chinese society, fathers focus on working, and mothers are responsible for children and the family. Consequently, most visitors to the swimming pool are women.

3.1. Analysis of the effect of environmental engineering on the situation of venues and fields

As shown in Fig. 2, the general public expressed that businesses are thoughtful and maintain excellent
quality in water, resting places, and traffic flow planning. Moreover, 75% of respondents were willing to reuse the businesses’ services. However, they expressed concern in using their services because of the following drawbacks: frequent transportation of large construction vehicles, walls blocking the pool’s surroundings and closed access roads, uncertain access road safety, difficulty locating the swimming pool, outdated indoor insulation boards, and inadequate planning of outdoor shading. Even with high-quality physical environments inside and outside venues and excellent maintenance of other environmental aspects such as water quality, other factors can discourage people from using the swimming pool.

![Figure 2. Comparison of the effect of public construction on venues and fields](image)

Specifically, drawbacks including flawed traffic flow and dust emissions caused by environmental engineering construction, transportation of large construction, obstruction of traffic flows to the swimming pool, old and damaged equipment, and unfavorable ventilation and shading design undermined respondents’ approval of maintenance and operation management at venues and fields. This reduced their willingness to reuse their services, as shown in Fig. 3.

![Figure 3. Impact of environmental engineering on site management](image)

### 3.2. Analysis of the impact of environmental engineering on current marketing and service quality

As shown in Fig. 4, the majority of respondents (88.2%) were willing to reuse their services indicating that businesses have high standards for their operation strategies, maintain employee dedication to their work, and maintain an excellent corporate image and corporate social responsibility. However, the public could not gain knowledge of current operation management of swimming pools because of fences blocking the road, reduced traffic flow and spaces, and difficulty identifying the current entrance to the swimming pool. Construction misinterpretation caused damage to cables and water pipelines, and they could not provide water or electricity. Broken underground pipelines can be polluted and lead to considerable amounts of sewage, sediment, and underground wastewater flowing into the pool. This increases the burden of water quality management and accelerates filtration system
impairment, resulting in unfavorable water quality and appearance of the swimming pool.

Figure 4. Effects of environmental engineering construction on current operation management

Safety maintenance measures required in environmental engineering, such as demolition and transportation, and unfamiliarity with on-site construction environments have impaired facilities and caused difficulties for operation managers, as shown in Fig. 5.

Figure 5. Impact of Environmental Engineering on Operational Management

3.3. Operation management and annual difference in the number of visitors

The general public approved of teaching sites, teaching content, teaching staff, and professional technology, and 80.9% of visitors were willing to revisit (Table 3).

Table 3. Cognitive analysis of the effect of environmental engineering and operation management

|                                    | Very dissatisfied | No comment | Very satisfied | Sequence |
|------------------------------------|-------------------|------------|----------------|----------|
| Planning of current teaching sites | 1.5%              | 14.7%      | 83.8%          | 2        |
| Planning of available teaching content | 1.5%          | 14.7%      | 83.8%          | 2        |
| Current teaching environment and facilities | 2.9%       | 10.3%      | 86.8%          | 1        |
| Current teaching staff and professional technology | 3.5%    | 14.7%      | 81.8%          | 2        |
| Willingness to participate in swimming activities again | 3%       | 16.2%      | 80.9%          |          |

Businesses grew by an average of 120% between 2017 and 2018, but growth was reduced by up to 200% because of the aforementioned reasons [12, 22] (Table 4).
Table 4.2017, 2018, 2019 Statistical differences in the number of tourists from July to September (Person-times)

| date     | 2017 | 2018 | 2017-2018 Growth rate | 2019     | 2018-2019 Attrition rate |
|----------|------|------|-----------------------|---------|--------------------------|
| July     | 926  | 1632 | 176.24%               | 585     | -279.10%                 |
| August   | 802  | 1013 | 126.31%               | 440     | -230.20%                 |
| September| 378  | 754  | 199.47%               | 258     | -265.10%                 |

The general public believed that businesses strive to train athletes, can plan competent teaching content and have professional and technical skills, and devote themselves to environmental protection. However, the swimming pool’s surroundings had considerable amounts of dust and water, and a power outage occurred once. Additionally, a construction company mistakenly damaged an underground water pipeline, causing sewage inflow that undermined the quality of water and environmental appearance. Moreover, sludge flowing into the pond increased the burden on the filtration system and undermined its function. Overall, this caused unfavorable energy waste, hygiene, and appearance at the swimming pool.

Problems such as dust emissions and pollution can discourage people from revisiting the pool and reduce the number of visitors even if businesses are effective in operation, marketing, and management and maintain professional teaching and service quality, as shown in Fig. 6.

Figure 6. The Effect of Environmental Engineering on Existing Venues and Operation Management

4. Conclusion
Environmental engineering can contribute to economic, social, and environmental development. However, if decision makers cannot reach a consensus with businesses and resolve problems such as reducing dust emissions, correcting fence planning, adjusting transportation routes, improving site survey accuracy, and reducing engineering errors, numerous negative outcomes will result. Even when businesses are effective in operation, marketing, and management and maintain professional teaching and service quality, the condition of the venues’ tangible and intangible facilities would be influenced. This discouraged people from reusing services, reduced the number of visitors, and undermined effective operation management.

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