

Changing Identities in Transportation: Definition and Measurement of Cultural Exclusion in Innovative Design.

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Abstract:

Innovative technology in transportation engineering is biased towards western models that are often adopted and directly applied in the context of developing communities. Theory, methods and language of communicating engineering technology, are often conceived in the context of standards and applications to suit the prescriptive nature of outcomes associated with these technologies. This creates severe constraints on the availability and utility value of these technologies to African communities.

Culture is a pervasive aspect that makes applications of engineering technologies adopt unique contextual value within specific communities. However, due to lack of identifiable frameworks for applications in African and other developing societies, the available technology often fails to achieve the intended results. Knowledge, information and culture are increasingly becoming borderless as new computer and communication technologies are transforming the way people work, travel, communicate, and consume, hence the need for an identifiable, distinct perspective is long overdue.

The paper reports on transportation technology applications and the impact of culture. The experiences of the author, working on transportation projects and on research in transportation construction and operations, has motivated investigation into the many challenging problems in application theory of science within the cultural perspective.

It argues that meaningful technology derives technical, functional or utility value within the context of individuals that use it. It posits that the current unique challenges of developing communities cannot be solved by the existing technology in its exclusionary perspective, but by innovative design and creation of scientific knowledge that Africa should create to solve its problems.

The tremendous need for new perspectives in defining and measuring the part of culture that makes transportation projects in developing communities succeed or fail is examined and possible solutions are proposed.

1. Introduction

The South African Department of Public Works established twelve construction projects located in various parts of the country in its initiatives of poverty alleviation and skills development. These were demonstration pilot projects to provide infrastructure to communities, while offering training and management skills, to the unemployed, women, youth and the disabled. Information gained from the projects evaluation was captured to provide standard guidelines on technical and programmatic applications of labor intensive construction methods to facilitate national policy analysis.

The information was gained through several periodic visits to the twelve projects construction sites which ranged from schools, clinics and community halls. Methods of data collection included unstructured interviews, participant observation, administration of questionnaires and project document analysis. 'Unskilled labour' from the communities benefiting from projects including roads, schools, hospitals and clinics, was exposed to structured classroom learning of technical, literacy, and basic mathematics skills.

In this paper, I investigate the program success, and factors that promote or limit their meaningful technology applications to empower communities are presented. The nature of emerging practical issues that involve technology in developing communities, and particularly in South Africa, the application of engineering technologies in the communities benefiting from these project.

1.1. Project sites and characteristics

The delivery of projects followed three different approaches. The *Main Contractor* type projects has an established company who sees to the main operation of construction, while subcontracting smaller, emerging contractors for specific tasks of the project. The *Affirmable Business Enterprises* are smaller, often

individually owned establishments where the entire project is run by this single entity. *Project Management* approach involves several community structures which come together to share tasks as they appoint contractors for specific ‘expertise’ as needed. With the *Community Based Project*, members of the community elect a steering committee, which in turn appoint a manager who liaises with them on appointing engineers, architects, surveyor etc. to complete specific tasks

| Established Main Contractor | Affirmable Business Enterprise | Project Management | Community Based Projects |
|---------------------------------------------------------|--------------------------------------------|-----------------------------------------------|--------------------------------------------|
| Botshabelo - Water supply (Free State) | Cala - Road construction (Eastern Cape) | Botshabelo- Road construction (Free State) | Hlabisa -Road construction (Kawzulu Natal) |
| Cala - Water supply (Eastern Cape) | Cala - College (Eastern Cape) | | Boipatong-School (Gauteng) |
| Khayelitsha - Streets and storm water (Western Cape) | Cala -Town Hall (Eastern Cape) | | Ndalen-School (Kwazulu Natal) |
| Matsulu - Bus route (Mpumalanga) | | | |
| Mbuzini - Access road (Mpumalang) | | | |
| Modimong - Road construction (North West) | | | |
| Schoonord - Road construction (Northern Province) | | | |
| Vulamehlo - Road construction (Kwazulu Natal) | | | |

Table 1: Project sites and classification

2. Road development technology Applications and Community Values

While there were several problems observed and documented through the evaluation process, the following three seem to stand out as conflicts between standard engineering practices which are directly extrapolated from the standard technology applications, and applied in this setting:

2.1. Contracts:

All contract documents for the projects were written in English. The targeted group of laborers had little or no literary and numeric skills, which presented a lot of complications. By design, a contract is a binding agreement on how a project should be accomplished, and gives a legal, binding definition of the process from start to end. No translation was offered to the emerging contractors, which posed several difficulties and hurdles. The established main contractors expected emerging sub contractors and laborers to understand that the items specified were legally binding. This resulted in conflicts where facilitation and resolution had to be constantly sought from the Department of Public Works, and the evaluation team. Most delays on project progress were attributed to this factor.

2.2. Expectations:

The projects were not only established in the disadvantaged communities, but most were also in areas where traditional beliefs and social structures are still highly valued. As in most standard business practice in South Africa some cases, absenteeism from work would have to be substantiated by a doctor’s or clinic letter, if the worker were to be paid in lieu of ‘sick leave’. On a number of occasions, some absent members of the workforce would report that they visited their relatives in some parts of the village to perform the traditional rituals to treat their illness instead of a medical doctor. Also, in cases where a traditional healer was consulted, members still expected the main contractor to understand that, which resulted in pay disputes.

2.3. Productivity:

In one case, a subcontractor was supposed to carry loads of loose stones to be used as an overlay in road construction. He was paid a minimum fee to cover initial expense such as petrol and ensuring that his pickup truck was roadworthy. Two weeks after the arrangement and payment, the load had not been delivered, and the construction had been halted, and laborers demanded to be paid for the time that they showed up at the construction site, but did not do any work. When the sub-contractor was eventually found, he had been trying to fix his pick-up which turned out to require a lot more time and money, for the initial problem anticipated. Productivity was compromised because of the different views of the need and means of task delivery between the contractor and subcontractor.

2.4. Community facilitation process:

In some projects, persistent confrontations and conflicts among laborers on the project, and community structures were noted. In one case at the Hlabisa road construction project, the necessary engineering activities were sabotaged by community needs, due to lack of proper communication. The main contractor instructed the laborers to close off a section of the road, after having resurfaced it. The local headman, who had to use the road to get in and out of his homestead was not informed of the road closure. When the laborers told him that he could not use the stretch of road, as directed by the contractor, but offering no alternative route to get to his house, he proceeded to drive through the construction. The constructor, (who happened to be a white male), complained to me stating that the person was abusing his power and position in the community and was being deliberately disrespectful to him by driving through a recently resurfaced stretch of road.

Monthly project organizational meetings often became forums for community issues resolutions. In another incident, a traditional healer, who had to perform drum beating and other ceremonial activities on a regular basis, was told that she could not practice this as it was disruptive to her neighbors, and would be even more so when a new clinic being built close to her house was completed. She complained to me that that is what her life is about, and that I needed to resolve the situation with the government. At a school construction project site at Boipatong, one woman on the Project Steering Committee pulled me aside and mentioned that she felt good that they did not have to deal with the “white” males when she had problems. In this regard, affirmation through identity was equated to legitimacy and justification of accomplishment of project.

2.5. Community Ideals

Traditional African customs have been documented in several disciplines and publications. In this case the specifics of these customs often permeated and presented problems to the engineers, while for the community, it was more of a way of breaking the tension and facilitating communication. During the process of project evaluations, I made an observation of how patriarchy and polygamy tendencies often penetrated the ‘professional’ engineering expected by the engineers and main contractors. At a meeting in Hlabisa, a man raised a hand, and when asked to speak, he asked if he could be allowed to pay lobola (bride price) to marry me, much to the dismay of the professional team. In other cases, when I accompanied male engineers to the road construction sites, the men would make jokes and bet on who would be the lucky guy to walk home with a bride at the end of the day. This is an example of how traditional African gatherings are used to negotiate and arrange problems that relate to livelihood in its entirety, giving the project a contextual value to the community. While the statements could have been jokes, it shows the differences of conceptualization of the way male/female relationships are situated in traditional societies. Other observations regard the ways in which men demanded to be treated differently from women. A good example is when they suggested that they should be paid more than the women because they worked harder, they were responsible for excavating while all the women did was to shovel or level the soil after all the hard work had been done. They also mentioned that they had more family responsibilities, most of them with more than one wife, felt that they would have to split the same amount of money as women, to several of their wives.

3. 'What is wrong with this picture?'

Looking at the information presented, it would seem apparent to any project engineer that there were several hurdles to effective project management in these projects. There are indications of problems including communication, work ethics, inability to honor contract and agreements,. However, it is also my argument that Euro-Western technology know little about non-Western standards of social organization and settling, the powers and social dynamics of the communities who they serve with infrastructure. Scientifically tested and accepted methods are available in various sections of literature. We have noted several design failures from what they build in their own culture because they do not know about the human impacts of their new 'creations' -housing projects in the U.S. (Pruitt-Igoe). It should be logical to state that their creations and designs become much more unsuitable when directly extrapolated and projected on other, non-Euro-Western cultures.

Meaningful technology application should not only provide for people's physical, social and economic needs, but should also respond to their cultural and spiritual needs. A good example of a successful architectural initiative of this type is the Aga Khan Foundation¹.It deals with fostering social action and promoting social change. Transfer of ownership assets from the public to communities. However, such transfers of assets do not necessarily by themselves achieve the objective of self sufficiency and meaningful development particularly in transport infrastructure.

However, African people's voices are noticeably absent from the debate over standards and procedures. Until fairly recently, black South Africans could not be admitted to engineering schools, or would be accepted in a few cases, only under specific, rigid rules. There is therefore the clear possibility that the values set on the public engineering enterprise will not be a true reflection of its actual worth.

4. Discussion

4.1 Addressing Technology Exclusions: Framework for Application

In the context of the South African situation, infrastructure shortage is not just a functional or technological problem, but of livelihood. The social structure which existed for centuries, governed by traditional laws, will continue to be undercurrents of any development effort,, and will not be eradicated by merely telling pole that they need t give it up to accommodate the engineer's perspective. Interaction with, and involvement of the community will remain a substantial reality that technical professionals need to contend with. In the effort to promote careful and creative interpretation, and evaluation of discourses and practices that empower and/or hinder groups, subcultures, or inflect on the practice of "everyday life." goes beyond the boundaries of the academy. What implications does incorporation of these technologies has for long term systemic change in the South African educational and technological spheres? How is the technology produced and transmitted ?

We could meaningful ask questions about how knowledge is applied and preserved, how people gain/do not gain from the technical exclusionary applications. This will complement the understanding of what conscious decisions in the development plans of technology and engineering agencies might be good for the 'hybrid' society in present-day South Africa. Infrastructure needs associated with transportation, as a component of road and other transport infrastructure design, it suggests users' behavior and composition of community activities as necessary components that should supplement the current criteria and guidelines in building and engineering standards.

Rapoport (1983, 1993) links the concepts culture and design to environment and behavior, which determine the environmental quality of spaces, and to systems of activities and systems of setting which show socially determined influences. These can be viewed as 'spatial ideals' based on social aspirations, but influenced by cultural norms, and economic and political constraints.

¹ The Aga Khan Award for Architecture is based on expressing Islamic culture and its principles in design. It has emerged to be the largest and wealthiest culturally oriented award in the world.

Empowerment and development, would be components the scientific and technological base for successful disseminating of new technology.

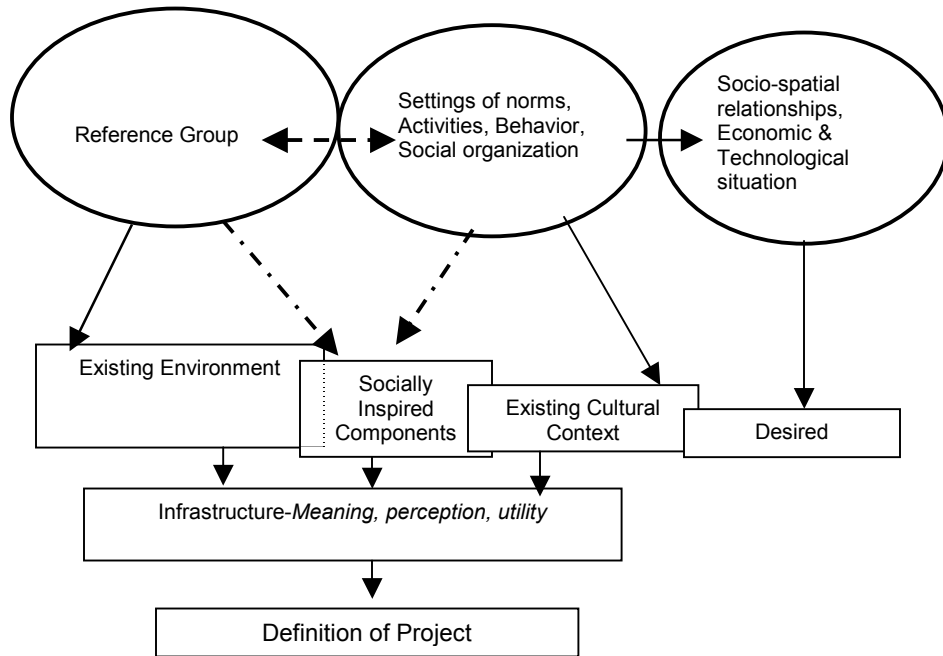


Figure 1. Conceptual and theoretical approach of socially necessary activities accommodated in spatial design

Rapoport's (1993) analytic framework on cultural change and the associated environments affected by external factors such as time progression, globalization and modernity. The culturally based theory suggests that cultural and physical factors interact to form an environment that is supportive of both latent and manifest functions of individuals and ascribe meaningful symbolism to environmental occurrences within a specific setting. Some physical modifications may also result if misfits occur, while in other circumstances, behavioral change may be the alternative.

Viewed within a structured and defined environment, linked actions performed by specific actors at a specific time not only become important for the accomplishment of a task, but almost become interdependent on each other as factors that cannot be freely transposed. Once transposition occurs, the action loses its contextual meaning. The starting point of the setting and activity system continuum is therefore the understanding that people (individuals and groups) perform functions within a specific space to attain specific results.

Socially inspired components arise from ideals created by a group and are regarded as appropriate within the given constraints in existing environments. *Culturally inspired components* are specifically related to Rapoport's (1983) work on supportive environments and systems of activities corresponding to systems of setting. The culturally inspired components of residential ideals are based on experience in the physical environment, and should therefore be understood as filtered by the degree of acculturation to the group. They accommodate expected patterns of activities and associated behaviors, cultural rules, socio-spatial relations and patterns. However, in the social and cultural emphases, it is more the activity (when and how often, for what purpose), performed that gives meaning to the physical structure. The social purpose becomes more important than the physiological or need-based one. This is seen as a way of using operations of social determinants of practice or 'straturation', which emphasizes the *spatial* and *temporal* components of social systems activities (Giddens 1979, 1981, 1984) in relation to their function of physical enclosure. In this

context, the key concepts are based on ongoing dependence of human action and social structure with human social activities being defined by space as a fundamental resource in human relations, and an indicator of power in society. Symbolism and commodification occur as the relationship and experience with the specific infrastructure is qualified by how it occurs and realized. The symbolic interaction implied by this study suggests however that scientific analysis is not a rigid, objective process, but that socially constructed facts do matter in explaining phenomena.

4.2. Empowerment, by whose definition?

The findings revealed that the laborers did not know the goals and mission statement of the government with the projects establishment, but only learned from community meetings that there was a contractor hiring unemployed people in the village or townships. While the project contract was available, with goals and objectives clearly documented, it was in English. As most workers could not read, they indicated that they depended on their group leaders for direction.

Because the laborers learned skills for the time that they were employed on the project, as a one-time task specific remedy and not in any other skills, they did not think that the skills benefited them in attaining self-sufficiency and job security, for example, if they were assigned measuring trenches or depth/ widths of road, the trainer would not teach them the actual mathematics about adding millimeter, centimeters and kilometers and how they are added, subtracted or converted, but would mark a point on the tape and told them to use the mark for measurement to determine points needed for road dimensions. This would likely be their main task for the duration of the project, and when it ended, they could not apply the skill learned, but had to undergo training for a different skill. In most of the discussions I had with laborers at different construction sites, it was felt that one-time drilling experiences were not adequate to bring about skills for long term learning.

People and objects are not randomly located in the physical environment. Rules, based on the structures of different societies organize, individual physical settings and groups of settings and the place of objects and people within those settings. These rules indicate appropriate use and behavior and make co-action possible. Some portion of an individual's definition of self, understanding of social position, and understanding of what is appropriate behavior, is developed through his or her socio-spatial experiences in daily life (Pader, 1988). Development of the fundamental conceptual understanding of the logical order of space, objects. Many women in this study believed that the sources of their poverty were migrant labor, widowhood, unemployment, and polygamy. Some women narrated how as single heads of families they struggled to make ends meet. On the other hand, government agencies in charge of these projects believed that the communities' poverty was due to lack of access to mainstream economy.

4.3. Eliminating technological dependency

Certainly neither Engineering as a broader field of study nor Transportation as a subsection of Engineering does address the question of culture and community values on public transportation buildings. Most recent studies on evaluation of infrastructure construction have traditionally been conceptualized within engineering and economic perspectives. These studies bring the debates primarily in a framework of western, market economies and not in relation to the perspective of socio-cultural groups that comprise the user populations. One reason for this has been the lack of techniques by which different socio cultural perspectives are integrated into a coherent framework to explain developing communities' relationships with infrastructure construction.

Space creating mechanisms are based on human will, which is independent on patterns that spaces offer. Spatial conditions that reinforce social status and hierarchy within traditional communities, but are ignored by practice within the professional engineering appear to find their expression in infrastructure utility, with context and meaning transposed to serve the need of the user at a specific time. Generic processes of spatial configurations and their relations have outlined geometric regularity determining movement patterns of people, Hillier et al (1996), Hillier (2000). Infrastructure is thus, not a definite entity, but an interpretation

of a system of relations between objects, resources, movements and effects, that together achieve a strategic derivative conceptualization to allow for the context of its use. Several problems and issues in implementing socio-cultural issues of infrastructure have been discussed. Kent (1984, 1991), Pader (1988, 1993), Rapoport (1993), and other anthropologically focused authors. They provide an understanding of culture through descriptions of activities and the relationship of people to recurrent everyday activities, people to people, and people and activities to physical elements in the environment. They conceptualize physical environments based on what motivates people in the person-environment relationship. Efficiency of design is also concerned with people's emotional responses and feelings of satisfaction or dissatisfaction when using or occupying such facilities. However, evaluation of appropriate design cannot be directly quantified outside of people's cultural and social connections to their physical environment. This suggests the need to examine connections between space, their associated meaning and value within social context of user groups.

5. DISSEMINATION AND APPLICATION

Knowledge, information and culture are increasingly becoming borderless as new computer and communication technologies are transforming the way people work, travel, communicate, and consume, hence, we cannot assume the static traditional conservation of community practices and ideals. Within the system of engineering infrastructure elements, the physical manifestation of transportation facilities, there is a clear influence of changing cultural aspirations towards modernity. These and other issues bear directly on developing economies, their sustainability of infrastructure as well as their social, and political institutions, we need to understand the complex issues that confront a society with deeply rooted traditional values but with an expanding capacity for scientific and technological manipulation of resources, so that engineering is practiced as a social as well as a technical activity.

Moore (1987) asserts that we need to understand the mutual relations and existence of human behavior in a physical space, to improve environments. This suggests the mutual dependence of physical environments and human activities. Further, Schneekloth (1987) supports this position by suggesting that infrastructure not only generates knowledge about people and their environments, but also creates a tool for meaningful interventions in the design, maintenance and management of physical environments to improve on people's experiences.

5.1. Values

The performance of any transportation system should ideally be linked directly to the needs of the transportation consumers. As it stands, most transportation providers continue to use transportation criteria that do not reflect ethnic, racial or gender social contexts. Engineering technology inevitably reflects a particular moment in time in terms of taste and technique. Good technology however, also reflects qualities related to values, norms, and therefore culture, within a community. The cultural value of technology lies in its ability to respond to these deeper sensibilities and to the tangible realities of place and to make connections with and enhance the specifics emanating from culture.

Because culture is mostly reproduced through daily activities, education, religion, politics, gender and social status filter through culture to determine areas that might still be valued as time progresses and technological advancements are assimilated into the population. In evaluating road projects, we could start by examining social consequences and cultural diversities as well as technology.

6. THE NEED FOR ENGINEERING STANDARDS

Highway capacity and road design manuals traditionally focus on specific methods for calculating project conformity based on geometry and structural adherence. There is an apparent existing conflict of interest in standards provided by design manuals in general, in relation to the qualitative value of products to the communities benefiting from road projects. While it is acknowledged that geometric design is an important element for safe and functional roads, the purpose for guidelines provided often ignore the community values

such as cultural contexts. The manuals with their technological, analytical and numerical procedures do allow for the production of successful structures that are efficient and safe to use, therefore science and technological analyses remain important. Technology and aesthetics without much scientific analysis would result in catastrophes, and despite the need to incorporate community values, road designs need to respond to the required standards in order to perform without posing safety hazards to the users.

The shortcomings of engineering manuals in their geometric adherence, however, not look into social issues. Most practitioners agree that this is a rigid tool in road projects design and implementation (Dennison, 1995), but that manuals are lacking in most other perspectives. Some authors however also view this as a lacking gap in theory and practice, which needs to be filled (Passonneau, 1988; Burke & Montoney, 1996).

This context is primarily linear (reductionistic) and deterministic in nature, whereby systems can be observed independent of the observer, and that the laws that govern their behavior can be deduced empirically through these "objective" observations (subject/object dualism).

It is hard to imagine a physical (or mechanical) world that is not amenable to such reductionism. Other aspects of concern to engineers of transport facilities designers are for provision of services targeted at speed, efficiency and safety. Because facts are presented but do not require opposition, they suggest how phenomena should, and do occur, which leads to their characterization as prescriptive or normative in nature, Lang (1987), Lynch (1981). Design theories are schemes of ideas, concepts, or expressions, that relate and serve to define and propose what and how design procedures should be carried out.

It is becoming imperative, though, not only to construct physical transport systems that are efficient, but also for road projects to capture the human elements to enhance cultural significance.

7. AN ALTERNATIVE VIEW OF ENGINEERING APPLICATIONS

The shift in the culture of engineering is an ambitious project that will necessitate research to develop a new curriculum. However, as this project gets understand the contextual underpinnings of the ethical questions at play, understand the human decision-making processes and to expand their ethical reasoning ability. the engineering profession would shift the emphasis from the engineer as a problem solver to the recognition that the way a technical problem is framed already contains ethical choices, but that they are able to thoughtfully reflect on their own internal assumptions as well as solve problems in an objective way, just as they are capable of being in an on-going dialogue with other members of the societal decision making process in an objective way.

Social values and ethics, how they function, and what they are based on. The emerging ethical issues arising from our technological developments, relationship between the individual's values, the technology that is being created and, the values of society. As the model presented in figure 1.1. shows, technology and ideals do exist in these society, so technological change is inevitable. However, engineering standards would be based on shared ideals among the community or subgroup.

8. CONCLUSION

This paper highlighted problems associated with the conventional technical assessment of transport projects performance. It supports designing socially-oriented projects and posits a view that there are equally legitimate technical approaches which are inclusive of communities' cultural contexts.

When South Africa achieved political independence the perceived (and actual) negative legacy of colonialism and apartheid justified the need to accelerate economic growth at rates that would permit poor and unskilled people to gain access to technology. However, the means with which this has been conceived, leaves a lot of practical issues out of the equation.

The objectivity of the practice of construction technology and engineering show that these designs can be applied to support socio-political structures, and community participation. Successful sustainable transport technologies and management tools are necessary in order to achieve this. Currently, we have little research-based evidence which explains how indigenous technologies impact on engineering technology, (in both the negative or positive perspective) and transportation project. This paper served as a tool to argue for such a

position. A differentiation is necessary. In South Africa we could start somewhere-by not just depending on what conventional technology has taught us, by asking questions on how communities sustain themselves, and giving them better tools and methods to reproduce technology that is meaningful to them. The review and expansion of engineering manuals and the South African Bureau of Standards are a few places to start. However, this would require other rigorous investigations to this end.

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