

# **WORK-RELATED STRESS, RESTORATION AND PURSUIT OF SUSTAINABLE MOTIVATIONAL FACTORS IN CONSTRUCTION**

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Work-related stress and consequent poor performance of workers require diligent application of innovative strategies on construction sites to achieve a viable labor resource. Humankind's desire for contact with nature serves an important adaptive function, in the form of psychological restoration that heals mental fatigue and the lack of motivation in the construction workforce. An underlying practical challenge is hereby offered in the "greening of the construction site", or the biophilic design concept, as a relevant aspect of construction management and planning. The question explored includes the nature of the biophilic construction site model (BCSM), and the specific design of workplaces to include "dynamic healing gardens" tailored to the project, environment, and construction processes. The methodology surveys, compares, and analyzes construction sites in South Africa with or without the BCSM. Findings indicate that workers actually achieve restoration and rejuvenation in a natural environment in harmony with the promotion of health and safety, ergonomic strategies in construction, and attention-restorative therapy. We recommend that "informal dynamic therapeutic gardens" be included within the construction planning of worksites, the interior of site offices and welfare facilities to enhance productivity and quality in construction.

*Keywords:* Attention restoration, Biophilic design concept, Health and Safety, Ergonomics, Performance.

## **1 INTRODUCTION**

Construction must accommodate the psychosocial recuperative value of the "livable green" construction site. This includes the ergonomic challenge of the sustainable-sites initiative in green construction, aimed at enhancing productivity through aesthetic experiences, such as the biophilic design concept or the biophilic construction site model (BCSM) strategy (Smallwood and Obiozo 2013). Adam Smith indicates that in behavioral economics, the "rational man" is often led by emotional responses, leading to unpredictable and/or irrational economic decisions (Altman 2006). The missing factor in the construction management body of knowledge is the impact of behavioral economics relative to the psychosocial recuperative value of the BCSM, and the cost-effective impact on the labor market in construction.

This paper explores the functional values of a "livable green" construction site, i.e., a "performing" construction site relative to the construction workforce. The methodology involves a survey on greening construction sites conducted on

construction sites in progress in the Northern Cape province of South Africa. This includes a comparative analysis of functional values derived from a focus group study of the workforce, and their reaction to a BCSM strategy introduced by the management. The findings indicate that the BCSM derived values that were psychotherapeutic, motivational, and cost-effective, conclusively recommending that contractors create “informal dynamic therapeutic gardens” on construction sites. This would include plants within site offices, welfare facilities, and construction site premises, as part of a holistic BCSM strategy for more cost-effective project delivery.

## **2 BCSM AND THE INTELLIGENT CONSTRUCTION WORKSITE**

Regarding innovative construction management strategies, Jones (2011) argued that creating the “best” solutions entails creating the conditions and environment for sharing experiences and developing an understanding of alternative viewpoints and criteria. This factor addresses the concept of “intellectual and creative teamwork”, derived from an intelligent worksite with the BCSM strategy, that heals the “sick construction site syndrome” (Hedge 2000, Obiozo and Smallwood 2014). The BCSM is derived from the biophilia hypothesis (Kellert and Wilson 1993), where Wilson (1984) defines biophilia as the “innate emotional affiliation of humankind to organisms in nature.” Greening an environment enables occupants to sustain better mental health and wellbeing (Miyake 2003), through contact with nature in the form of trees, grass, and vegetation. This helps overcome physical and emotional stresses that could lead to demotivation and reduced emotional intelligence (EI) of the construction worker (Hartig 2006).

Research findings suggest that humans have a definite limit for “directed attention” that is required to carry out necessary work and duties (Miyake, 2003); when that ability diminishes, humans tend to get easily angered, lose concentration, and make debilitating mistakes out of distraction, irritability, and loss of focus resulting from stress or burn out (cidb 2011). However, related studies hold that the conditions connected to “attention-fatigue” can be turned around (Hartig 2006). The theory of attention restorative therapy (ART) indicates that humankind can rejuvenate easily through “involuntary attention”, a particular feature of the attention faculty that engenders the derivation of pleasure and recognition of the value of nature (Hartig 2006). A pleasant encounter with sight, sound and smell of natural elements reduce the levels of a stress hormone known as cortisol, thereby relaxing the mind. The calmness produced in the individual enhances the healing and rhythmic beating of the heart (Hartig 2006).

## **3 METHODOLOGY: GREENING CONSTRUCTION SITE SURVEY**

The research method involved a field survey and exploratory case study on construction sites to determine how their greening affects workers and managements’ health, well-being, and performance. The data collection technique included a focus-group study, oral and written interviews, personal observations of workers and management, a questionnaire survey, and photo elicitations.

The case studies involved two temporary construction sites with the BCSM, comprised of four construction companies involved with the BHP Billiton Wessel’s

Manganese Mine Central block project site at Hotazel, Northern Cape Province of the Republic of South Africa. They include: CS-1 – at the entrance location, occupied by Murray and Roberts Cementation, and Synntech Project Management Company, with a four-year contract and staff of 204 and 10 respectively (Photo 1). CS-2 – located close to the project site and occupied by Bashewa and Olivier Construction, with a 9-month contract and staff of 10 and 40 (18 at the time of survey) respectively (Photos 2 and 3).

The fifth construction company, Gear Mine Steel, denoted as CS-3, had no BCSM or any form of greening, and was strategically located between CS-1 and CS-2. However, its presence had an impact on the employees of the other firms (Photo 4). Their staff strength is however unknown, since the workers were not present onsite at the time of survey.



Figures 1, 2, 3 and 4 (left to right). Rose garden courtyard with giant water jug fountain at CS-1; Outdoor shelter at CS-2; live chameleon on the Carmel Thorn tree at CS-2; Contrasting construction site at CS-3 without the BCSM (Source: Field Survey).

### 3.1 Background of the Study

The construction sites are located in Hotazel, about an hour's drive from the nearest town, Kuruman, where the workers live. According to the environment office of BHP Billiton, it is a semi-desert location near the Kalahari Desert near the border between Botswana and South Africa, with over 21m of sand atop a dense manganese core. It experiences extreme temperatures in the winter (frequently dropping to  $-16^{\circ}\text{C}$ ) and summer seasons. Bashewa's management reported that summertime is lonely, desolate, extremely dry, dusty, and stuffy. Winter is similarly arid with sparse vegetation.

This environment increased psychotraumatic stress, giving rise to absenteeism and discontented workers (cidb 2011). Unsatisfactory worker performance, and a high turnover on investment arising from poor work attitude, absenteeism and "presenteeism" (i.e., being present at the workstation but not focused) threatened the successful delivery of the project. Realizing that the problem was due to environmental distraction (since the workers were well paid, with frequent gift packages and monetary incentives), the management felt obliged to consider a BCSM, albeit unconsciously, adapted to each construction site as a solution to existential human needs. It is significant that the management of both firms had no prior knowledge of the biophilic design concept, confirming the veracity of literature findings (Wilson 1984, Kellert and Wilson 1993, Heerwagen 2006), and making these construction sites ideal for the exploratory greening construction site survey.

### 3.2 The key biophilic element of study: The BCSM on CS-1 and CS-2

- (1) CS-1: The key biophilic element of greening included a rose garden courtyard fondly referred to as “an oasis in the desert” developed at the entrance (Photo 1). It featured a large giant water jug fountain, trees, and various colors of rose bushes. Soft grass was planted on the entire site office premises. Yellow sun shading devices were used on covered walkways to enhance the rays of the sun, with rose bushes planted alongside the walkways and within the courtyard extensions. In this case, the construction site was initially devoid of vegetation, and an existing dump-yard filled before the landscaping and planting of trees and shrubs.
- (2) CS-2: Bashewa construction protected the existing three Carmel Thorn (*Acacia Erioloba*) trees on the site, and placed live chameleons in them for the workers to feed (Photo 3). The shade of the trees was enhanced with shade nets to create two outdoor shelters between the office containers. These were used for site meetings, lunch breaks, and community gatherings, and as a place of rest, refuge and shelter from the elements. The shelters were also furnished with chairs and tables (Photo 2).

### 3.3 Observation of and Interviews with Workers

The workers collectively agreed that CS-3, without any form of greening, seemed extra stark, hot and dry, with the psychological impact of dampening their spirit. It seemed to prolong the distance between CS-1 and CS-2 as the workers commuted to and from the project site. There was a 100% collective dissociation from CS-3 by the workforce of all four construction firms. As a measure of the appreciation of the BCSM at CS-2, it is notable that the workers began to take their breakfast in the shelter, not just their lunch, which increased their punctuality at work; they would usually gather there before leaving for their home after work. By unanimous agreement and personal observation, communication between the workforce on CS-1 and CS-2 improved, thanks to frequent fraternal interaction within the shelter on CS-2 and around the rose garden courtyard at CS-1. Commenting on the ergonomics, increased comfort and restfulness within the shelter, the workers agreed that the shelter was comfortable enough for a television set to be placed within, encouraging them to come to work and stay for the entire duration of work time. The employees of CS-1 and CS-2 unanimously agreed that the rose garden courtyard was a pleasant and healing encounter at the beginning and end of the workday. This confirms the BCSM aided the healing of the “sick construction site syndrome” (Hedge 2000).

### 3.4 Results and Analysis of the Questionnaire Survey

A Likert-type scale was used for the self-administered questionnaire, with 68 respondents. Table 1 indicates their degree of concurrence with respect to the cost-effectiveness of the implementation of the BCSM, with a scale of 1 (strongly disagree) to 5 (strongly agree), and in terms of a mean score (MS) between 1.00 and 5.00. The computing of the MS enabled the results to be ranked (R) in importance to one another.

Table 1. Cost effectiveness of the implementation of BCSM in terms of functional values.

Functional values	Unsure	Strongly disagree.....Strongly agree					MS	Rank
		1	2	3	4	5		
		Increased work effectiveness	0.0	4.4	7.4	27.9		
Improved comfort	4.4	5.9	7.4	20.6	42.7	2.9	2.72	2
Greatly reduced turnover	2.9	10.3	11.8	27.9	33.8	1.5	2.63	3
Rapid payback investment	4.4	10.3	13.2	22.1	27.9	8.8	2.63	4
Absenteeism cut in half	5.9	8.9	14.7	33.8	17.7	2.9	2.31	5

Source: Field Survey.

In Table 1, it is notable that one (20%) of the functional values has a MS > 3.00, which indicates that there is more agreement than disagreement in terms of the impact of the implementation of the BCSM on “increased work effectiveness”. However, four (80%) of the functional values have MS < 3.00, i.e., more disagreement. However, three of the MS are 2.72 and 2.63, which are moderately near the cut point, namely 3.00 – “improved comfort”, “greatly reduced turnover”, and “rapid payback in investment”. In terms of the various ranges, the functional values ranked first to fourth have MSs > 2.60 ≤ 3.40, which indicates that in general the extent of the agreement is between disagree to neutral / neutral. However, only one functional value, namely “absenteeism cut in half” has a MS > 1.80 ≤ 2.60, which indicates that the agreement is between “strongly disagree” and “disagree”.

In corroboration with literature findings, management reports, and interviews and observations with the workforce, the findings indicate that the BCSM was effective in achieving “increased work effectiveness” (MS = 3.07) and ranked first. The MS of the functional values also indicate the psychotherapeutic measure of the BCSM has moderately contributed to generally-improved cost effectiveness, enhanced performance, and a successful delivery of the project. Literature findings indicate that there is significant evidence that work effectiveness is increased through the presence of motivational incentive factors, enhancing the performance of the workforce. Improved comfort is ranked second among the functional values, with MS = 2.72, which means that within the range of MS ≥ 2.60 to ≤ 3.40, the extent of the agreement is near “strongly disagree” to “moderately agree”. Literature findings confirm that improved comfort is indicative of improvement in psychosocial values, ergonomics, H&S, and well-being on construction sites.

#### 4 CONCLUSIONS AND RECOMMENDATIONS

This empirical study finds that the greening of the construction site, and contact with nature in the form of the BCSM, is a cost-effective and significant motivational incentive package for enhanced H&S, ergonomics, wellbeing, and performance on construction sites. The inclusion of informal dynamic therapeutic gardens, plants, elements and attributes of nature within construction sites is hereby recommended. Further research would substantiate the BCSM as a healing and motivational factor to construction workers, given the complexities of different construction project sites.

## References

- Altman, M. (ed.), *Handbook of Contemporary Behavioral Economics: Foundation and Developments*, M. E. Sharpe Inc., Armonk, New York, 2006.
- Construction Industry Development Board (cidb), *Construction Quality in South Africa: A Client's Perspective*, Construction Industry Development Board, Pretoria, South Africa, 2011.
- Hartig, T., *Towards Understanding the Restorative Environment as a Health Resource*, Institute for Housing and Urban Research, Uppsala, Sweden, 1-6, 2006.
- Hedge, A., Where are we in understanding the effects of where we are? *Ergonomics*, 43(7), 1019-1029, 2000.
- Heerwagen, J., Investing in people: the social benefits of sustainable design, Presentation at Rethinking Sustainable Construction '06, September 28–30, Sarasota, FL, 2006.
- Jones, B. K., Facilitating integrated project delivery, in innovation and sustainable construction in developing countries, *Proceedings of the International Council CIB W107*, Uwakwe, B. O. (Ed.), Nov 1-3, Construction Publishing House, Hanoi, Vietnam, Uwakwe, B. O. (ed.), 85-91, 2011.
- Kellert, S. R., and Wilson, E. O. (eds.), *The Biophilia Hypothesis*, Shearwater Books, Island Press, Washington DC, 31-41, 1993.
- Miyake, S., Nature psychophysiology – Its concept and future prospects, *Proceedings, XVth Triennial Congress of International Ergonomics Association (IEA)*, August, 24-29, Seoul, Korea, 24–29, 2003.
- Obiozo, R. N., Smallwood, J. J., Healing gardens for the construction site: an innovative organisational management strategy, in *Proceedings, 8th Construction Industry Development Board (cidb) Postgraduate Conference*, Laryea, S., Ibem, E. (Eds), February 10-11, University of Witwaterstrand, Johannesburg, South Africa, 325-338, 2014.
- Smallwood, J. J., Obiozo, R. N., Green ergonomics, biophilic design, sustainable construction workplaces and workers' performance, in implementing sustainability – barriers and chances, *Proceedings of Sustainable Building Conference (SB13)*, Hauser, G., Lutzkendorf, T., EBig, N. (Eds), Munich, Germany, 1175-1185, April, 24-26, 2013.
- Wilson, E. O., *Biophilia*, Harvard University Press, Cambridge, MA, 1984.