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From the Editor

The recently concluded World Cup gripped the world's attention for almost a month. So what has it got to do with engineering education besides keeping the student awake late nights? Nothing. Yet when we study the successful tactics of winning teams, we can learn valuable lessons to succeed in academics and later in professional practice. To win the World Cup, the number one factor is hard work and dedication. This includes practice, practice and more practice. No matter how talented an individual player is, he cannot meet the high standards of the game without constant dedication and practice. The same is true for the students. Knowledge cannot be obtained without constant application to one's study. Then comes coordination and teamwork. This is important to expand one's horizon during student life but becomes indispensable during professional work. So the next time the World Cup comes around, don't treat it simply as a game; learn from it.

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EMERGING SECURITY THREATS AND RECOMMENDATIONS FOR ONLINE SOCIAL NETWORKS

Binod Sitaula*
Raju Mishra**

Abstract:

This paper aims to provide a useful introduction to security issues in the area of Online Social Networks (OSN), highlight the commercial and social benefits of safe and well-informed use of Social Network Sites (SNSs) and emphasize the most important threats and best practices to reduce the security risks to users of SNSs. In recent years, a dramatic rise in popularity of online social networking services, with several SNSs such as MySpace, Facebook, Blogger, YouTube, Bebo, hi5, Wasabi, MEETin etc. have been observed. As a result, such commercial and social sites may often generate a number of privacy and security related identity threats for the members. A number of policies and technical recommendations to improve privacy and security without compromising the benefits of information sharing through SNSs has also been presented.

Keywords: Online Social Network, Social Network Sites, Identity threats

* Assistan Professor, Department of Computer Science and Engineering, Nepal Engineering Colleg

** Junior Professor, Department of Computer Science and Engineering, Nepal Engineering College

1. Introduction:

Online Social Networks (OSN) or Social Networking Sites (SNSs) are one of the most remarkable technological phenomena of the 21st century, with several SNSs now among the most visited websites globally. SNSs may be seen as informal but all-embracing identity management tools, defining access to user-created content via social relationships. There are various online SNSs each targeting different audiences, communities, business networks, online matchmaking, alumni etc. Online Social Networks are online communities of Internet users where most users share common interests, hobbies, religion, politics, profession, friends, school, sports etc. in various ways such as chat, messaging, e-mail, video, voice chat, file sharing, blogs and discussion groups. For the past few years, the number of participants of such social networking services has been increasing at an incredible rate. These online networks provide significant advantages both to the individuals and to the business sectors. Some of the remarkable benefits of online social networks are:

- Enable the people to stay connected with each other very conveniently and effectively, even at the international level. The connectedness and intimacy developed through this social networking might contribute to increased self-esteem and satisfaction [1].
- Allow like-minded individuals to discover and interact with each other.
- Provide a forum for new modes of online collaboration, education, experience sharing and trust

formation, such as the collection and exchange of reputation for businesses and individuals.

- In the business sector, a well-tuned SNS can enhance the company's collective knowledge and engage a broad range of people in the company in the strategic planning process.

Since the success of an SNS depends on the number of users it attracts, there is pressure on SNS providers to encourage design and behavior which increase the number of users and their connections. However, the security and the access control mechanisms of SNSs are relatively weak by design as the security and privacy are not considered as the first priority in the development of SNSs [2]. Sociologically, the natural human desire to connect with others, combined with the multiplying effects of Social Network (SN) technology, can make users less discriminating in accepting 'friend requests'. Users are often not aware of the size or nature of the audience accessing their profile data and the sense of intimacy created by being among digital 'friends' often leads to disclosures which are not appropriate to a public forum. Such commercial and social pressures have led to a number of privacy and security risks for SN members. As a result, along with the benefits, significant privacy and security risks have also emerged in online social networking [3]. As a result, the study of SNS security issues has now become an extensive area of research.

2. Principal Threats of Online Social Networking

The major focus is on threats which are

specific to SNSs rather than those which are common to all web applications (e.g. identity theft, pharming, profiling), unless there is an SNS-specific variant (e.g. phishing, spam), or the threat is increased by some specific feature of SNSs (e.g. corporate espionage). Each threat description specifies the threat scenario and vulnerabilities (the technical or systemic weaknesses which lead to the risk) as well as the risks themselves (the potential negative impact). The potential threats that the users might face can be broadly categorized in four groups: privacy related threats, SNS variants of traditional network and information security threats, identity related threats and social threats.

2.1 Privacy Related Threats

Threat 1: Digital Dossier Aggregation

Vulnerabilities: Profiles on SNSs can be downloaded and stored over time incrementally by third parties, creating a digital dossier of personal data. Information revealed on an SNS can be used for purposes and in contexts different from the one the profile owner had considered. With the advancement of data mining technology and the reduction of cost of disk storage, the third party can create a digital dossier of personal data with the information revealed on the profiles of SNSs.

Risks: Outside the social context of the network, information can become embarrassing or even damaging. While profiles can be changed or even deleted, additional storage elsewhere cannot be prevented, thus personal data takes on a life of its own even when the information itself may no longer be accurate or relevant. An adversary can

retain information from SNS profiles for negative use in, for example, a blackmailing scheme or to embarrass the profile holder.

Threat 2: Secondary Data Collection

Vulnerabilities: In addition to personal data knowingly disclosed in a profile, an SNS member discloses personal information to the network operator using the network itself: data such as time and length of connections, location (IP address) of connection, other users' profiles visited, and messages sent and received and so forth. While this in itself is not specific to SNSs, in other contexts information on a users' behavior is protected to some degree by being spread across multiple websites, e-mail accounts (e.g. work e-mail and one or multiple private e-mail accounts), one or more instant messaging systems and multiple Internet access points (at work, at home, through a cell phone etc.).

Risks: Due to the expansion of SNSs from a mere collection of profiles to a one-stop communication hub for messaging services, interest groups, video content and more, network operators and application providers can now gather unprecedented amounts of secondary personal information on their users. While information disclosed is ostensibly used by the network operator to customize and personalize its services, it can also be used for targeting (e.g. advertising), discrimination (e.g. price discrimination) or the transfer of data to third parties through resale.

Threat 3: Face Recognition

Vulnerabilities: Users of the social network often tend to add images to their

individual profiles that can be used for identifying the corresponding profile holders. Thus a stranger can use this data source for the correlating profiles across services using face recognition algorithm which is a part of the broader threat posed by so-called mashups.

Risks: Face recognition can be used for the linking of image instances (and the accompanying information) across services and websites which in turn enables connecting, for example, a pseudo-anonymous dating profile with an identified corporate website profile. As a result, an adversary can gather substantially more information about a user than intended.

Threat 4: CBIR (Content-Based Image Retrieval)

Vulnerabilities: CBIR is an emerging technology which is able to match features, such as identifying aspects of a room (e.g. a painting) in very large databases of images and thus increases the possibilities of locating the users [3]. Currently, privacy controls on images uploaded and the advice given on SNSs do not take into account the possibility of CBIR, and few people are aware of the consequences of posting images with location-specific content online.

Risks: CBIR allows linking of location data through the recognition of common objects in images. It opens up the possibility of deducing location data from apparently anonymous profiles containing images of users' homes. This can lead to stalking, unwanted marketing, blackmailing and all other threats associated with unwanted disclosure of location data.

Threat 5: Link Ability from Image Metadata, Tagging and Cross-profile Images

Vulnerabilities: Many SNSs now allow users to tag images with metadata such as the name of the person in the photo, a link to their SNS profile (even if they are not the owner/controller of that profile), or even their e-mail address. Very few SNSs offer privacy tools to control the tagging of images with links to their profile or the accessibility of tagged images in search results.

Risks: An adversary can use this feature to slander some well-known personalities or brands and gain profit from their reputation.

Threat SN.6 Difficulty of Complete Account Deletion

Vulnerabilities: Users of SNS normally face more difficulty in deleting the secondary information than to delete their user accounts from any online social network. In some cases, such secondary information is almost impossible to remove. For instance the public comments a user has made on other accounts using their identity will remain online even after deleting his account. Moreover, in general there is ambiguity as to whether information will be deleted upon account closure.

Risks: The user may lose the control over his/her personal information. Users cannot use their fundamental right of control over their own personal information. The information that can't be removed can be used as digital dossier.

2.2 SNS Variants of Traditional Network and Information Security Threats

Threat 7: SN Spam

Vulnerabilities: SN spam is unsolicited messages propagated using SNSs. Many spammers have sought to capitalize on the exponential growth of SNSs and the free traffic they provide. This is a very serious issue since statistics suggest that SNSs are replacing e-mail in some circles as a method of communication. This means that the same scale of spam problems which have affected e-mail communications systems could soon affect SNSs.

Risks: SN Spam may cause traffic overload, loss of trust or difficulty in using the underlying application as well as Phishing and diversion to pornographic sites.

Threat 8: Cross Site Scripting, Viruses and Worms

Vulnerabilities: SNSs are vulnerable to cross-site scripting (XSS) attacks and threats due to widgets produced by weakly verified third parties [4]. In addition, a heavy reliance on message-posting and viral marketing means SNS viruses spread extremely quickly.

Risks: An adversary can use this vulnerability to compromise the account, to perform phishing attack and to spread the unsolicited content to the email and Instant Messaging traffic. Moreover, it can also be used for denial of service and associated loss of reputation.

Threat SN.9 SNS Aggregators

Vulnerabilities: Some of the new

applications such as Snag, Profile Linker provide read/write access to several SNS accounts to integrate the data into a single web application. But such applications use weak authentication method and thus the vulnerability is increased. Social Aggregators also carry the risk of increasing the potential for attackers to mine data across sites since many offers cross SNS search features.

Risks: The effects of this vulnerability are Identity theft, Zombification of SNS accounts (e.g. for XSS attacks or advertising), loss of privacy for other members of the SNS by allowing search across a broader base of data.

2.3 Identity Related Threats

Threat 10: Spear Phishing Using SNSs and SN-specific Phishing

Vulnerabilities: Spear phishing describes any highly targeted phishing attack. The existence of easily accessible self-created 'profiles' and self-declared 'circles of friends' on SNSs allows a phisher to harvest large amounts of reliable social network information which may be used for a highly personalized phishing attack. The spread of such phishing attacks is greatly increased by the vulnerability of SNSs to social engineering techniques based on the infiltration of SNSs with low entry thresholds. Another factor is the prevalence of scripting attacks allowing the automated injection of phishing links.

Risks: Phishing can reveal the sensitive information, such as passwords and credit-card or bank account numbers and cause financial and reputation damage.

Threat 11: Infiltration of Networks Leading to Information Leakage

Vulnerabilities: The privacy of online social networks is endangered since an adversary can easily become a friend of a member of any restricted group by disassembling one's identity and then accessing the private information that belongs to the members of only that group. Moreover, on many SNSs such as MySpace it is even possible to use scripts to invite friends.

Risks: Some of the potential risks associated with this threat are: Leakage of Private information, Phishing for information and conducting spamming and marketing campaigns.

Threat 12: Profile-squatting and Reputation Slander through ID Theft

Vulnerabilities: An intruder can create a fake profile to impersonate a renowned person or a brand. Such profiles are usually created by the people who know the personal details of a user and create a profile to impersonate him or her, thereby causing all sorts of problems for the victim.

Risks: Profile squatting can do significant damage to the reputation of a person or any brand which may in turn lead to financial and social embarrassment, Phishing, marketing under false pretences etc.

2.4 Social Threats:

Threat 13: Stalking

Vulnerabilities: Stalking typically involves threatening behavior in which the perpetrator repeatedly seeks contact with a victim through physical proximity and/

or phone calls (offline stalking), but also by electronic means such as e-mail, Instant Messenger and messaging on SNSs (online or cyber stalking). A participant can reveal his personal information including location, schedule, home address, phone number etc. in his profile which can be used by an attacker for social stalking. Stalking using SNSs is increasing currently.

Risks: The impact of cyber stalking on the victim is well known and can range from mild intimidation and loss of privacy to serious physical harm and psychological damage.

Threat 14: Bullying

Vulnerabilities: Cyber bullying is a term used to describe repeated and purposeful acts of harm that are carried out using technology, particularly mobile phones and the Internet [7]. Based on research, it is apparent that reported instances of cyber bullying via SNSs are increasing.

Risks: Forms of cyber bullying that can be carried out on SNSs are flaming, harassment, denigration, impersonation, outing, trickery, exclusion, stalking and threatening behavior.

Threat 15: Corporate Espionage

Vulnerabilities: Social engineering attacks using SNSs are a growing but often underrated risk to corporate IT infrastructure. Social engineering is a means of attack frequently used by hackers to bypass security mechanisms and access sensitive enterprise data -not by using technology (although technology may be involved), but by using the employees themselves. Data is often acquired subtly and is gathered

gradually piece by piece. SNSs can be a particularly important tool in an organized social-engineering attack on an enterprise.

Risks: The main risk here is the loss of corporate intellectual property, but gaining access to insiders may also be a component in a broad range of other crimes, such as hacking corporate networks to cause damage, blackmailing of employees to reveal sensitive customer information and even to access physical assets.

3. Recommendations and Countermeasures

Some of the recommended strategies for circumventing the threats associated with the online social networks are described below:

Building self awareness about the information disclosure: Users need to be more conscious about the information they reveal through their personal profiles in online social networks. They also have to accurately maintain their profiles through periodical review and necessary modification of the profile contents to ensure appropriate disclosure of information [6].

Encouraging awareness-raising and educational campaigns: Government should initiate different educational and awareness-raising campaigns to inform the users to make the rational usage of the Social Networking Sites as well as to encourage the providers to develop and practice security conscious corporate policies.

Reviewing and reinterpreting the regulatory framework: The existing statutory law may need to be modified

or extended due to the introduction of some issues like the legal position of image tagging by the third person which are not addressed by the current version. As a result, the regulatory framework governing SNSs should be reviewed and revised as it requires.

Promoting stronger authentication and access-control where appropriate: The strength of authentication method varies from SNS to SNS. However, in order to avoid fake and troublesome memberships, the authentication mechanism needs to be further strengthened using additional authentication factors such as e-mail verification through Captchas.

Setting appropriate defaults: Since most of the users are not aware of the necessity for changing the default privacy preference [5], it is essential to set the default setting as safe as possible. The SNS service provider also needs to offer user-friendly guidelines that help the users to change the privacy settings successfully.

Providing suitable security tools: Providers also need to offer the following strategies for better user control on different privacy and security related issues:

- Tools that will allow the users to remove their accounts as well as edit their own posts on the other people's public notes or comment areas conveniently.
- Automated filtering tools for determining the legitimate contents.
- Tools for controlling the tagging of images depicting them.
- New privacy software such as visualization tools for increasing the

utilization of privacy options by providing clear representations of social networks, friend proximity, and availability of profile features.

4. Conclusion:

SNSs have clear benefits to society, not least because they discourage the end of passive media, but bring free interactive user-generated content to anyone with an Internet connection. Social Networking is fundamentally an Identity Management system. If used correctly, it can enhance data privacy over and above more established mechanisms. If not, however, it provides a dangerously powerful tool in the hands of spammers, immoral marketers and others who may take criminal advantage of users. Finally, this is a matter for governments as well as service providers and end-users. Legislation and policy is currently not equipped to deal with many of the challenges that social media present. Education policy should reflect the urgent need to educate both young and older users, students, teachers and parents on how to benefit from SNSs without suffering their downsides. Legislation should be reviewed and interpreted to fit the new paradigms with which we are faced.

References

- [1] Ellison, N. B., Steinfield, C., Lampe, C., (2007), *The Benefits of Facebook Friends, Social Capital and College Students' Use of Online Social Network Sites*, *Journal of Computer-Mediated Communication*, volume 12.
- [2] Gross, R., Sweeney, L., (2006), *Towards Real-world Face De-identification*, *IEEE Conference on Biometrics: Theory, Applications and Systems*.
- [3] Chen, Y., Roussev, V., Richard, G. III, Gao, Y., (2005). *Content-based Image Retrieval for Digital Forensics*, *Proceedings of the First International Conference on Digital Forensics (IFIP)*.
- [4] Grossman, J., *Whitehat Security*, (2006), *Cross-Site Scripting Worms And Viruses – The Impending Threat and the Best Defense*.
- [5] Mackay, W., (1991), *Triggers and Barriers to Customizing Software*, *Proceedings of CHI'91*, ACM Press, pages 153–160.
- [6] Acquisti, A., Gross, R., (2006), *Imagined Communities: Awareness, Information Sharing, and Privacy on the Facebook*, *Workshop on Privacy Enhancing Technologies (PET)*.
- [7] Willard, N., (2007), *Cyberbullying and Cyberthreats, Responding to the Challenge of Online Social Aggression, Threats, and Distress*, Research Press.



CULTURAL PLANNING AND SUSTAINABILITY: A THEORETICAL ANALYSIS

Bhatta, Kishan Datta*

Abstract

This paper tries to relate culture, urban form and sustainability and emphasize the significance of cultural planning in contemporary urban context. It is primarily based on relevant literature review. The author has tried to analyze the need of cultural planning to lead cities and towns towards sustainability.

Culture, Identity and Sustainable Urban Form:

Many anthropologists, scholars and others have defined culture in a number of ways. As per Anthropologist Edward B. Tylor, culture is the full range of learned human behavior patterns. Tylor (1871)¹ said that culture is "that complex whole which includes knowledge, belief, art, law, morals, custom, and any other capabilities and habits acquired by man as a member of society." Of course, it is not limited to men. Women possess and create it as well. However, UNESCO (2002)² defined "culture should be regarded as the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and it encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs". So, culture in its widest sense is about what matters to people and communities.

* Assistant Professor, Department of Architecture, Nepal Engineering College,

1. Referenced from Website, http://anthro.palomar.edu/culture/culture_1.htm,

2. UNESCO, Universal Declaration on Cultural Diversity (2002), Cited on Bega Valley Shire Council, Cultural Plan 2006-2011, Website: http://www.begavalley.nsw.gov.au/Community/social_plan/Final%20Cultural%20Plan.pdf,

Culture and identity are interrelated concepts. Many people believe culture is their identity and vice-versa. However, individuals' and people's identities are often explained in terms of nationality and this is a multi-faceted concept that encompasses attitudes, values, traditions, heritage and myths. Together, these factors bind individuals together and give them a sense of belonging as members of society so that they can appreciate their 'place in the contemporary world order'³. Identity cannot be directly observed and must be inferred from its many different forms of expression- culture, urban form and heritage are the important manifestations.

Urban form is the configuration and spatial characteristics of cities, their nature and density. Together the arrangement of these features within the urban landscape constitutes the three-dimensional elements of the city. Hence, urban form can be understood as the skin of the city and is that component of morphology that is most visible and that is capable of greatest transformation (Troy, 2004)⁴. As defined by Conzen (1968)⁵ urban form is a product of the street formation, land use, buildings, and the land subdivision (lots), while Caniggia and Maffei (2001)⁶ said that urban form

derives primarily from building types, which in turn generate the dimensions of lots and streets. Hence, the urban form, place and culture are interrelated. The places where collective and public cultural activity occur have an important and lasting influence-aesthetic, social, economic and symbolic-on the form and function of towns and cities (Graeme Evans:2001). Moreover, "Place and culture are persistently intertwined with one another, for any given place...is always a locus of dense human interrelationships (out of which culture in part grows), and culture is a phenomenon that tends to have intensely local characteristics thereby helping to differentiate places from one another" (Scott 2030;30)⁷.

Every society shapes a distinctive social space⁸. That space, and the discourses associated with it, is a vehicle for transmitting cultural values and for maintaining cultural identity from one generation to the next. There is a powerful link between places and memory⁹. On a personal level, people can become deeply attached to places in a way that is critical to their well-being. Whether such places are conserved, transformed or destroyed can be a crucial issue for the maintenance of their memories and sense

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3. Smith, A.D., (1991), *National Identity*, London: Penguin, p. 17, Cited on Joan Henderson(2001), *Heritage, Identity and Tourism in Hong Kong*, *International Journal of Heritage Studies*, vol. 7, No. 3, , pp. 219- 235.
 4. Cited in Gilleri Mike (2006), "The Challenge of Attaining a Sustainable Urban Morphology for South East Queensland," *Planning Practice & Research*, Vol. 21(3), pp. 291-308.
 5. Cited in Scheer, B. and Scheer D., (2002), *Towards a Sustainable Urban Form in Chiang Mai*,. Website: <http://staff.arch.utah.edu/scheer/ChiangMai.pdf>.
 6. Ibid.
 7. Cited in Graeme Evans (2001), *Cultural Planning; an Urban Renaissance ?* Routledge, London and New York.
 8. Lefebvre, H., *The Production of Space*, Cambridge: Blackwell, (1991), cited in Elizabeth Kenworthy Teather and Chun Shing Chow: *Identity and Place: the Testament of Designated Heritage in Hong Kong*, *International Journal of Heritage Studies*, Vol. 9, No. 2, pp. 93-115.
 9. Casey, E.S., (1987), *Remembering: a Phenomenological Study*, Bloomington: Indiana University Press; Halbwachs, M., (1987), *The Collective Memory*, New York: Harper & Row, cited in: Elizabeth Kenworthy Teather and Chun Shing Chow: *Identity and Place: the Testament of Designated Heritage in Hong Kong* *International Journal of Heritage Studies*, Vol. 9, No. 2, pp. 93-115.

of identity¹⁰. At the level of the group, certain places are significant because they trigger social memory.

Hayden calls such places 'storehouses of memory' and argues that public policies are needed to designate and conserve them in the interests of protecting social memory for the benefit of present and future generations¹¹.

Indeed, sustainable urban form is one that can adapt well to the requirements of growth and change without destroying natural resources and traditional culture in the process.

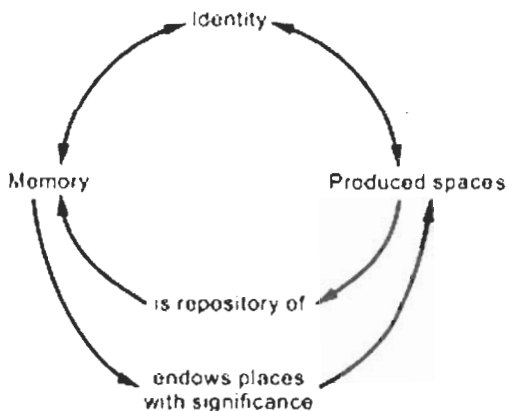


Fig: 1, Relationship between Place, Identity and Memory. (Teather and Chow: 2003)

It is established that there is not a single model of sustainable urban form that is applicable in all situations (Guy and Marvin, 2000)¹² and the different urban

forms may have different degrees of sustainability (Frey 1999, Jenks et.al. 1996)¹³. In fact, there is some controversy regarding even the simplest assumptions about sustainable form, but there are some widely accepted principles of sustainable urban form that might serve as criteria for evaluating particular urban form alternatives. According to Brenda Scheer and David Scheer (2002) the sustainability in the urban form can be achieved if we: (a) create and preserve higher density, compact forms, (b) preserve the urban region's agricultural land, water systems, recreational areas, and fragile ecologies, (c) provide a mix of land uses, (d) preserve the existing built form, (e) provide open spaces, (f) encourage moderate parcel sizes, (g) limit buildings to a moderate size and (h) provide a mix of building types, sizes and ages etc.

The conservation of cultural identity is one of the major approaches to head towards the sustainability in the urban areas. In the course of rapid modernization and development, cities are losing authentic identities of their culture and urban form. So, urban conservation is the fundamental approach for sustainable urban form as it acknowledges the cultural built heritages as a resource for both current and future generations.

10. Marris, P., (1986), *Loss and Change*, London: Routledge & Kegan Paul; Nora, P., (1989), 'Between Memory and History: *Les Lieux de M'emoire*', *Representations*, Vol. 26, pp. 7-25, cited in Elizabeth Kenworthy Teather and Chun Shing Chow: *Identity and Place: the Testament of Designated Heritage in Hong Kong* International Journal of Heritage Studies, Vol. 9, No. 2, pp. 93-115

11. Hayden, D., (1995), *The Power of Place*, Cambridge, MA: MIT Press, pp. 5, 9, cited in Elizabeth Kenworthy Teather and Chun Shing Chow: *Identity and Place: The Testament of Designated Heritage in Hong Kong*, International Journal of Heritage Studies, Vol. 9, No. 2, pp. 93-115.

12. Cited in Scheer, B. and Scheer, David, (2002), *Towards a Sustainable Urban Form in Chiang Mai*, published in Romanos Michael and Auffrey (ed. 2002), *Managing the Development of Intermediate Size Cities*, Kluwer Academic Publishing.

13. Ibid.

Hence, we can argue that the culture, place and urban form are the significant factors to recall memories and create sense of belonging and support to maintain the image of the city as a cultural city. So, the local characters, urban patterns, urban forms and culture are the resources for present as well as future generations and their conservation and continuity may enhance the sustainability of cities.

Cultural Planning and Sustainable Development

Cultural Industries are defined as those industries which produce tangible or intangible artistic and creative outputs, and which have a potential for wealth creation and income generation through the exploitation of cultural assets and production of knowledge-based goods and services (both traditional and contemporary)¹⁴. Cultural industries use creativity, cultural knowledge, and intellectual property to produce products and services with social and cultural meaning. They include advertising, architecture, crafts, designer furniture, fashion clothing, film, video and other audiovisual production, graphic design, educational and leisure software, live and recorded music, performing arts and entertainment, television, radio and internet broadcasting, visual arts and antiques, and writing and publishing (ibid).

The term "cultural industries" is almost interchangeable with the concept of

"creative industries." Whereas the notion of "cultural industries" emphasizes those industries whose inspiration derives from heritage, traditional knowledge, and the artistic elements of creativity, the notion of "creative industries" places emphasis on the individual and his or her creativity, innovation, skill and talent in the exploitation of intellectual property (ibid). Many cities have emphasized cultural industries as the backbone of economic development and prioritized as one of the major concern of cultural planning.

The term cultural planning is relatively new, emerging out of Europe in the 1960s and 1970s as cities and towns faced changing economies and demographics. Today, communities around the world are actively engaged in cultural planning and nurturing cultural development¹⁵. Cultural Planning is about the relationships, shared memories, experiences, identity, history and a sense of place¹⁶. It is a process of inclusive community consultation and decision making that helps all the stakeholders identify cultural resources and think strategically about how these resources can help a community to achieve civic goals. Hence, it is a strategic approach that directly and indirectly integrates the community's cultural resources into a wide range of planning activities and it is our way of connecting the present with the past and the future, and a way of looking at all aspects of a community's cultural life as community assets¹⁷.

14. UNESCO: Backgrounder on Cultural Industries, Website: http://www.unescobkk.org/fileadmin/user_upload/culture/Cultural_Industries/HK_Open_Forum/Backgrounder-FINAL.pdf.

15. Quoted from Cultural Planning Toolkit: A Partnership between 2010 Legacies Now and Creative City Network of Canada, Website: <http://creativecity.ca/toolkits/downloads/Cultural-Planning-Toolkit.pdf>.

16. Referenced from NSW Ministry For the Art and Department of Local Government, Cultural Planning Guidelines For Local Government,, Website: <http://www.dlg.nsw.gov.au/dlg/dlghome/documents/information/CPG-final.pdf>.

17. Ibid.

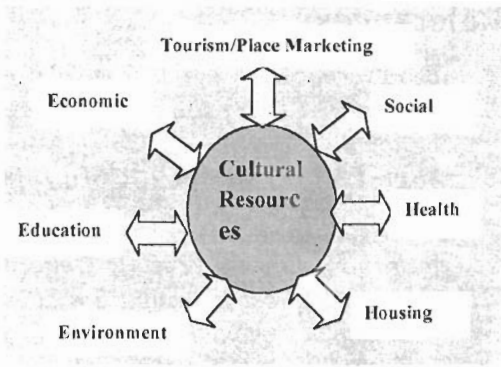


Fig: 2, Cultural resources and policy interaction,
Source: Franco Bianchini (2004)

It is a cultural sensitive approach to policy and planning-not just for urban planning but for every type of public policy¹⁸. According to Colin Mercer it is 'the strategic and integral planning and the use of cultural resources in urban and community development'. So, strategic and integral means that it is actually not appended as a kind of after-talk to an urban policy, but it is integrating cultural policy with other policy processes in an organic way and it is strategic in the sense that it is part of a larger strategy¹⁹. So, what cultural planning does, is to relate cultural resources through a process of two-way interaction to policy and establishing these two-way relationships between the tool of cultural resources existing in a place and tourism, economic policy, educational policy, environmental policy, social and health policy and so on (ibid).

Hence, cultural planning has to be part of a larger strategy for urban and community development. It has to make connections with physical and town

planning, with economic and industrial development objectives, with social justice initiatives, with recreational planning, with housing and public works. So, the cultural planners must make connections between their own interests and activities and the other agencies responsible for planning and development. Cultural planning cannot come after the fact and cannot be added on. So, "cultural planners must persuade other types of planners that what is being planned in cultural planning, are the lifestyles, the texture and quality of life, the fundamental daily routines and structures of living, shopping, working, playing - *folk, work, place*. Not just streets and buildings but conjunctions of habit, desire, accident and necessity - *folk, work, place*". (Colin Mercer: 2006)

Achieving sustainability and sustainable development has become the most important goals of many cities and towns. Brundlant Commission has defined "Sustainable development as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It has been also defined by several scholars and institutions as a process of achieving economic, social and environmental sustainability in the development, where community participation is considered as the fundamental approach to achieve its goals. The fundamental presumption of Agenda 21 has also emphasized "sustainable development is only possible if it is built by, through and with the

18. Referenced from Bianchini Franco (2004), Cultural Planning in Post- industrial Societies, published in Cultural Planning, a report from conference at Center of Urbanism, The Royal Danish Academy of Fine Arts, School of Architecture

19. Ibid.

commitment of local communities" (Magnoli 2002)²⁰. Hence, the local government, organizations and community have a crucial role to plan, implement and address the local issues of culture, identity, economy and built form within the planning and development process.

In a fast globalizing and changing world, the need of cultural planning to preserve cultural identity, heritage and urban form and achieve urban sustainability is imminent. In this context, all the development works and planning attempt should realize and emphasize the importance of local culture, identity and urban form in the long term and short term plans, which will eventually enhance to achieve sustainability.

Conclusion:

Cities are known as the source of collective memory of people²¹ and memory is the basis of self identity²². The local characters, culture and urban form of the towns are the living memory of the people which are considered as very essential elements in cultural planning to achieve urban sustainability. Hence, their conservation and continuity may lead to sustainable development. The sense of place, cultural identity and urban form need to be preserved and its spirit should be maintained by giving the continuity of the space, urban form and authentic characters.

References:

1. Bega Valley Shire Council, Cultural Plan 2006-2011, Website: http://www.begavalley.nsw.gov.au/Community/social_plan/Final%20Cultural%20Plan.pdf.
2. Bianchini, Franco (2004), Cultural Planning in Post Industrial Societies, published in Cultural Planning, a report from conference at Center of Urbanism, The Royal Danish Academy of Fine Arts, School of Architecture. Website: http://www.karch.dk/forskning/centre/cbp/Cultural_Planning_2004.pdf.
3. Bosselmann, P, (2002), "Transformations and City Extensions: Some Observations of Copenhagen's City Form at a Time of Global Change," *Journal of Urban Design*, Vol. 7(1), pp. 75-97.
4. Centre for Cultural Policy Research, HKU, (2003), Base Line Study on Hong Kong's Creative Industries, Prepared for the Central Policy Unit HKSAR, website: http://ccpr.hku.hk/Baseline_Study_on_HK_Creative_Industries-eng.pdf.
5. Chui Hau Man, Melody and Tsoi Tan Mei, Agnes (2003), Heritage preservation, Hong Kong and Overseas Experiences, The Conservancy Association, Website: http://www.conservancy.org.hk/heritage/Heritage_Report_eng.pdf.
6. Colin Mercer (2006), Cultural Planning For Urban Development and Creative Cities, Website: <http://www.culturalplanning-oresund.net/>

20. Cited in Sharif Shams Imon, (2006), "Sustainable Urban Conservation: The Role of Public Participation in the Conservation of Urban Heritage in Old Dhaka", PhD Thesis, HKU.

21. Rossi, Aldo, (1982), *The Architecture of the City*, MIT: The Institute for Architect and Urban Studies, p.130, cited in Ho, Betty (2000), *Achieving Heritage Conservation in Sustainable Development; Transfer of Development Rights as a Sustainable Solution*.

22. Lynch, Kevin, (1972), *What Time Is This Place?* MIT Press, p.124. cited in Ho, Betty, (2000), *Achieving Heritage Conservation in Sustainable Development ; Transfer of Development Rights as a Sustainable Solution*.

- P D F _ a c t i v i t i e s / m a j 0 6 / Shanghai_cultural_planning_paper.pdf.
7. Cultural Planning Toolkit: A Partnership Between 2010 Legacies Now and Creative City Network of Canada, Website: <http://creativecommons.ca/toolkits/downloads/Cultural-Planning-Toolkit.pdf>.
 8. District Highlights, Yau Tsim Mong District, Website: <http://www.districtcouncils.gov.hk/ytm/english/welcome.htm>.
 9. Teather, Elizabeth Kenworthy and Chun Shing Chow, (2003): Identity and Place: the Testament of Designated Heritage in Hong Kong, *International Journal of Heritage Studies*, Vol. 9, No. 2, pp. 93–115.
 10. Edson, Gary, (2004), Heritage: Pride or Passion, Product or Service?, *International Journal of Heritage Studies* Vol. 10, No. 4, pp. 333–348
 11. Gibson, L. & Stevenson, D., (2004), "Urban Space and the Uses of Culture," *International Journal of Cultural Policy*, Vol. 10(1), pp. 1-4.
 12. Evans, Graeme, (2001), *Cultural Planning; an Urban Renaissance?*, Routledge, London and New York.
 13. Henderson, Joan, (2001), Heritage, Identity and Tourism in Hong Kong, *International Journal of Heritage Studies*, Vol. 7, No. 3, pp. 219-235.
 14. HK 2030 Working Paper No. 20, Arts and Cultural development, Website: http://www.hk2030.gov.hk/eng/wpapers/pdf/workingPaper_20.pdf.
 15. Ho, Betty, (2000), Achieving Heritage Conservation in Sustainable Development; Transfer of Development Rights as a Sustainable Solution, Website: <http://www.conservancy.org.hk/articles/docs/20000510e.pdf>.
 16. Hong Kong General Chamber of Commerce (2003), Developing Hong Kong's Creative Industries-An Action Oriented Strategy, Website: http://www.chamber.org.hk/memberarea/chamber_view/others/Creative_industries.pdf.
 17. Keating, M. and de Frantz, M., (2003), "Culture-led Strategies for Urban Regeneration: a Comparative Perspective on Bilbao," *International Journal of Iberian Studies*, Vol. 16, No. 3, pp. 187-194.
 18. Lai Wai-tin Belinda, (2006), A Study of the Policy on the Performing Arts in Hong Kong: Is the West Kowloon Cultural District Project a Solution?, Thesis, Master of Public Administration, HKU.
 19. Lung, D., (1999), "In Search for Soul, Memory and Identity: Heritage in Hong Kong's Urban Development", *Planning & Development*, Vol. 15, No. 1.
 20. Marta de la Torre (ed), (2002), *Assessing the Values of Cultural Heritage*, Research Report, the Getty Conservation Institute, Los Angeles. Website: http://www.getty.edu/conservation/publications/pdf_publications/assessing.pdf.
 21. Mills, Deborah, (2003), Cultural Planning-Policy Task, not Tool, *Artwork Magazine-Issue 55*, Website: http://www.ccd.net/pdf/art55_cultural_planning.pdf.
 22. NSW Ministry For the Art and Department of Local Government, *Cultural Planning Guidelines For Local Government*, Website: <http://www.dlg.nsw.gov.au/dlg/dlghome/documents/information/CPG->

- final.pdf.
23. Scheer, Brenda and Scheer, David, (2002), *Towards a Sustainable Urban Form in Chiang Mai*, Website: <http://staff.arch.utah.edu/scheer/ChiangMai.pdf>.
24. Sharif Shams Imon (2006), "Sustainable Urban Conservation: The Role of Public Participation in the Conservation of Urban Heritage in Old Dhaka", PhD Thesis, HKU.
25. The Conservancy Association, (2003), *Heritage For the People*, Position Paper by the Conservancy Association, Website: http://www.conservancy.org.hk/heritage/Herit_posE.pdf.
26. UNESCO, *Backgrounder on Cultural Industries*, Website: http://www.unescobkk.org/fileadmin/user_upload/culture/Cultural_Industries/HK_Open_Forum/Backgrounder-FINAL.pdf.
27. Website, http://anthro.palomar.edu/culture/culture_1.htm.
28. Websites: http://www.discoverhongkong.com/eng/attraction/hkwalks/pdf/yau_ma_tei.pdf.
29. Websites: http://www.hkta.org/eng/attraction/hkwalks/ta_walk_walk2.jhtml.



EULER'S APPROXIMATION FOR THE SOLUTION OF THE FIRST ORDER DIFFERENTIAL EQUATION:

Toya Narayan Paudel*

In this article an attempt has been made to find an approximate particular solution of a given first order differential equation by using Euler's method. In fact Euler's method is a procedure used to construct a numerical approximation for the solution curve of first

order differential equation $\frac{dy}{dx} = f(x, y)$ such that the solution (or integral) curve satisfies some initial condition. This method is based on the use of the linear approximation method derived from differential calculus.

We know that the slope of the tangent to the curve $y = f(x)$ is given by

$$f'(x) = \lim_{h \rightarrow 0} \left[\frac{f(x+h) - f(x)}{h} \right].$$

For small h we may approximate

$$f'(x) \cong \frac{f(x+h) - f(x)}{h}$$

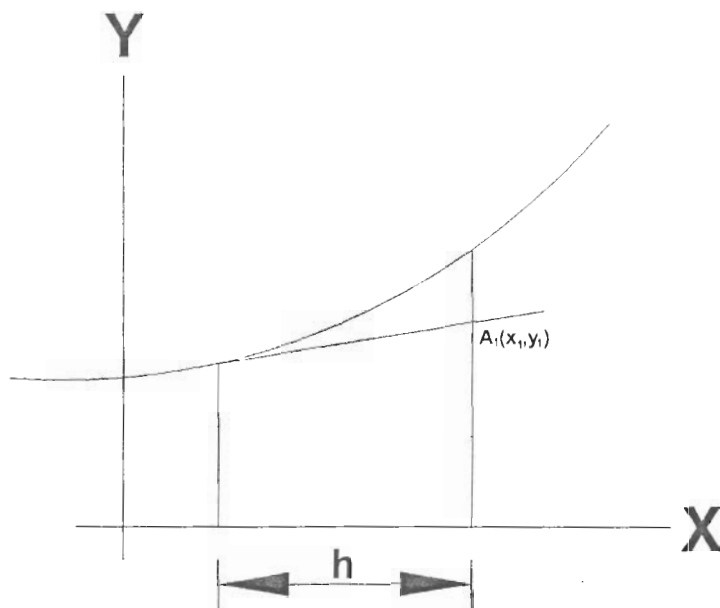
$$\Rightarrow f(x+h) \cong f(x) + h \times f'(x) \dots \dots (1)$$

This is the approximate value of y for corresponding value of $x + h$.

Let $A(x_0, y_0)$ lie on the solution curve and B is another point on the curve having x coordinate of B as $x + h$.

From the diagram, y coordinate of point B is given by $f(x + h)$ and that of C by $f(x) + hf'(x)$, where the point C is on the tangent line of the curve at the point $A(x, y)$ or $(x, f(x))$. Here equation (1) gives the approximate value of y coordinate of B. It is needless to mention that the smaller the value of h , the closer will be the C to the point B. That is for smaller h , we can find better approximation of y coordinate of B.

We try to see how this works by making use of only the derivative function and an initial point that is known to lie on the integral curve (i.e. solution curve).



We now explain Euler's method in detail:

Let $A_0(x_0, y_0)$ be the starting point on the integral curve of $\frac{dy}{dx} = f(x, y)$. Then slope of the tangent at $A_0(x_0, y_0)$ will be $m_0 = f(x_0, y_0)$. The equation of the tangent at A_0 will be $y - y_0 = f(x_0, y_0)(x - x_0)$.

On this tangent line let $A_1(x_1, y_1)$ be a point with $x_1 = x_0 + h$. Then

$$y_1 - y_0 = f(x_0, y_0)(x_1 - x_0)$$

$\Rightarrow y_1 = y_0 + h \times f(x_0, y_0)$, which is approximate value of y_1 for $x = x_1$.



We draw line through $A_1(x_1, y_1)$ whose slope is $m_1 = f(x_1, y_1)$.

Its equation will be $y - y_1 = f(x_1, y_1)(x - x_1)$.

We take $A_2(x_2, y_2)$ on the line through A_1 with $x_2 = x_1 + h$.

Then as above $y_2 = y_1 + f(x_1, y_1)(x - x_1)$.

$\Rightarrow y_2 = y_1 + h \times f(x_1, y_1)$, which is approximation of y at x_3 .

A line will be drawn through $A_2(x_2, y_2)$ as above and $A_3(x_3, y_3)$ can be determined.

Repeatedly using the above method a sequence of coordinates (x_n, y_n) can be obtained

with $x_{n+1} = x_n + h$ and $y_{n+1} = y_n + h \times f(x_n, y_n)$



Let us consider a simple example $\frac{dy}{dx} = \frac{x}{2} + 1$ (2) , it being given that the solution curve passes through the point (2 ,3) and want to find an approximate value for f (x) at x = 2.1.

Using linear approximation formula $f(x+h) \cong f(x) + h \times f'(x)$, we get

$$f(2.1) = f(2+0.1) \cong f(2) + 0.1 \times f'(2) = 3.2 \dots (3)$$

where $h=0.1$, $f(2)=3$ and $f'(2) = \frac{1}{2} \times 2 + 1 = 2$

From equation (2), by integrating, we get $y = \frac{x^2}{4} + x + c$, where c is an integrating constant. As the curve passes through $(2, 3)$, we get $c = 0$. Thus we get the actual relation between y and x , $y = \frac{x^2}{4} + x \dots (4)$.

From equation (3) and (4) our approximation of y which was 3.2 turns out to be acceptable.

For the same problem (2) if we need the approximate value of y corresponding to $x=3$, we would have $f(3) = f(2+1) = 3 + 1 \times 2 = 5$ [for $x=2$, $h=1$].

The actual value of y from equation (4), $y = 5.25$, which is not as good an approximation as the previous approximation.

This makes clear the importance of taking smaller h to get better approximation value of y . To get better approximation rather than using $h=1$ in getting $x=2$ to $x=3$. We make use of 10 smaller steps getting us from $x=2$ to 2.1 to $x=2.2$ to $x=2.3$, ..., $x=2.9$ to $x=3$. We now show how the first couple of steps would work.

We have already found $f(2.1) \cong 3.2$.

Next to determine $f(2.2)$, we use $f(2.2) = f(2.1) + 0.1 f'(2.1)$

$$\begin{aligned} &= 3.2 + 0.1 \times \left[\frac{1}{2} \times 2.1 + 1 \right] \\ &\cong 3.405 \end{aligned}$$

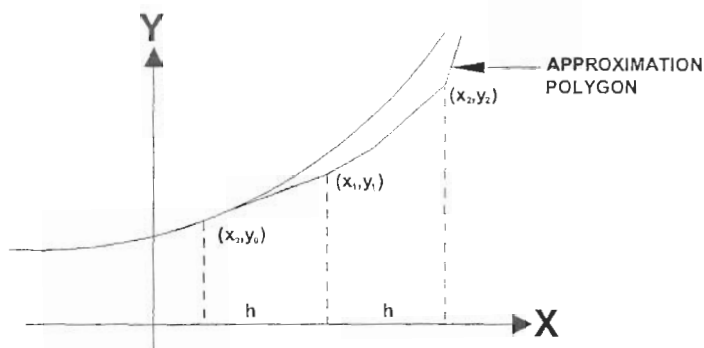
Using the approximate value of $f(2.1)$, we similarly find that $f(2.3) = 3.615$

We generate an iterative process and get the better approximate value of y for the corresponding value of $x=3$.

Before proceeding to another example we provide a summary of what is needed to obtain an approximation.

Suppose the given differential equation $\frac{dy}{dx} = f(x, y)$, with an initial value $A_0(x_0, y_0)$ on the solution curve.

It is important to recognize this fact that if solution of the given differential equation might not be possible our only recourse is to obtain find an approximate solution using numerical methods.



Example:

Find an approximate value of y at $x = 5$ given that $\frac{dy}{dx} = \sqrt{1+xy} = f(x, y)$ and that the curve passes through the point $(4.5, 1)$.

Solution: Here $(x_0, y_0) = (4.5, 1)$. We use a step of 0.1 [that is $h = 0.1$], in the recursive equation $y_{n+1} = y_n + hf(x_n, y_n)$, where $f(x, y) = \sqrt{1+xy}$.

Then, $y_1 = y_0 + h \times f(x_0, y_0) = 1 + 0.1 \times \sqrt{4.5 \times 1 + 1} = 1.2345$

Next $y_2 = y_1 + 0.1 \times \sqrt{4.6 \times 1.2345 + 1} = 1.4929$ [$\because x_1 = 4.6$]

$y_3 = y_2 + hf(x_2, y_2) \cong 1.4929 + 0.1 \times \sqrt{4.7 \times 1.4929 + 1} \cong 1.7760$

Proceeding in this way we get, $y_4 = 2.0846$, $y_5 = 2.4195$ and $y_6 = 2.7780$.

That is approximation solution at $x = 5$ [i.e. approximate value of y for $x = 5$] is 2.7780.

Conclusion:

Even if the first order differential equation cannot be solved, by using Euler's Approximation method one can find the value of dependent variable corresponding to a given value of independent variable, it being assumed that the solution curve passes through a fixed given point.

References:

1. Chapra, Steven C., Canale, Raymond P., Numerical Methods for Engineers (with Programming and Software Application), New Delhi, Tata McGraw-Hill Publishing Company Limited.
2. Swokowski, Earl W., (1991), Calculus, 5th edition, Boston, PWS Kent Publishing Company.
3. Thomas / Finney, (1998), Calculus and Analytical Geometry, Sixth edition, New Delhi, Narosa Publishing House.
4. Kreyszig, Erwin, (1999), Advance Engineering Mathematics, 8th edition: New York, John Wiley & Sons, Inc.

ESTABLISHMENT OF A MODEL TO DETERMINE THE CONCENTRATION OF PROTEIN, FAT AND TOTAL SOLID IN RAW MILK BY USING FOURIER TRANSFORM INFRARED (FTIR) SPECTROMETRY

Sulochana Pradhan*

Abstract

The attenuated total reflectance spectroscopy in MIR was a rapid method for quantitative determination of protein, fat and total solid in raw milk. A partial least squares (PLS) algorithms was used to perform the calibration. To decide upon the number of PLS factors included in the PLS model, the model with the lowest root mean square error of calibration (RMSEC) was chosen. The correlation coefficient (r) between predicted and the actual value was used as a evaluation parameter for the model: for protein, $r = 0.93$; for fat, $r = 0.96$ and for total solid, $r = 0.98$. The mean difference (MD) between predicted and the actual values and standard deviation of mean differences (SDD) were 0.05 (0.05), 0.06 (0.07) and 0.06 (0.04), being standard deviation of mean differences values between brackets, for protein, fat and total solid.

Key words: mid-infrared, raw milk, attenuated total reflectance, fourier transform infrared .

* Assistan Professor, Department of Science and Humanities, Nepal Engineering College.

Abbreviation Keys: ATR = Attenuated Total Reflectance, FTIR = Fourier Transform Infrared, IR = Infrared, MIR = Mid Infrared

Introduction:

Milk is a complex fluid and complete nutritional food for new born secreted by mammary glands. Additional sources of milk for humans are cow, buffalo, sheep, and camel etc[1]. The main chemical components of milk are water (85.5-88.7%, w/w), fat (2.4-5.5%, w/w), protein (2.3-4.4%, w/w), lactose (3.8-5.3%, w/w), minerals (0.53-0.8%, w/w) and organic acids (0.18-0.22%, w/w)[6]. The determination of protein and fat content in the raw milk is of great interest for the processing of milk into dairy product because the composition of milk is essential from the view point of quality control[9].

The reference methods such as Kjeldahl nitrogen analysis for protein and Rose-Gottlieb for fat being expensive and too time consuming are replaced by spectroscopic techniques for the rapid mass analysis in industries and quality control laboratory in order to save cost and effort [8].

Most of the infrared methods are based on filter-instruments. Fat, protein and lactose in milk were predicted from the complete mid – IR spectrum in the wave number range from 3000 to 1000 cm^{-1} after excluding the water absorption band around 1660 cm^{-1} [5]. The original application of IR in milk analysis was based on transmission spectroscopy in which the previous works on FTIR milk analysis were based and spectral information were acquired by transmission measurements using CaF_2 cell of 37 μm

or 40 μm and 0.05mm path length. Different calibration techniques such as classical and inverse least square (CLS and ILS) analysis, partial least square (PLS) and principal component analysis were applied [3, 4, 5].

The success of mid IR for determination of fat, protein and lactose opened the way to measure casein contents in milk without sample preparation. The rapid, direct measurement of casein in the raw milk had been studied involving FTIR spectrometry combined with partial least square (PLS) and principal component analysis for calibration and quantification [3].

The application of quantities MIR spectroscopy to milk analysis has developed into a Standard AOAC method in 1997, which includes determination of fat, protein, lactose and, in some cases total solids and solid not fat in mid IR range from 4000 to 400 cm^{-1} which were clearly mentioned for direct measurement of specific constituents in the sample and their characteristic molecular structure. This MIR range can be acquired at high resolution within a few seconds. This high speed allows the scanning of a large number of spectra within a short time in order to achieve an improved signal to noise ratio [2].

MIR spectroscopy is a technique that needs reference measurement to perform the calibration experiment during the method development. This involves the collection of a set of references or calibration samples in which all the physical and chemical variations are expected in unknown raw samples. The main component concentration of these unknown samples are predicted later with

the help of respective IR spectra. The aim of this calibration experiment is to establish a multiple regression between IR spectra data and chemical parameter or reference value of analyzed sample set [10].

The multivariate models are set up by using the partial least square (PLS) regression and are based on two data sets (of the same objects), the reference values and the spectra. The purpose of PLS algorithms is to establish a model that allows the analysis of unknown samples. That means one can get a prediction of required results of reference parameters based on the MIR spectrum of unknown samples. The goal of this study was to establish the model using Fourier transform infrared /attenuated total reflectance (ATR) spectroscopy in the mid infrared range to predict protein, fat and total solid in raw milk.

Materials and Methods:

Sampling:

Fifty-two fresh raw tank milk samples were collected from Junyao Group, Wuxi Dairy Co. Limited, Wuxi. All samples were preserved with formaldehyde (2drops per 30 ml of raw milk) and kept at 4°C before analysis. All the chemical reagents used were analytical reagent (AR) grade.

Reference Analysis:

The protein reference values of all samples determined by Kjeldahl method, the fat reference values of all samples determined by Rose-Gottlieb method and the total solid reference values of all samples determined by Hot air oven method was based on the Official Method of Analysis of AOAC International method (AOAC,1997).

Single analysis was carried out with duplicate analysis for all samples to determine the repeatability and 95% confidence limits of the method. The concentration of protein, fat and total solid were expressed on percentage (w/w) basis.

FTIR analysis:

Samples were warmed up to about $39 \pm 1^\circ\text{C}$ in a water bath to make it homogenous, shaken gently at intervals to prevent over-heating and the sample bottles were loosely stoppered to reduce evaporation. After cooling the samples at room temperature, the spectra were scanned between 4000 to 400 cm^{-1} by averaging 64 scans for each spectrum with a resolution 4cm^{-1} on a Nicolet Nexus 470 FTIR spectrometer, controlled by OMNIC for windows software from thermo electron corporation (Madison, WI, USA) equipped with a smart OMNI sampler. The reference or background spectra of pure water also consisted of the same number of scans, resolution and interval as the sample spectra. The background spectra of the pure water was recorded once for every sample at the beginning with the identical condition. The amount used to collect the spectra of sample and pure water was 0.5 ml. The tissue papers were used for wiping and a smart OMNIC sampler was cleaned by pure water to prevent the contamination from other samples.

Calibration and Quantification :

(a) For protein:

A total set of 52 samples were selected, with 38 assigned for use as a calibration set for method development and 14 assigned for as a validation set for the method performance. Then the PLS

calibration was performed and four samples of validation set were rejected as outliers. The recalibration was done with the rest using variance scaling technique.

(b) For fat:

A total set of 18 samples were selected, with 12 assigned for use as a calibration set for method development and 6 assigned for as a validation set for the method performance. Then the PLS calibration was performed and one sample of validation set was rejected as outlier. The recalibration was done with the rest using variance scaling technique.

(c) For total solid:

A total set of 38 samples were selected, with 28 assigned for use as a calibration set for method development and 10 assigned for as a validation set for the method performance. Then the PLS calibration was performed. Then 2 samples of calibration set were rejected and six samples of validation set were rejected as outliers. The recalibration was done with the rest using variance scaling technique.

Result and discussion:

The attenuated total reflectance in the mid infrared range 4000 to 400 cm^{-1} is especially attractive for direct measurement of specific constituents in the raw cow milk and their characteristic molecular structure. The characteristic absorbance of milk protein includes the amide I and amide II bands ranging from 1500 to 1700 cm^{-1} and the absorbance in the 1060 to 1100 cm^{-1} range is associated with phosphate groups covalently bound to casein protein. Since the strong water band

around 1640 cm^{-1} overlaps with amide I and amide II, the optimized automated procedure for accurate water subtraction was applied. On analyzing the spectra of standard raw milk by simple band integration, partial least square (PLS) and neural network, the PLS result was found to have prediction error of about 0.22% for protein [2].

The band for milk protein was ascribed to amide I band ($\text{C}=\text{O}$ stretching) which appears at 1670 to 1630 cm^{-1} . This band is blocked by strong absorption of water. So the amide II band was appeared at 1544 cm^{-1} [5]. The spectral regions from 2877 to 2827 cm^{-1} and 1782 to 1705 cm^{-1} for fat and the spectral region from 1701 to 1507 cm^{-1} for protein were selected on the study of nutritional parameter of commercially available milk samples [7].

AOAC criteria for analysis of protein and fat in milk has been mentioned as mean difference between instrument estimates and values by reference methods equal or lower than 0.05%, w/w and standard deviation of mean difference between instrument estimates and values by reference methods equal or lower than 0.06%, w/w [8].

In the determination of casein in raw milk, the sample spectra were divided by water as background and the resolution used for acquisition was 4 cm^{-1} . The wave number range included in calibration set was 3000 - 1000 cm^{-1} . The PLS was applied in order to make casein model in which the correlation coefficient ($r = 0.976$) was reported [3].

In this study, a good correlation was observed with the amide II band (1550 cm^{-1}) in the PLS model of protein. The

correlation coefficient between actual and calculated values was found to be 0.93. The PLS regression yielded a nine factor model for protein giving a root mean square error of calibration (RMSEC) of 0.05 for calibration set. The mean difference (MD) and standard deviation of mean difference (SDD) predicted by FTIR in this model was found to be 0.05 and 0.05 (Fig. 1).

The mean difference (MD) and standard deviation of mean difference (SDD) for fat in the study of commercially available milk sample predicted by PLS-ATR-FTIR were reported as 0.06 and 0.38 [7].

In this study, the C=O stretching region (1746 cm^{-1}) was present in the PLS fat model. The correlation coefficient between actual and calculated values was found to be 0.96 for fat. The PLS regression yielded a seven-factor model for fat giving a root mean square error of calibration (RMSEC) of 0.05 for calibration set. The mean difference and standard deviation of difference predicted by FTIR in this model was found to be 0.06 and 0.07 (Fig. 2)

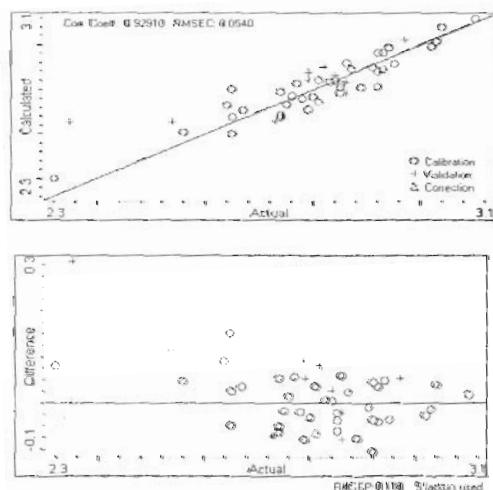


Fig. 1. Plots of (top) calculated versus Kjeldahl protein content using a 9 factors PLS model and (bottom) difference (reference minus calculated) versus reference protein content.

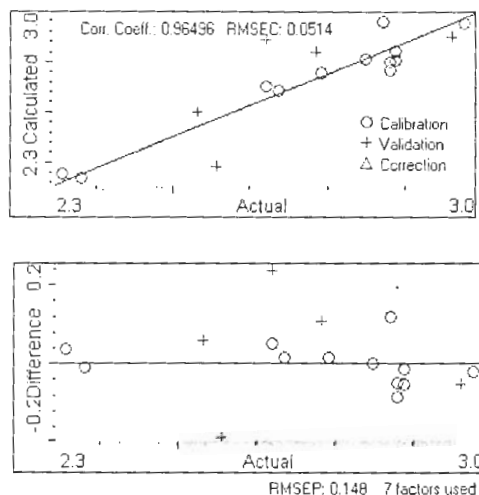


Fig. 2. Plot of (top) calculated versus Rose-Gottlieb fat content using a 7 factor PLS model and (bottom) difference (reference minus calculated) versus reference fat content.

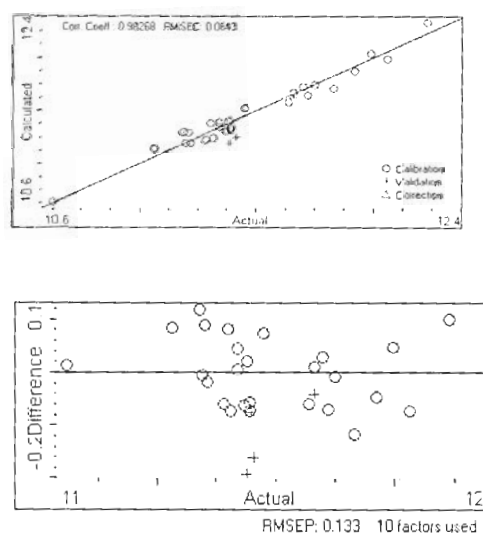


Fig. 3. Plots of (top) calculated versus hot air oven total solid content using a 10 factors PLS model and (bottom) difference (reference minus calculated) versus reference total solid content.

Similarly AOAC criteria for analysis of total solid in milk has been mentioned as mean difference between instrument estimates and values by reference methods equal or lower than 0.09%, w/w and standard

deviation of mean difference between instrument estimates and values by reference methods equal to or lower than 0.12%,w/w [8].

In this study, the wave number range from 3000 to 900 cm^{-1} were included in the PLS total solid model to predict protein, fat and lactose as a total solid. The correlation coefficient between actual and calculated values was founded to be 0.98 for total solid. The PLS regression yielded a ten-factor model for total solid giving an root mean square error of calibration (RMSEC) of 0.06 for calibration set. The mean difference (MD) and mean deviation of mean difference by FTIR in this model was found to be 0.06 and 0.04 (Fig. 3).

Conclusion:

The PLS-regression is a promising method for predicting the principal components of raw milk. The protein content can be predicted well ($r > 0.90$) with performance index value > 90.0 . The mean difference of protein was found to be 0.05 ± 0.05 (protein value by Kjeldahl method 2.80 ± 0.15 versus protein value by FTIR method 2.82 ± 0.13). The fat content can be predicted well ($r > 0.90$) with performance index value > 90.0 . The mean difference of fat was found to be 0.06 ± 0.07 (fat value by Rose-Gottlieb method 2.72 ± 0.19 versus fat value by FTIR method 2.73 ± 0.20). The total solid (TS) content can be predicted well ($r > 0.90$) with performance index value > 80.0 . The mean difference of total solid was found to be 0.06 ± 0.04 (TS value by Hot air oven method 11.44 ± 0.30 versus TS value by FTIR method 11.46 ± 0.33).

Different aspects of prediction of three major parameters (protein, fat and total solid contents) by ATR /FTIR spectroscopy have been discussed in the present study. The ATR, being less affected by presence of water, has the advantage over the transmission spectroscopy. Thus it provides a good signal to noise ratio in large range of wave numbers on using water as a background. The performance of the calibration approach for all parameters presented here can be implemented for routine analysis of raw cow milk samples.

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Reference

1. Eckles, C.H., Combs, W.B., Macy, H., (1957), *Milk and Milk Products*, 4th edition, Mcgraw-hill book company.
2. Etzion, Y., Linker, R., Cogan, U., and Shmulevich, I., (2004), *Determination of Protein Concentration in Raw Milk by Mid Infrared Fourier Transform Infrared/ Attenuated Total Reflectance Spectroscopy*, *J. Dairy Sci.*, 87: 2779-2788.
3. Hewavitharana, A. K., and Brakel, B. V., (1997), *Fourier Transform Infrared*

- Spectrometric Method for Rapid Determination of Casein in Raw Milk, *Analyst* 122: 701-704.
4. Luginbuhl, W., (2002), Evaluation of Designed Calibration Samples for Casein Calibration in Fourier Transform Infrared Analysis of Milk, *Lebensm.-wiss.u.-technol.*, 35: 554-558 (2002).
5. Luinge, H. J., Hop, E., Lutz, E. T. G., van Hemert, J. A., and de Jong, E. A. M., (1993), Determination of the Fat, Protein and Lactose Content of Milk Using Fourier Transform Infrared Spectrometry, *Analytica chimica Acta*, 284: 419-433.
6. Walstra, P., Jenness, R., (1984), *Dairy Chemistry and Physics*, John Wiley and Sons, New York.
7. Inon, F.A., Garrigues, S., de la Gurdia, Miguel., (2004), Nutritional Parameters of Commercially Available Milk Samples by FTIR and Chemometric Techniques, *Analytica chemical Acta*, 513: 401-402.
8. Official Method of Analysis of AOAC International, 16th edition, 3rd Revision, 1997, vol.II.
9. Spreer, E., 1998, *Milk and Dairy Product Technology*, Marcel Dekker, New York.
10. Shenk, J., Workman, S., & Westerhaus, J.J., (1992), *Application of NIR Spectroscopy to Agricultural Products*.



A BRIEF INTRODUCTION TO BRIDGE SCOUR AND ITS COUNTERMEASURES

Him Jyoti Thapa*
Rupak Bastola**

Abstract

Scour is the result of erosive action of flowing water, excavating and carrying away material from the bed and banks of stream and from around the piers and abutments of bridges. Bridge scouring and streambed instability has been one of the prominent problems for failure of bridges and the selection and implementation of suitable countermeasures for reducing the scour and instability is a very vital aspect. Different types of scour, scour mechanism, streambed instability and types, factor affecting scour, rate of scour, countermeasures, types of countermeasures and their selection are the key topics discussed in this paper.

Keywords: *Scour Instability, Migration, Vortex, Aggradations, Degradation, and Countermeasures.*

1. Introduction

Globally, bridge scouring has been one of the major causes for the collapse of bridges. Failure of bridges due to local scouring at their supports has tragically become a common occurrence. Earthquake, wind, corrosion, structural, accidental and construction related bridge failures combined do not exceed failures caused by scour.

Scour is a natural phenomenon in which the bed and banks of alluvial channels are eroded by the action of flowing water. The flow interacts with varied mixtures of sediments that may range from alluvial sands to clays and weathered rocks. At a bridge site, scour can

* Former Assistant Professor, Department of Civil Engineering, Nepal Engineering College, Currently with Nepal Sadak Board.

** Junior Professor, Department of Civil Engineering, Nepal Engineering College.

cause significant reduction in the support system of the structure, undermining the piers and abutments. Floodwaters can further complicate the problem because of the unsteady nature of the flow. In a flood situation, the flow may act in many different directions other than that experienced during normal flow conditions. In addition, flood induced floating or submerged debris may contribute to an increase in scour depth. (Lagasse, et.al:2001)

Following are the main factors that are responsible for the failure of bridges (Lagasse, et.al:2001)

- 1.1.Scour: Scour is the result of the erosive action of flowing water, excavating and carrying away material from the bed and banks of stream and from around the piers and abutments of bridges, and is the primary cause of bridge failures. Scour is primarily divided into two components.
 - i. Local Scour: Local scour involves removal of material from around piers, abutments, spurs, and embankments. Although local scour can occur for any flow

condition, it is most severe during floods when flow velocities are greatest. Any obstruction to moving water can cause local scour as the flow accelerates around the obstruction.

a) Pier Scour

The basic mechanism causing local scour at piers is the formation of vortices (known as the horseshoe vortex) at their base (Figure 1.1). The horseshoe vortex results from the pileup of water on the upstream surface of the obstruction and subsequent acceleration of the flow around the nose of the pier. The action of the vortex removes bed material from around the base of the obstruction. The transport rate of sediment away from the base region is greater than the transport rate into the region, and, consequently, a scour hole develops. As the depth of scour increases, the strength of the horseshoe vortex is reduced, thereby reducing the transport rate from the base region.

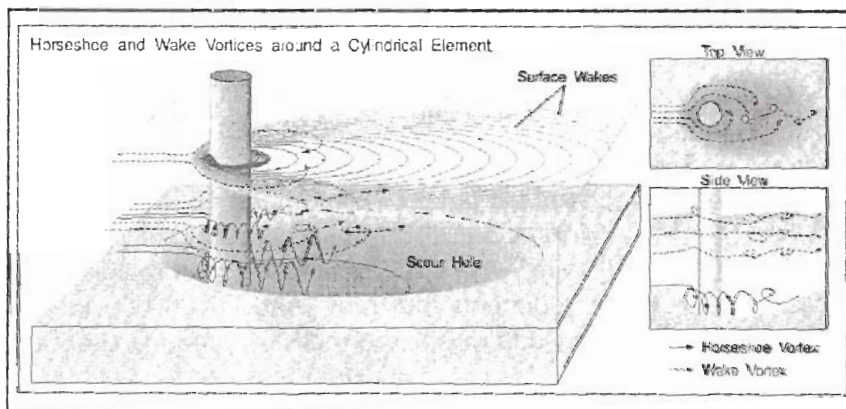


Fig1.1: Horseshoe vortex and wake vortex (Source: FHWA NHI 01-001 HEC- 18, EVALUATING SCOUR AT BRIDGES).

b) Abutment Scour

Local scour occurs at abutments when the abutment and embankment obstruct the flow. The flow obstructed by the abutment and approach embankment forms a horizontal vortex starting at the upstream end of the abutment and running along the toe of the abutment, and a vertical wake vortex at the downstream end of the abutment (Figure 1.2). The vortex at the toe of the abutment is very similar to the horseshoe vortex that forms at piers, and the vortex that forms at the downstream end is similar to the wake vortex that forms downstream of a pier. Abutment scour can be extremely deep, but can progress laterally if the abutment wall is undermined and embankment material sloughs into the scour hole. Abutment failures and erosion of the embankment fill also occur from the action of the downstream wake vortex. An example of this type of scour is shown in Figure 1.2. However, research and the development of methods to determine the erosion from the wake vortex has not been conducted.

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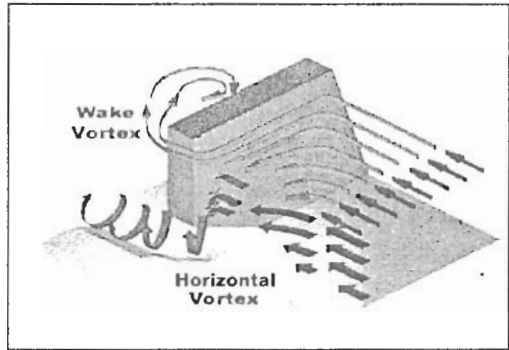


Fig1.2: Scour mechanism at abutment (Source: FHWA NHI 01-001 HEC-18, EVALUATING SCOUR AT BRIDGES).

• Factor affecting local scour:

Factors that affect the magnitude of local scour depth at piers are:

- i. Velocity of the approach flow
- ii. Depth of flow
- iii. Width of the pier
- iv. Angle of attack of the approach flow to a pier
- v. Size, gradation and erosion resistance of bed material
- vi. Shape of a pier
- vii. Bed configuration
- viii. Ice formation or jams and debris

• Rate of Scour:

Scour will reach its maximum depth in:

- i. Sand and gravel bed materials in hours
- ii. Cohesive bed materials in days
- iii. Glacial tills, sand stones and shale in months
- iv. Limestone in years and dense granites in centuries

i. **Contraction Scour:** Contraction scour occurs when the flow area of a stream at flood stage is reduced, either by a natural contraction of the stream channel or, more commonly, by a bridge. It also occurs when over

bank flow is forced back to the channel by roadway embankments at the approaches to a bridge. As compared with an unobstructed flow in the channel and floodplain upstream of the bridge, the decreased flow area at the bridge opening results in an increase in velocity through the contraction. Hence, there is an increase in erosive forces in the constricted area and more bed material is removed from the contracted reach than is transported into the reach. This increase in transport of bed material from the reach lowers the natural bed elevation. As the bed elevation is lowered, the flow area increases and the velocity and shear stress decrease until relative equilibrium is reached. The result can be a much lower channel bed in the bridge opening. During receding flows, the channel contraction scour hole will often refill. (Zevenbergen et. al: 2005)

a. Contraction scour types:

Contraction scour has been further divided into two types as following:

- **Live-Bed Contraction Scour:**
This occurs when bed material is already being transported into the contracted bridge section from the upstream of the approach section (before the contraction reach).
- **Clear-Water Contraction Scour:**
This occurs when the bed material sediment transport in the uncontracted approach section is negligible or less than carrying capacity of flow.

b. Determination of Contraction scour type

- $V_c < \text{mean velocity}$: **Clear-Water Contraction Scour**

- $V_c > \text{mean velocity}$: **Live-Bed Contraction Scour**

Where V_c is the critical Velocity

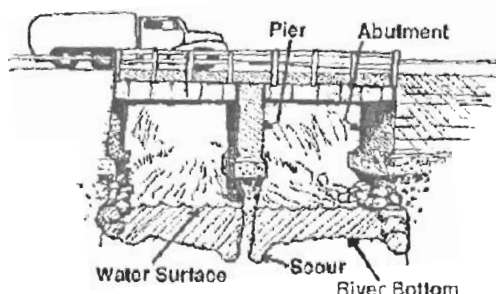


Fig1. 3: Contraction Scour ((Source: FHWA NHI 01-001 HEC-18, EVALUATING SCOUR AT BRIDGES)).

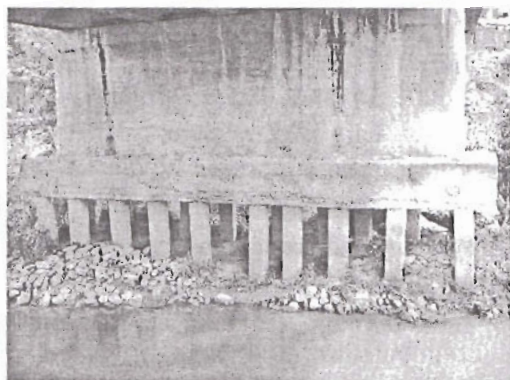


Figure 1.4: Combined Effect of Local and Contraction scour to the Pier and abutment: Balaju bridge and Gongabu bridge respectively.

1.1. Streambed Instability: It is the changes in the morphological form of

the river i.e. change in its plan and profile. It sometimes has become a prominent factor for the collapse of bridges. It is categorized into the following two topics:

- i. **Channel Aggradations and Degradation:** Aggradations and degradation are long-term streambed elevation changes due to natural or man-induced causes. Aggradations involve the deposition of material eroded from the channel or watershed upstream of the bridge; whereas, degradation involves the lowering or scouring of the streambed due to a deficit in sediment supply from upstream or adjustment to changes in downstream conditions. Aggradations can result in reduced flow capacity at a bridge and increased roadbed inundation and overtopping. Degradation can expose bridge piers and abutment foundations. Whether from upstream or downstream, degradation alone can cause bridge failure or it can make the bridge more vulnerable to other types of scour.
- ii. **Channel Lateral Migration:** Lateral migration of a stream channel as it moves within a floodplain may affect the stability of piers in a floodplain, erode abutments or the approach roadway, or increase other scour by changing the flow angle of attack at piers and abutments. Although lateral migration is natural, factors that affect lateral stream movement also affect the stability of a bridge foundation.

2 Countermeasures for Scouring and Streambed Instability

2.1 Introduction:

Scour and stream bed instability problems have always threatened the safety of highway bridges. Countermeasures for these problems are defined as measures incorporated into a highway-stream crossing system to control, inhibit, change, delay, or minimize bridge scour and stream instability problems. A plan of action, which can include timely installation of stream bed instability inspection units and scour countermeasures, should be developed for each scour vulnerable bridge.

Countermeasures may be installed at the time of highway construction or retrofitted to resolve scour and instability problems as they develop at existing crossings. The selection, location, and design of countermeasures are dependent on hydraulic and geomorphic factors that contribute to stream instability, as well as construction cost and maintenance considerations.

2.2 Countermeasure Groups

2.2.1 Group 1. Hydraulic Countermeasures

Hydraulic countermeasures are those that are primarily designed either to modify the flow or resist erosive forces of the flow. Hydraulic countermeasures are organized into two groups: river training structures and armoring countermeasures. The performance of hydraulic countermeasures is dependent on design considerations such as filter requirements and edge treatment. They are further classified as follows:

- a) **River Training Structures.** River training structures are those which

modify the flow. River training structures are distinctive as they alter hydraulics to mitigate undesirable erosional and/or depositional conditions at a particular location or in a river reach. River training structures can be constructed of various material types and are not distinguished by their construction material, but rather, by their orientation to flow. River training structures are described as transverse, longitudinal or areal depending on their orientation to the stream flow.

- **Transverse River Training Structures:** Countermeasures, which project into the flow field at an angle or perpendicular to the direction of flow. Spur, a permeable or impermeable linear structure that projects into a channel from the bank to alter flow direction, induce deposition, or reduce flow velocity along the bank, are the transverse countermeasures.
- **Longitudinal River Training Structures:** Countermeasures that are oriented parallel to the flow field or along a bank line. Bulkheads; A vertical, or near vertical, wall that supports a bank or an embankment are this type of structure.
- **Areal River Training Structures:** Countermeasures that cannot be described as transverse or longitudinal when acting as a system. This group also includes countermeasure "treatments" which have areal characteristics such as channelization, flow relief, and sediment detention.

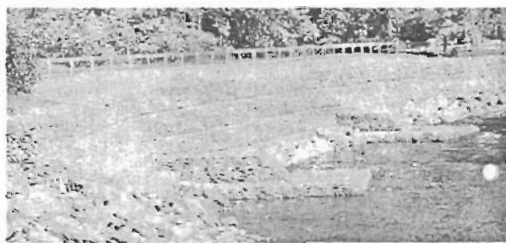


Figure 2.1: Combination of transverse and longitudinal river training structures. (Source: FHWA NHI 01-001, HEC-18)

a) Armoring Countermeasures.

Armoring countermeasures are distinctive because they resist the erosive forces caused by a hydraulic condition.

Armoring countermeasures do not necessarily alter the hydraulics of a reach, but act as a resistant layer to hydraulic shear stresses providing protection to the more erodible materials underneath. Armoring countermeasures generally do not vary by function, but vary more in material type. Armoring countermeasures are classified by two functional groups: revetments and bed armoring or local armoring.

- **Revetments and Bed Armoring:** They are used to protect the channel bank and/or bed from erosive/hydraulic forces. They are usually applied in a blanket type fashion for areal coverage. Revetments and bed armoring can be classified as either rigid or flexible/articulating. Rigid revetments and bed armoring are typically impermeable and do not have the ability to conform to changes in the supporting surface. These countermeasures often fail due to undermining. Flexible/

articulating revetments and bed armoring can conform to changes in the supporting surface and adjust to settlement. These countermeasures often fail by removal and displacement of the armor material.

- **Local scour armoring:** It is used specifically to protect individual substructure elements of a bridge from local scour. Generally, the same material used for revetments and bed armoring is used for local armoring, but these countermeasures are designed and placed to resist local vortices created by obstructions to the flow.

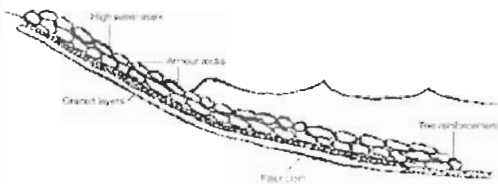


Figure 2.2: RockRevetments
(Source: www.unesco.org/csi/pub/source/ero12c.gif)



Figure 2.3: Bed Armoring using the concrete floor in Balkhu Bridge Kathmandu.

2.2.2 Group 2. Structural Countermeasures

Structural countermeasures involve

modification of the bridge structure (foundation) to prevent failure from scour. Typically, the substructure is modified to increase bridge stability after scour has occurred or when a bridge is assessed as scour critical. These modifications are classified as either foundation strengthening or pier geometry modifications.

- a. **Foundation strengthening:** This includes additions to the original structure, which will reinforce and/or extend the foundation of the bridge. These countermeasures are designed to prevent failure when the channel bed is lowered to an expected scour elevation, or to restore structural integrity after scour has occurred. Design and construction of bridges with continuous spans provide redundancy against catastrophic failure due to substructure displacement as a result of scour. Retrofitting a simple span bridge with continuous spans could also serve as a countermeasure after scour has occurred or when a bridge is assessed as scour critical.

- b. **Pier geometry modifications:** These are used to either reduce local scour at bridge piers or to transfer scour to another location. These modifications are used primarily to minimize local scour.

2.2.3 Group 3 Biological Countermeasures

It is not as well accepted as the classical engineering approach to bridge stability. Bioengineering is a relatively new field with respect to scour and stream instability at highway

bridges. Research is being conducted in this field, but bioengineering techniques have generally not been tested specifically as a countermeasure to protect bridges in the riverine environment.

2.3 Selection of Countermeasures

The selection of an appropriate countermeasure for a specific bank erosion problem is dependent on factors such as the erosion mechanism, stream characteristics, construction and maintenance requirements, potential for vandalism, and costs. Perhaps more important, however, is the effectiveness of the measure selected in performing the required function.

Protection of an existing bank line may be accomplished with revetments, spurs, retardance structures, longitudinal dikes, or bulkheads. Spurs, longitudinal dikes, and area retardance structures can be used to establish a new flow path and channel alignment, or to constrict flow in a channel. Because of their high cost, bulkheads may be appropriate for use only where space is at a premium. Channel relocation may be used separately or in conjunction with other countermeasures to change the flow path and flow orientation.

Conclusion

Bridge scouring is one of the most reoccurring problems that are responsible for collapse of bridge all over the world. Since it is not economically feasible to construct all bridges to resist

all high floods, or to install scour countermeasures at all existing bridges to ensure absolute invulnerability from scour damage, some risks of failure from future floods may have to be accepted. However, every bridge over water, whether existing or under design, should be assessed to its vulnerability to floods in order to determine the efficient measures to be taken. The need to ensure public safety and minimize the adverse effects resulting from bridge closures requires our best efforts to improve the practice for designing and maintaining bridge foundations to resist the effects of scour.

References:

- [1] DoR, Planning and Design Branch, Bridge Unit, *Guidelines for Inspection and Maintenance of Bridges*, Volume 1
- [2] Lagasse, P.F., Zevenbergen, L.W., Schall, J.D., and Clopper, P.E., (2001), "Bridge Scour and Stream Instability Countermeasures," Report FHWA-NH-01-003, Federal Highway Administration, Hydraulic Engineering Circular No. 23.
- [3] Richardson, E.V. and Davis, S.R., 2001. "Evaluating Scour at Bridges," Report FHWA-NHI-01-001, Federal Highway Administration, Hydraulic Engineering Circular No. 18.
- [4] Zevenbergen, L.W., Lozano, D.E., Lagasse, P.F., (2005), "New Arema Bridge Scour Resources"
- [5] FHWA NHI 01-001, HEC-18, *Evaluating Scour at Bridges*.
- [6] <http://www.unesco.org/csi/pub/source/ero12c.gif>



THE IMPORTANCE OF WEAK FORMS OF GRAMMATICAL WORDS IN COMMUNICATIVE LANGUAGE TEACHING

Arjun Khanal*

Introduction:

It's the common feature to use weak forms of grammatical words in spoken English; however, from researches in teaching, it has been found that only a few non- native students actually use it when speaking English. One possible reason could be that they are rarely taught weak forms; therefore, they have less idea about what the weak form is and how to use it in their speech. Basically there are two reasons why weak forms ought to be taught. First, teaching weak forms can enhance students' production of spoken English. Second, it strengthens students' comprehension of the English spoken by fluent speakers. However, in some cases teachers themselves don't take it seriously because it's easier to teach individual sounds, such as vowels and consonants, than weak forms. In other cases, they may hold the view that weak forms are not as important as phonemes, so they don't want to take the trouble to teach them. It is also the fact that there are many materials for teaching other segmentals, materials for teaching weak forms are not readily available in the language market.

* Teaching Assistant, Dept. of Science & Humanities, Nepal Engineering College

Whatever the reason, the negligence to teach weak forms makes it difficult for students to speak English comprehensibly and to comprehend the speech of native and other fluent speakers of English. This article aims to build teachers' awareness of the importance of teaching weak forms and suggests some practical ways to do so, regardless of what native language students speak.

What are the strong and weak forms?

Unlike Nepali language, English is a stress-timed language, which means that stressed syllables are equal in timing. In order to fit our words into this pattern, we tend to "squash" or compress other syllables or words occurring between stresses, in order to keep up with the more or less regular rhythm (Mayers, 1981:422). Therefore, compressing or "weakening" some sounds is necessary to keep the rhythm of English. A weak form is the pronunciation of a word or syllable in an unstressed manner. Of course, the difference between the strong form (stressed) and the weak form (unstressed) of a word is not apparent in writing, but in speech these two variations in pronunciation can be drastically different. If spoken in isolation, the weak form of a word would probably be unintelligible. The difference between the two forms can affect meaning. Here is an example to show how strong and weak forms of a single word (*that*) can change the entire meaning of a sentence:

- John thinks that man is evil. /dæt/

This version of the sentence, with the weak (unstressed) form of *that*, means "John thinks all humans are evil."

- John thinks that man is evil. /dæɪt/

This version of the sentence, with the strong (stressed) form of *that*, means "John thinks a specific (male) individual is evil."

As indicated by this example, if a speaker unknowingly uses the strong form instead of the weak form, misunderstandings can occur.

Rationale for teaching weak forms:

Generally there are two good reasons why weak forms ought to be taught. First, teaching weak forms can help students improve their production of spoken English. Because of the influence of their first language, the students tend to pronounce every word very clearly. As a result, their speech always sounds foreign, sometimes unintelligible, because enunciating each word in a sentence can disrupt the natural rhythm of spoken English.

Second, not knowing the weak form may inhibit students' comprehension of the English spoken by fluent speakers. Therefore, acquiring weak forms is important not only for students' production of spoken English but also for their listening comprehension.

Introducing the concept of weak forms:

It is effective to commence instruction of weak forms by raising students'

awareness of the concept. The teacher should let them know that using weak forms is a common feature of natural English speech and does not represent a degenerate manner of speaking (Seymour, 1969). If students know the rationale for using weak forms, then they will be motivated to learn them.

The teacher can have students listen to some sentences in which weak forms are used. For example, the weak form of *to* is used in the following two sentences:

- He went to the library to read magazines.
- After the accident, she had to go to the hospital.

The teacher could first ask students to pronounce the word *to* in isolation in the strong form, then has them listen to these two sentences and draw their attention to the pronunciation of *to* in the weak form, comparing the different pronunciations. When the students perceive the difference, the teacher can introduce the notion of weak forms.

Before teaching some specific weak forms, the teacher needs to introduce their main phonological features. There are generally three ways in which the strong form is changed into the weak form.

1. A vowel is reduced to a schwa (the neutral vowel /ə/) in function words, such as *to*, *a*, *the*, *and*, and *of*. If the students are not familiar with the term of *function word*, the teacher can explain that function words are usually articles, conjunctions, and preposi-tions, as well as auxiliary verbs.

2. A final consonant is omitted from a function word, such as *and*.
3. An initial consonant is omitted from pronouns, such as *he*, *him*, *her*, and *them* (except when the pronoun occurs at the start of a sentence).

Example sentences should be given to illustrate each of these three ways for students to get a rough idea of weak forms. After students have an initial understanding of the weak form, it's time for the teacher to organize some activities to help them master pronunciation of weak forms in English. An important guideline for teaching weak forms is that the teacher shouldn't give students a long list of weak forms of words and teach them all at once. A better technique is to teach the weak forms according to the grammatical category of function words. Generally speaking, there are six groups of function words that have weak forms: articles, pronouns, auxiliary verbs, prepositions, conjunctions, and interjections. In the following two sections, teaching the weak form of the auxiliary verb *can* is presented as an example of one way to teach this important aspect of spoken English.

Presentation and controlled practice:

When the teacher is about to teach, he writes some sentences on the blackboard which contain both the strong and weak forms of the same word. For example:

1. Can you drive?
2. Yes, I can.
3. He can drive, too.

The teacher says them out loud. Just like the awareness- raising activity mentioned above, the teacher focuses the students' attention on the pronunciation of *can* in these sentences, helping them perceive that the strong form /kæn/ is used in the first two sentences, while the weak form /kən/ is used in the third sentence. In the initial or final position of a sentence, the strong form of function words will usually be used even if it is unstressed. If students are familiar with the phonetic symbols, the teacher can write the two different phonetic transcriptions next to each sentence, and then read them aloud, having students listen to the two forms in isolation. The teacher can check whether they can distinguish these two sounds accurately with a minimal pair exercise. The teacher says one form of *can* and asks students whether it is the strong (/kæn/) or weak (/kən/) form. Next, the teacher can briefly use some imitation exercises, saying aloud and having students repeat the two forms of the word *can*. With these activities, the teacher can be sure that the students can recognize and produce these two sounds, at this point, in isolation.

It's usually easier for the students to pronounce the weak form in isolation than in a sentence, so controlled practice with sentences is needed. The teacher has them read the model sentences out loud; if necessary, he reads first and the students repeat. After they have read these three sentences correctly a few times, drilling can reinforce the proper pronunciation of the weak form in sentences. It has been found that there is

no need to practice the strong form, because the students are quite familiar with it.

Substitution drills can be used. Based on the model sentence "He can drive," the teacher can give some cue words. For example, the verb *dance* is given, and students have to produce the sentence "He can dance." If the pronoun *they* is given, then the students have to produce "They can drive," etc. This kind of substitution drilling should be done first in chorus and then individually. Choral drilling can help to build students' confidence and give them the chance to practice anonymously, without feeling nervous about whether they can pronounce correctly in front of the entire class (Kelly, 2000). After the choral drilling, the teacher can call on individual students to pronounce. In this way, the teacher can determine how well individuals can pronounce the weak form in sentences.

At this point of instruction, there are other kinds of activities that can be used in teaching weak forms. One is the use of a tape recorder. Students read aloud and record a dialogue or passage then compare their reading with a recording of the same material made by fluent speakers of English, paying special attention to the weak forms used. This activity not only raises students' awareness of weak forms, but also helps them to know what they need to improve in their pronunciation.

After the weak forms of some function words have been taught, the teacher can give students a listening passage to practice recognition. Students identify the

strong and weak forms of function words in the passage. Also, students can listen to a passage from which some function words have been deleted; they have to decide which form is appropriate (strong or weak) and fill in the blanks.

Communicative practice:

if only controlled practice is used in teaching weak forms, the teacher cannot be sure whether the students can apply what they have learned in natural English speech and the students may get bored with the mechanical drills. The teacher must involve students in meaningful and communicative pronunciation activities to make learning interesting and motivating (Fangzhi, 1998:39). Therefore the teacher must design some communicative activities in which the weak forms will inevitably be used. The following three-step activity is one that has been used successfully with my students:

1. In pairs, students interview each other about what special skills each of them has.
2. If the initial questions are not adequate for the students to get a comprehensive idea of the special abilities of his/her partner, the student being interviewed should provide more information voluntarily.
3. Students report to the whole class what abilities his/her partner has.

In this activity, students get a lot of chances to practice the two forms of *can*. In step 1,

some interview questions should contain *can*, for example: "Can you play _____ (a

game or sport)?" "What else can you do?" "I remember you can _____, can't you?" The answers "Yes, I can" and "No, I can't" will be used. In step 2, the statement "I can _____" will be used spontaneously. In this activity, both the strong form and weak form should be used in the students' speech many times, so the teacher can determine whether students can use them in the appropriate places. In the interview, students ask their partners something that they don't know and talk about themselves, which makes this activity meaningful to them.

To encourage students' spontaneous communication where the use of weak forms is almost inevitable, the teacher can organize other activities, such as *role plays*. In this kind of activity, students are given the opportunity to practice the weak form in a meaningful context.

Conclusion:

From the aforementioned illustrations it can be asserted that weak forms are important components of natural and fluent English speaking, but systematic teaching of the weak forms has been ignored in communicative language teaching for non-native speakers. It has been found that students who receive systematic instruction in weak forms over a period of time show a significant improvement in their production and comprehension of spoken English. That's why the instruction of the use of the weak forms of grammatical words is a must to enhance the communicative capability of the non-native students.

References:

- [1] Fangzhi, Cheng., (1998), The Teaching of Pronunciation to Students of English, *English Teaching Forum*, 36, 1, pp. 37-39.
- [2] Kelly, G., (2000), *How to Teach Pronunciation*, London: Longman/Pearson Education Limited.
- [3] Mayers, R. P., (1981), A New Approach to the Teaching of Weak Form, *ELT Journal*, 35, 1, pp. 421-426.
- [4] Seymour, G., (1969), *Practical English Phonetics*, London: Leonard Hill.



RETROSPECT ON RE-DESIGNATED CORE AREA AND CONSONANT AREA OF PASHUPATI

Bharat Sharma*

Pashupati Area Development Master Plan and Newly Designated "Core Area"

The initial concept master plan of Pashupati Development Area, which was duly approved, had hierarchical spatial distribution originating from the supreme Core Area, which consisted of supreme divine niches basically incorporating the temple precincts namely Pashupati and Guheshori with concentric circles of consonant continuum and cognitive congruent areas (2045).

In the latest endeavor and so called pragmatic reconsideration in the changed political context, the master planner was given directive by the master plan committee of governing council of the Trust to shrink and re-delineate the sacred area which could be operational.

As such the designated and approved Core Area and Consonant Area now have an entirely new physical meaning. In the east it consists of Tribhuvan International Airport (physically non-developed area incorporating the forest and the artifacts area). In the west it consists of a dirt road to the west of Bhandarkhal leading to the sattal on the west of Jaybageshori and heading out to the ring road up to Mitra Park intersection. In the north the core area originates from Mitra Park intersection and becomes east bound up to Gauri Ghat

* Professor, Department of Architecture, Nepal Engineering College.

Balman and then incorporates a 20 meter strip of land north of Bagmati up to Utterbahini and east boundary. In the south it consists of the last boundary of ward 8 in the south west and then heads to Guashala intersection and then sweeps east to Tilganaga and meets the walk way leading to the barrack.

In no way should it imply that the promulgated total Pashupati Area is physically and functionally delinked from this Core Area. Essentially the whole area is inseparable spiritually, culturally and above all environmentally.

Basically the salient objectives of this redefined Core Area are the following:

- i) Physically enhance the dignity of the two temple precincts (Pashupati and Guheshwori).
- ii) Physical restoration and enhancement of other important artifacts and cultural heritages.
- iii) Restoration of dignified and compatible land use with symbiosis.
- iv) Religious and functional restoration by appropriate and harmonious land use.
- v) Rare opportunity to enlarge "Prangan" especially that of Pashupati for essential functions and environmental requirements.
- vi) Rare opportunity to meet essential volume requirements to some extent.
- vii) Graded enhancement of the total environment in holistic way.
- viii) Opportunity to restore encroached artifacts, built-forms and natural heritages.

However, there is a note of caution regarding the operational aspects of

some of the aforesaid "opportunities" to meet the goal. It is achievable but it has some constraints as well. Some hard decisions have to be made by the concerned authorities and the Trust. Not only do these decisions have to be put into actions, the issue of displacement, rehabilitation and compensation are sensitive hurdles and ought to be settled gingerly. Developmental aspect always has a cost factor and we should be prepared to meet it. Pashupati Area Development does not carry any weight if we essentially maintain status-quo and just do cosmetic treatment only in the name of development.

The Master Plan of the area is in dire need of many resources, above all land resource, to meet various requirements. The issue of illegal constructional activities in this area is a big challenge to this noble cause. So is the alarming rate of encroachment of public land or Guthi land and other religious and cultural built forms such as Patis, Sattal etc. This unauthorized and abused land use has to be taken care of.

An extra effort for this noble cause would be to look for Guthi and Government lands in close vicinity which would help alleviate the situation. It will help in rehabilitation as well as resolving issues as per master plan.

The north-south strong visual corridor along Bagmati in Pashupati Area still offers some chance to redeem the land requirement if the Trust feels so and acts accordingly.

SUB DIVISION OF CORE:

The latest redefined Core Area should be taken as one entity but should not be

treated and executed in blanket fashion. For operational convenience it could be divided into Sub-Cores and Supreme Cores as following:

- i) Pashupati and Guheshori Prangans as Supreme Cores especially after endorsement of enlarged Pashupati Prangan.
- ii) The front open plaza with cultural heritages on the west of Pashupati can be taken as one package sub core.
- iii) Bankali Area could have three sub cores as
 - a. Forest Area
 - b. Dharmasala Area
 - c. New heavily built- up area between ring road and road leading to Dharmashala.
- iv) Ghat area along Charshivalaya.
- v) Area within east of Ring Road, west of road coming from Gaushala and going to Pashupati and Guheshori, south of road going from Mitra Park to Gaurighat and north of office of Pashupati Area Development Trust Secretariat.
- vi) The alarmingly mushrooming settlement has to be given top priority.
- vii) Shandarkhal is also under stress and needs sympathetic attention.

Though it is not an entire comprehensive list of Sub-Core areas, the areas mentioned above have to be given priority within a fixed time-frame. Things are going from bad to worse which is eroding the very foundation of public credibility for tangible noble actions.

Noble intension is just not good enough.

However, one very pertinent rationale has to be crystal clear and that is the conceptual Master Plan of the area which was approved in 2045/4/28 still holds good in its approach though it is being said that in the changed political context the developmental plan should be changed drastically. A master plan is definitely not a static thing but at the same time a developmental master plan should not be subject to fluid, inconsistent and unstable treatment. It will lead us to nowhere.

In the process of improvement and enhancement of new designated Core Area there is a unique opportunity of an easy and workable gravity flow alignment of sewer line along the road west of Pashupati instead of the complicated and very costly tunnel sewer line passing through east of Vishwaroop and crossing Bagmati at two points: one near Guheshori and another at Tilganga.

The above suggested alignment would be totally on the right bank (west) of Bagmati thus avoiding river crossing at two points as being executed now by "Adhikar Sampanna Bagmati Dhal Sudhar Samiti".

But to do so, it will require firm determination and a lot of will power and above all a "futuristic vision" to break the stagnant, status-quo "limbo scenario". The 2045 master plan was definitely geared towards the future, taking care of the area in general and Pashupati in particular with urban ecology as well as natural ecology along with heritage as top priority.

CLOUD COMPUTING: THE FUTURE OF COMPUTATION

Birodh Rijal*

1. Introduction :

The advent of the Internet and the World Wide Web brought about the greatest revolution that has drastically changed our life and style of living. The giant computer weighing thousand of tons and with very primitive functionalities was converted into a small note book with sophisticated functionalities. Along with the advancement of computing technology the price of computers has fallen and computers have become a necessity for every institution and even at the individual level. The diversified and short term need of software and hardware has led to the essence of using shared resources. Despite its failure to garner universal support, cloud computing is slowly emerging as a timely system which could meet the enterprise's needs in a cheaper and more reliable way.

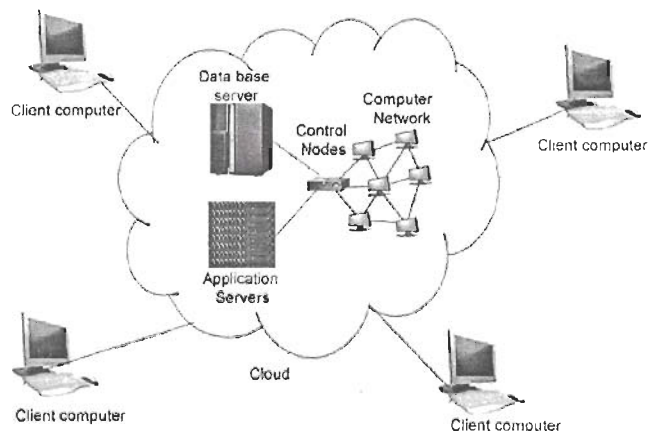


Fig: A Model of Cloud Computing

* Junior Professor, Department of Computer Science and Engineering, nec

Cloud computing is a term you can see being used a lot in the IT arena. However, it is doubtful whether it will change the paradigm of computation in terms of the personal computer as a computing device. The advent of the cloud platform is the major factor that has led to the growing shift towards cloud computing. Most of us have probably been making use of cloud computing without realizing it. The use of e-mail accounts like Gmail or hotmail and sharing of photos in social networking applications like Facebook are some of the cases where we are using cloud computing.

2. What is Cloud Computing?

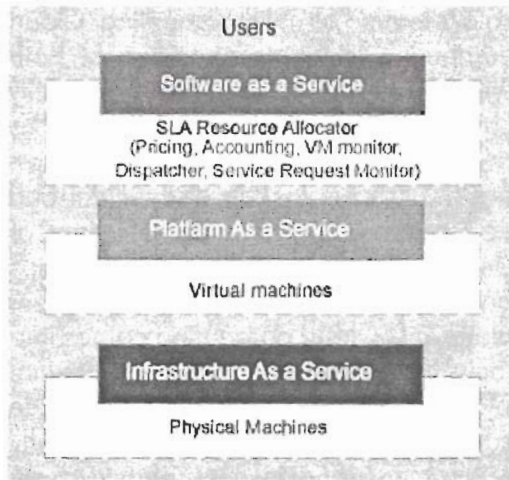
Cloud computing refers to the whole IT infrastructure as a service over the Internet. It includes hardware as well as system software at data center and the applications that are delivered as services over the Internet. The applications that have been provided are termed as software or services (SaaS) whereas the software and hardware at the data center is termed as cloud. In the cloud computing environment the application builder can build their applications and run them on the cloud. The cloud applications use large data centers and powerful servers that host web applications and web services.

Cloud computing has the ability to rent a server or a thousand servers and run a geophysical modeling application on the most powerful systems available anywhere. It can rent a virtual server, load software on it, turn it on and off at will, or clone it ten times to meet a sudden workload demand [1]. When a cloud is made available to the public on a pay-as-you-go manner then the service being

sold is termed as utility computing. Cloud computing is the combination of both the software as a service and the utility computing. The service provider furnishes the cloud and the end user can accomplish the task in an efficient and economic way. The main element of cloud computing is virtualization in which one can run applications on different platforms. Cloud computing comes into focus only when one thinks about what IT always seeks: a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends IT's existing capabilities. There is no long term commitment and an organization is only charged for what it actually uses. If one instance needs to be added, it is literally a matter of minutes to configure new server instances.

3. Cloud Architecture

Cloud Computing is a new term for a long-held dream of computing as a utility, which has recently emerged as a commercial reality [2]. Any application needs a model of computation, a model of storage and a model of communication. Although some of the cloud applications are already commercially available in the market they have their own model of cloud. Amazon EC2 is at one end of the spectrum whereas at the other extreme of spectrum are application domain specific platforms such as Google AppEngine [2]. Amazon Elastic Compute Cloud (EC2) allows users to rent computers on which to run their own computer application which



can be considered as Infrastructure as a Service. In case of Google AppEngine it provides the platform for developing and hosting the web application on Google managed datacenter. It virtualizes the application across multiple servers and data centers which can be taken as Platform as a Service.

Although almost all the infrastructures have been built for cloud computation, it is still in its infancy and lots of managerial systems are yet to be developed. The architecture proposed by Oracle and Sun Microsystems are of three types: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) [8].

3.1. Software as a Service (SaaS): In SaaS, a single instance of software runs on a cloud and services multiple end users or client organizations. A SaaS provider typically hosts and manages a given application in his own data center and make it available to multiple users over the web. Google Apps offering of basic business including email and word

processing and services provided by salesforce.com are well known example of SaaS.

3.2. Platform as a Service (PaaS): Platform as a service encapsulates a layer of softwares and provides an application development and deployment environment delivered as a service to the developers over the web. The PaaS platform consists of infrastructure software that can provide for every stage of software development and testing. The infrastructure software typically includes a database, middleware and development tools. Google AppEngine is a commercially available PaaS.

3.3. Infrastructure as a Service (IaaS): It is the lower layer of cloud computing in which the cloud provider supplies hardware (server, storage and network) and associated software (operating system, virtualization technology and file system) as a service. The cloud user can scale up the resources automatically if there is higher demand. It is like some advancement of traditional hosting which do not require long term commitment. The prevailing commercial offerings are Amazon web services, Elastic Compute Cloud (EC2) and Secure Storage Service (S3).

4. Benefits: As there will be many numbers of cloud providers, enterprises would have the flexibility to choose a vendor as per their requirement. The primary advantage would be the cost and efficiency. Essentially, the capital cost of computing can be done away with if an

organization relies on the cloud, buying virtual server time and storage on demand. Expenditure on IT becomes operational rather than capital. Scalability allows the organizations to add capacity as well as scale down as per the demand. It reduces the IT infrastructure investment cost that is provided by the vendors. It would be beneficial for the new entrant organization as they can save a substantial amount of investment on IT, because they are able to scale up or down the resources as per their demand.

5. Problems: The pace of development in IT infrastructure and web technology is increasing, however, cloud computing is still at an early stage of development and there is lack of definitive market standard. Once an organization is committed to a particular cloud provider, the agreement should preferably be a logical lock not a contractual lock-in. All the data of the organization would be stored on the cloud which would introduce the high risk of data security and getting data out and moving to another cloud provider becomes difficult. The issue of lock-in reflects the concern of reliability. If the application or data cannot be moved to another system, what happens when the system is down for some duration? The data in the cloud also increase the cost of data transfer as the large volumes of data consume more bandwidth and are slower than the simple transfer of data in hard drive.

6. Conclusion: Despite its many existing problems and the lack of universal

standards, cloud computing has already made significant gains. Cloud providers are slowly increasing and more research is going on that will support its standardization. Cloud computing offers real alternatives to IT departments for improved flexibility and lower cost [8]. These services are readily accessible on a pay-per-use basis and offer great alternatives to businesses that need the flexibility to rent infrastructure on a temporary basis or to reduce capital costs.

7. References

- [1]. Sun Microsystem, (2009), *Introduction to Cloud Computing Architecture*, White Paper 1st Edition.
- [2]. *Above the Clouds: A Berkeley View of Cloud Computing*, Technical Report No. UCB/EECS-2009-28, February, 2009.
- [3]. *7 Things You Should Know about Cloud Computing*, ID: EST0902, EDUCAUSE Publications, March, 2009
- [4]. Chappell, David, (2008), *A Short Introduction to Cloud Platforms, an Enterprise-oriented View*.
- [5]. Boss, Greg; Malladi, Padma; Quan, Dennis; Legregni, Linda, (2007), *Cloud Computing*, Harold Hall.
- [6]. Powell, John, *Cloud Computing – What is it and What Does it Mean for Education?*
- [7]. *Cloud Storage for Cloud Computing*, A joint production of the Storage Networking Industry Association and the Open Grid Forum, September 2009.
- [8]. *Architectural Strategies for Cloud Computing*, An Oracle White Paper in Enterprise Architecture, August 2009.

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SCITECH Nepal
Nepal Engineering College
Changunarayan, Bhaktapur
GPO Box : 10210, Kathmandu
E-mail : info@nec.edu.np