

## Factors for Electronic Media Selection in Project Communication

Rachel Magwenzi, Cornelis C. van Waveren, Kai-Ying Chan

Department of Engineering and Technology Management, University of Pretoria, South Africa

**Abstract**--Knowledge transfer in projects are more complex and challenging than such transfers in normal operations due to the temporary nature of project teams in which team members often do not see the capturing and transferring of knowledge across projects as important for long term benefits to the organization. Understanding how and why different communication media, computer-mediated or otherwise, are used in organisations becomes essential to prescribe and to predict sound rationale organisational investments in different media choices. Although a lot of research has been done on factors that influence media selection as a knowledge transfer tool, organisations are becoming more dependent on using the electronic media for communication and further advancement in the electronic media necessitate continued research. This study investigates the key factors that influence the selection of electronic media in projects communication focussing on the engineering sector as well as identifying factors which are more dominant than others. The communication factors which were identified during the study were grouped into four groups: system characteristic factors, task factors, organisational factors and people factors. The study investigated the influence of the communication factors on the following forms of electronic media: e-mail, internet, intranet, extranet, electronic bulletin boards, television networks, audio recordings, video conferences, tele conferences, instant messaging, telephonic systems and multimedia presentations. Results showed that the top ten key factors which influence selection of electronic media consisted of; six system factors, three task factors, one organisational factor and one people factor. Systems factors were more critical than the other factors in influencing the choice of electronic media.

### I. INTRODUCTION

Project communication is the exchange of project-specific information with the emphasis on creating understanding between the sender and the receiver. Projects communication is the basis of collaboration and it's critical that everyone understands the communication shared among the project team members. Electronic media is now being commonly used as a communication tool to convey information amongst project stakeholders and is the second most commonly used media to verbal communication. The electronic media distributes information in electronic/digital form using several mechanisms or systems which allow one to access, search, share, store and publish information within and outside organisations.

Although many studies have been done with regards to factors influencing communication media choice [1], [2], the increase in organisations reliance on the electronic media for communication and continuous advances in electronic media technology have necessitated continued research in the area of electronic media choice. Although rich media facilitates

communication, media choice is seen as a strategic component of communication because but "there is no single medium that is uniformly correct [1]. Media choice is dependent upon the characteristics of the media and each communication medium is unique in its ability to convey certain information content. Understanding how and why different electronic/digital communication media are used in organisations becomes essential to prescribe and to predict sound rationale organisational investments in different media choices [3].

The objective of this paper is to identify factors that influence the selection of certain forms of electronic media in terms of their characteristics in project communication. This study asks the following two research questions:

- Which forms of electronic media are frequently used in project communication?
- Which factors influence the users' choice of electronic media in project communication?

By answering the above two research questions this paper contributes to media choice literature in two ways. Firstly, there are limited studies on media choice in project environments. Over time, projects have become a common form of doing business [4]. Knowing the importance of factors influencing electronic communication media choices will allow more effective and efficient project communication, thus the success of projects. Secondly, media richness theory [5] has been the most commonly applied theory in exploring factors influencing media choice. However, due to the complexity of projects, this paper applies other theories such as media synchronicity theory [6], behavioural complexity theory [7] and social influence theory [8] with the aim to build a more comprehensive list of factors.

### II. LITERATURE REVIEW AND CONCEPTUAL MODEL

This section will review various forms of electronic media and factors that influence the choice of electronic media. After the review, a conceptual framework model for this research was developed which examines the extent of the influence of the factors in the selection of various electronic media. The application of the different forms of the electronic media will be detailed as well as how the factors influence users to select the electronic media.

#### A. Forms of electronic media

This study reviewed the literature and identified the following forms of electronic media: e-mail, internet, intranet, extranet, electronic bulletin boards, television networks, audio recordings, video conferences,

teleconferences, instant messaging, telephonic systems and multimedia presentations. E-mail is an asynchronous, fast, text based medium that supports multiple uses and uses computers, mobile phones and tablets to exchange information. Sivulén & Valo [9] mention that e-mail messages can be stored and accessed, can be distributed to all team members at the same time, can easily be sent and forwarded, as well as used to attach documents. The Internet is a global system of interconnected computer networks that use the standard internet protocol suite (TCP/IP) to link several billion electronic devices worldwide. The intranet allows access to information on an organisation's website to members within the organisation only whilst the extranet allows access to information on an organisation's website to members outside the organisation. Instant messaging is a synchronous computer mediated messaging system that allows chatting between individuals. Chen et.al. [10] states that instant messaging has a number of capabilities which include visual and non-verbal cues, such as emotional icons, presence awareness, presence notification, voice chat, video conferencing, file exchange, drawing pads, application sharing. Sivunen and Valo [9] mention that telephonic systems are usually used when performing urgent tasks and they enable speaking to clarify uncertain issues. Verbal communication via telephonic system is often used as an informal way of communication in projects [11]. Video conferencing involves conducting a conference between two or more participants at different sites by using computer networks to transmit audio and video data. In their study Sivunen and Valo [9] state that video conferences are used when there is need to discuss a number of issues at the same time. Teleconferencing occurs when phones are used to initiate and conduct conference calls, which enable multiple callers to listen and/or talk on the same call. Multimedia presentations refers to the use of computers to present text, graphics, video, animation, and sound in an integrated way, an example is the PowerPoint presentations. Audio recordings occur when there is electronic recording of sound. A television network is a telecommunications network for distribution of television program content. When project stakeholders are the public, television is an efficient way to communicate with the public by broadcasting projects' information. Electronic bulletin boards (also known as message boards or as computer forums) are online communication systems where one can share, request, or discuss information on just about any subject.

### *B. Factors that influence the choice of electronic media*

The factors which were identified during the study were identified by various media choice theories and grouped into four groups namely: system characteristic factors, task factors, organisational factors and people factors.

The system factors which influence the choice of electronic media in projects are usefulness and system characteristics. To, et.al. [12] mention that individual perceptions of ease of use and usefulness of electronic media

influences the selection for use of electronic media within and outside organisations for various task requirements. System characteristics factors which influence the selection of electronic media for use are identified in this paper by using media richness theory [5] and media synchronicity theory [6]. These are: capability to carry information of media, immediacy of feedback, multiple cues, language variety, personalisation, parallelism, rehearse-ability, reviewability, simultaneity, and configuration. Capability of media refers to the ability of media to carry desired amount of information from low amount of information to high amount of information. Sun and Cheng [13] state that the richness of media is based on four factors: (1) immediacy of feedback: the promptness of responses, such as questions to be asked; (2) multiple cues: use of multiple information channels, such as vocal inflection and body gestures; (3) language variety: use of numbers and formulas provide clarity and (4) personalisation: personal emotions and feelings. Immediacy of feedback refers to the urgency in which the message is sent and a quick response is needed. Palvia et al [3] and Sun and Cheng [13] also describe multiple cues as the ability of the media to display an array of cues, which includes physical presence, voice inflections, body gestures, words, numbers, and graphic symbols, facilitate conveyance of interpretation and meaning, rather than simply information or data. Language variety refers to the ability of the media to allow the use of numbers and formulas to provide clarity. Personalisation refers to the ability of media to display personal emotions and feelings in communication. According to Calefato and Lanubile, [14] parallelism refers to the ability of media to allow a number of simultaneous conversations that can exist effectively i.e. the "width" of the medium. According to Calefato and Lanubile, [14] rehearseability refer to the extent to which the media enables the sender to rehearse or fine tune the message before sending. According to Calefato and Lanubile, [14] reviewability refers to the ability of media to allow the user to re-examine and process the message to ensure accurate understanding, thus fostering conveyance. According to Calefato and Lanubile, [14] simultaneity refers to the ability of the medium to allow for full-duplex communication that allows individuals to send and receive communication at once and simultaneously. Zack [15] mention that configuration refers to the ability of the media to communicate to a wider audience, one-to-many communication increases the effectiveness of use of that type of media. An e-mail can be sent to everyone in the organisation no matter how large the organisation is.

Calefato and Lanubile, [14] and Plotnick et al [16] mention that use of appropriate technology which provides features that support the task requirements increases performance and effective use of the technology. Behavioural complexity theory state that task at hand affects the selection of media [7]. The task factors which influence the choice of electronic media in projects are task complexity, task interdependency, task confidentiality and task related

accountability. Sun and Cheng, [13] established that task complexity and variety is directly linked to the amount of information to be processed. Complex tasks require more information to be communicated to reduce uncertainty. According to Jarvenpaa and Staples [2], the social exchange theory assumes that relationships between individuals as interdependent. Individuals who perform tasks which are interdependent of others feel obliged to use electronic media for information sharing. Palvia et al, [3] state that the high need for confidentiality in communication will lead to selection of media that is assumed to be secure by individuals. They also state that the requirement for individual and task related accountability will lead to the selection of a medium perceived to provide more accountability. Task related accountability refers to the ability of media to show who is responsible for communication sent or received.

The organisational factors which influence the choice of electronic media in projects are environment, economy and communication across authority. These factors are related to the social influence theories with specific focus on institutional factors [17]. The environmental effects include influence due to expectation and perceptions of peers and superiors and their business counterparts outside their organisations. Kwon and Onwuegbuzie [18] mention that

individuals tend to use forms of electronic media that are used by peers and business associates because they need to have the sense of connection to their business environment. Lo and Lie, [19] state that distance affects the choice of media due to different access cost, error cost and delay cost. During recession companies had to reduce cost by reducing unnecessary travel, the use of videoconferencing increased as it was a cheaper and efficient option. The choice of media differs depending on the one's position of authority in the organisation. D'Ambra and Rice [20] identified that managers use different communication media for similar tasks, and suggest that when an individual moves from one position to the next, they tend to choose certain media because of their new positions.

The people factors which influence the choice of electronic media in projects are users experience, cultural differences and language differences. These factors relate to "social proximity and cultural diversity" in the behavioural theory by Shachaf and Hara [7]. Gaining experience with certain forms of electronic media channels increases the perceived richness of the media and the effectiveness of their use. King & Xia, [21] contend that media choice is correlated with one's prior experience with media. Snyder and Lee-Partridge, [22] state that people tend to choose to use

TABLE 1: RESEARCH FRAMEWORK

Factors		Definition	
System Characteristic Factors	SF1	Capability to carry information of media	Capability to carry desired amount of information from low amount of information to high amount of information
	SF 2	Usefulness	Ability of media to convey important, relevant, useful or valuable information
	SF 3	Immediacy of feedback	The degree to which a prompt response is required from the receiver by the sender of the communications.
	SF 4	Personalisation	Personal emotions and feelings
	SF 5	Rehearsability or Revisability	The extent to which media enables the sender to rehearse or fine tune the message before sending
	SF 6	Reviewability or reprocessability	Ability to re-examine and process the message to ensure accurate understanding, thus fostering conveyance
	SF 7	Simultaneity	Refers to the ability of the medium to allow for full-duplex communication, that is, individuals can send and receive at once and simultaneously
	SF 8	Configuration	Ability of media to communicate to a broader audience
	SF 9	Multiple cues	An array of cues, including physical presence, voice inflections, body gestures, words, numbers, and graphic symbols, facilitate conveyance of interpretation and meaning, rather than simply information or data.
	SF 10	Language variety	Use of numbers and formulas to provide clarity
	SF 11	Parallelism	The number of simultaneous conversations that can exist effectively—the "width" of the medium.
Task Factors	TF1	Task complexity	Complex tasks require more information to be communicated to reduce uncertainty
	TF2	Task related confidentiality	This is when communication is not disclosed to unauthorised persons, or organisations
	TF3	Task Interdependency	People whose work involves tasks that are interdependent of others
	TF4	Task related accountability	The ability of media to show who is responsible for communication sent or received.
	TF5	Task equivocality	Ambiguous, unclear tasks which results in multiple and conflicting interpretations of the task
Organisational Factors	OF1	Environment	The environment in which individuals do their projects influence the way they choose the forms of electronic media to use.
	OF2	Economy	Distance affects the choice of media due to different access cost, error cost and delay cost.
	OF3	Communication across authority	The choice of media differs depending on the one's position of authority in the organisation
People Factors	PF1	User's experience	One's prior experience with media influences the choice of electronic media
	PF2	Cultural differences	Culture can influence the selection of certain media for certain tasks due to cultural perceptions.
	PF3	Language differences	Language differences influence your choice of electronic media to use in project communication.

electronic media which they have experience and feel comfortable to use. Klitmoller and Lauring, [23] argue that cultural differences and low shared language commonality play a significant role in the effectiveness of communication and knowledge sharing. Culture can influence the selection of certain media for certain tasks due to cultural perceptions. Plotnick et.al. [16] mention that the choice of media for formal, official and business use may vary by culture

### C. Conceptual framework

This research identified 22 factors for consideration. Table 1 provides the research framework and definition of the 22 factors from the literature discussed in the previous section. The degree of influence of these factors on electronic media choice will be examined in the context of engineering projects.

## III. RESEARCH METHODOLOGY

A quantitative research methodology was used in this study by using a questionnaire survey. The research was cross sectional as the respondents were only interviewed once. The surveys were collected during the period July to August 2015. The population for this research was the engineering industry. The unit of analysis were employees from the engineering sector. A sample of the population was surveyed through questionnaires with a sample size of 403 people. Of this sample size, 345 people were current Masters students enrolled for Engineering Management and Project Management at the University of Pretoria in South Africa. These students are also involved in projects in the engineering industry. The research instrument used to collect data for this research was a written web based survey questionnaire using Survey Monkey as a tool. Questionnaire survey was chosen as a research instrument because the data gathered can be statistically analysed. There is less bias as there is uniform questions presentation and no middle-man bias. Moreover, it is less intrusive than interviews [24]. The questionnaire for this research consisted of a set of questions which were designed to answer the research questions. The type of questions in the questionnaire included close ended as well as open ended questions. The close ended questionnaire included statements in which the respondents need to express the degree of influence a specific factor has on his/her choice of electronic media using a five-point Likert scale where a 1 indicated "no influence", 2 indicated "minor influence", 3 indicated "neutral", 4 indicated "moderate influence" and a 5 indicated "major influence". Questions asking respondents' frequency of usage of the 12 forms of electronic media were also included in the questionnaire using a five-point Likert scale where 1 indicated "never used", 2 indicated "rarely", 3

indicated "sometimes", 4 indicated "most of the time" and a 5 indicated "always". Other questions with regards to respondents' personal demographic such as age, gender, education level and project experience. The questionnaire was pre-tested and revised before being sent to the respondents.

Statistical analysis was used to analyse the responses received from the respondents. In order to rank the degree of influence of the 21 factors, Friedman's test as the non-parametric alternative to the one-way ANOVA with repeated measures was used to determine the differences between the factors' mean ranks. In addition, chi-square test determines whether the differences in the mean ranks amongst the factors are statistically significant or not.

## IV. RESULTS

A total of 65 responses were completed out of a sample size of 403, the response rate was therefore 16.1%. After screening for completeness of the surveys, there were 63 usable questionnaires. The results are listed under the headings, demographics, media selection and ranking of the media.

### A. Demographics

As reported in Table 2, results found in this study will be biased towards users younger than 40 years and male users. This is expected in South Africa, as engineering is male dominated. The majority of respondents are technical and/or professional with a minimum education qualification of a Bachelor's degree or higher. 71.4% of the respondents have more than 5 years of project experience, this indicates that the respondents are knowledgeable in this area and their opinions to the other parts of the questionnaire are valid.

### B. Media selection

This research identifies and focused on the following forms of electronic media used in project communication: e-mail, instant messaging, video conferences, teleconferences, multimedia presentations, television networks, audio recordings, telephonic systems, intranet, extranet, internet, electronic bulletin boards. The respondents were asked to express the frequency of usage of these forms on a five-point Likert scale ranging from 1 (never used) to 5 (always). The Friedman test was used to compare mean ranks between the usage of media and to indicate how the usage of media differed. The results of the ranking from highest to lowest rank is depicted in Table 3. The results show that the differences amongst the mean ranks were statistically significant (Chi square value is significant at  $p < 0.05$ ).

## 2016 Proceedings of PICMET '16: Technology Management for Social Innovation

TABLE 2: FREQUENCY TABLE OF DEMOGRAPHICS OF THE RESPONDENTS

Demographics		Frequency	%	Cumulative %
Age Group	Younger than 30 years old	14	22.2	22.2
	30 ~ 39 years old	33	52.4	74.6
	40 ~ 49 years old	10	15.9	90.5
	50 ~ 59 years old	6	9.5	100.0
Gender	Male	39	61.9	61.9
	Female	24	38.1	100.0
Job Position	Clerical/Secretarial	2	3.2	3.2
	Technical/Professional	47	74.6	77.8
	Professor/ Researcher	3	4.8	82.5
	Manager/ Administrator	11	17.5	100.0
Education Level	Other (please specify)	2	3.2	3.2
	Grade 12 (School)	2	3.2	6.3
	Diploma / Advanced Certificate	1	1.6	7.9
	Bachelor Degree / Advanced Diploma	32	50.8	58.7
	Postgraduate Diploma	9	14.3	73.0
	Master's Degree	16	25.4	98.4
Project Experience	Doctoral Degree	1	1.6	100.0
	Less than 5 years	18	28.6	28.6
	5 - 9 years	22	34.9	63.5
	10 - 19 years	17	27.0	90.5
	20 - 29 years	4	6.3	96.8
	30 years and more	2	3.2	100.0

TABLE 3: RANKING OF ELECTRONIC MEDIA

Media	Mean Rank	Ranking
Media 1: E- mails	10,19	1
Media 11: Internet	10,17	2
Media 9: Intranet	8,67	3
Media 8: Telephonic systems	8,62	4
Media 2: Instant message	7,72	5
Media 10: Extranet	6,18	6
Media 5: Multimedia presentations	5,33	7
Media 4: Tele conferences	4,92	8
Media 3: Video conferences	4,64	9
Media 12: Electronic bulletin boards	4,37	10
Media 7: Audio recordings	3,75	11
Media 6: Television networks	3,43	12

### C. System Characteristic Factors

The mean ranks from the Friedman test were determined and used to rank the system characteristic factors. The results for the ranking of the System characteristic factors are depicted in Table 4. The results show that the differences amongst the mean ranks were statistically significant (Chi

square value is significant at  $p < 0.05$ ). The media's capability to carry information (System Factor 1) is mostly considered when selecting the electronic media to use whilst the media's capability of personalisation (System Factor 4) has the least influence when selecting the electronic media for project communication.

TABLE 4: RANKING OF SYSTEM FACTORS (SF)

Factor	Mean Rank	Ranking	Test Statistics <sup>a</sup>	
SF1: Capability to carry information of media	9,73	1	N	59
SF2: Usefulness	7,18	3	Chi-Square	217,049
SF3: Immediacy of feedback	7,33	2	df	10
SF4: Personalisation	3,23	11	Asymp. Sig.	,000
SF5: Rehearsability or Revisitability	4,67	9	a. Friedman Test	
SF6: Reviewability or reprocessability	6,35	6		
SF7: Simultaneity	6,38	5		
SF8: Configuration	6,79	4		
SF9: Multiple cues	3,64	10		
SF10: Language variety	5,17	8		
SF11: Parallelism	5,54	7		

*D. Task Factors*

The results in Table 5 shows that the differences amongst the mean ranks were statistically significant (Chi square value is significant at  $p < 0.05$ ). Confidentiality (Task Factor 2) is mostly considered when selecting the electronic media to use task equivocality had the least influence when selecting the electronic media to use in project communication.

*E. Organisational factors*

The results in Table 6 shows that the differences amongst the mean ranks were statistically significant (Chi square value is significant at  $p < 0.05$ ). The environment (Organisational Factor 1) is mostly considered when selecting the electronic media to use whilst the position of authority (Organisational Factor 3) has the least influence when selecting the electronic media to use in project communication.

*F. People factors*

The results in Table 7 shows that the differences amongst the mean ranks were statistically significant (Chi square value

is significant at  $p < 0.05$ ). The user's experience with the media (People Factor 1) is mostly considered when selecting the electronic media to use whilst cultural differences (People Factor 2) has the least influence when selecting the electronic media to use in project communication.

*G. Ranking of the factors influencing the electronic media selection*

The Friedman test was used to compare mean ranks of all 21 factors described in the above sections. Table 8 shows that System Factor 1 has the highest mean rank. The differences amongst the mean ranks were statistically significant (Chi square value is significant at  $p < 0.05$ ). Among the top 10 factors (based on the highest ten mean ranks), systems factors are more dominant than all the other factors for all respondents. The top ten factors are comprised of: six system factors, three task factors, one organisational factor and one people factor (due to a tie at No.10).

TABLE 5: RANKING OF TASK FACTORS (TF)

Factor	Mean Rank	Ranking	Test Statistics <sup>a</sup>	
TF1: Task Complexity	3,17	2	N	59
TF2: Task related confidentiality	3,24	1	Chi-Square	16,236
TF3: Task Interdependency	3,16	3	df	4
TF4: Task related accountability	2,97	4	Asymp. Sig.	0,003
TF5: Task equivocality	2,46	5	a. Friedman Test	

TABLE 6: RANKING OF ORGANISATIONAL FACTORS (OF)

Factor	Mean Rank	Ranking	Test Statistics <sup>a</sup>	
OF1: Environment	2,19	1	N	57
OF2: Economy	2,05	2	Chi-Square	9,879
OF3: Communication across authority	1,75	3	df	2
			Asymp. Sig.	0,007
			a. Friedman Test	

TABLE 7: RANKING OF PEOPLE FACTORS (PF)

Factor	Mean Rank	Ranking	Test Statistics <sup>a</sup>	
PF1: User's experience	2,36	1	N	59
PF2: Cultural differences	1,69	3	Chi-Square	21,436
PF3: Language differences	1,94	2	df	2
			Asymp. Sig.	0,000
			a. Friedman Test	

TABLE 8: RANKING OF ALL FACTORS

Factors	Mean Rank	Ranking	Test Statistics <sup>a</sup>	
System Factor 1	19,05	1	N	57
System Factor 3	14,34	2	Chi-Square	287,487
System Factor 2	14,11	3	df	21
Task Factor 1	13,54	4	Asymp. Sig.	0,000
Task Factor 2	13,54	5	a. Friedman Test	
Task Factor 3	13,41	6		
System Factor 8	12,96	7		
Organisation 1	12,71	8		
System Factor 7	12,24	9		
System Factor 6	12,18	10		
People 1	12,18	10		
Task Factor 4	12,07	11		
Organisation 2	12,03	12		
Task Factor 5	10,40	13		
System Factor 11	10,35	14		
System Factor 10	9,64	15		
Organisation 3	9,57	16		
People 3	9,04	17		
System Factor 5	8,80	18		
People 2	7,94	19		
System Factor 9	6,86	20		
System Factor 4	6,03	21		

V. CONCLUSION

From the demographics data, the research results (that is, the ranking of factors) are more biased towards electronic media users who are younger than 40 years, males, users with a minimum education qualification of a Bachelor’s degree and technical/professionals working in the engineering field.

The study investigated the frequency of use of 12 types of electronic media. These media were then ranked using mean ranks. The selection of electronic media for use were ranked as follows: 1-e-mails (most frequently used), 2-internet, 3-telephonic systems, 4-intranet, 5-instant messaging, 6-extranet, 7-multimedia presentations, 8-teleconferences, 9-video conferences, 10-electronic bulletin boards, 11-audio recordings, and 12-television networks. The finding corresponds to the findings from the previous research of George et.al. [1] where e-mails and telephonic systems are the two most commonly used communication media. From media richness theory, e-mails are considered to be more formal with slow feedback, whereas telephone is a more informal way of communication with immediate feedback [5]. It is reported in the qualitative research by Watson-

Manheim and Bélanger [25] that “If you talk to me on the phone I probably, after you tell me something, I’ll say, great! Can you send that to me as an e-mail?”. In engineering projects, collaborative problem solving and knowledge sharing are important activities which require mixture of communication media. From interviews reported by Niinimäki et al, [26] the project manager stated that “status reporting works very well [via email], as well as assignment of technical tasks, but if you want something more conceptual, out-of-the-box-thinking, it’s better to use the telephone”. Telephonic verbal communication fulfils the tasks of stay in touch and exchange urgent/timely information [21] but on the other hand it requires “a large share of constant attention that working on other tasks simultaneously is impossible” [26]. This implies that depending on the importance and urgency of the message to be communicated, the use of telephonic verbal communication can be applied more efficiently in the project communication.

This study investigated 22 factors which influence the choice of electronic media in four groups of factors identified by using various media selection theories: system characteristic factors, task factors, organisation factors and

TABLE 9: KEY FACTORS THAT INFLUENCE CHOICE OF MEDIA

Rank No	Factors Codes	Factor	Factor Definition
1	System Factor 1	Capability to carry information of media	Capability to carry desired amount of information from low amount of information to high amount of information.
2	System Factor 3	Immediacy of feedback	The degree to which a prompt response is required from the receiver by the sender of the communications.
3	System Factor 2	Usefulness	Ability of media to convey important, relevant, useful or valuable information.
4	Task Factor 1	Task complexity	Complex tasks require more information to be communicated to reduce uncertainty
5	Task Factor 2	Task related confidentiality	This when communication is not disclosed to unauthorised persons, or organisations.
6	Task Factor 3	Task Interdependency	People whose work involves tasks that are interdependent of others
7	System Factor 8	Configuration	Ability of media to communicate to a broader audience.
8	Organisation 7	Environment	The environment in which individuals do their projects influence the way they choose the forms of electronic media to use.
9	System Factor 7	Simultaneity	Refers to the ability of the medium to allow for full-duplex communication, that is, individuals can send and receive at once and simultaneously.
10	System Factor 6	Reviewability or reprocessability	Ability to re-examine and process the message to ensure accurate understanding, thus fostering conveyance.
11	People Factor 1	Users experience	One's prior experience with media influences the choice of electronic media.

people factors. For system factors, system characteristic factor 1 (capability to carry information of media) is mostly considered when selecting the electronic media to use followed by system characteristic factor 3 (immediacy of feedback) and then system characteristic factor 2 (usefulness). For task factors, task factor 2 (task related confidentiality) is mostly considered when selecting the electronic media to use followed by task factor 1 (task complexity) and then task factor 3 (task interdependency). Organisational factor 1 (environment) is mostly considered when selecting the electronic media to use followed by organisational factor 2 (economy) and then organisational factor 3 (communication across authority). For people factors, people factor 1 (users experience) is mostly considered when selecting the electronic media to use followed by people factor 3 (language differences).

The key factors which influence selection of electronic media consists of, six system factors, three task factors, one organisational factor and one people factor. The key factors are detailed in Table 9.

The factors which influence the choice of electronic media in terms of their characteristics are in order of decreasing influence: system factors, task factors, organisational factors and people factors. It can be concluded that system factors are more critical than the other factors in influencing the choice of electronic media: people tend to consider system characteristic factors first when choosing the form of electronic media to use. In project communication large amount of information often needs to be shared to various stakeholders simultaneously and feedback is required as quickly as possible to aid in the project decisions and project work. Electronic media that support these functions are considered first to allow the project to complete successfully. The systems characteristic factors were identified by media richness theory and media synchronicity theory and therefore

it seems that both these theories explain the choice of media in engineering project communication, rather than social influence theory [27]. This may be to the fact that project teams are temporary in nature (the team dissolves when project ends) therefore, the social proximity is low amongst the team members to socially influence each other on the choice of media.

## VI. LIMITATION AND RECOMMENDATION

This research focussed on the key factors that influence the choice of electronic media in the field of engineering therefore the results are not applicable to selection of electronic media for use in projects outside the engineering sector as there may be different factors that influence the selection of the electronic media in those sectors. Moreover, this study is limited to a smaller sample size and therefore it is recommended to expand this research by including bigger sample including non-engineering sectors.

The following factors are key and should be considered before implementation or decisions on which electronic media to use in projects communication can be done (in order of decreasing importance): capability to carry information of media, immediacy of feedback, usefulness, task complexity, task related confidentiality. We recommend engineering organisations to use the following most commonly used media in project communication: e-mails, internet, telephonic systems, intranet, instant messaging. However, it is important to note that there is no elimination phenomenon in terms of use communication technology tools, people may use one or more forms of electronic media at any time.

## REFERENCES

- [1] J. F. George, J. R. Carlson, and J. S. Valacich, "Media Selection as a



- Strategic Component of Communication,” *MIS Q.*, vol. 37, no. 4, pp. 1233–1251, 2013.
- [2] S. . Jarvenpaa and D. . Staples, “The use of collaborative electronic media for information sharing: an exploratory study of determinants,” *J. Strateg. Inf. Syst.*, vol. 9, no. 2–3, pp. 129–154, 2000.
- [3] P. Palvia, P. Pinjani, S. Cannoy, and T. Jacks, “Contextual constraints in media choice: Beyond information richness,” *Decis. Support Syst.*, 2011.
- [4] S. J. Benade and C. C. van Waveren, “Technology Management for Emerging Technologies,” in *Technology Management for Emerging Technologies, Proceedings of PICMET '12*, 2012, pp. 2395–2404.
- [5] R. L. Draft, R. H. Lengel, and L. K. Trevino, “Message Equivocality , Media Selection , and Manager Performance : Implications for Information Systems Author ( s ): Richard L . Daft , Robert H . Lengel and Linda Klebe Trevino Published by: Management Information Systems Research Center , University o,” *MIS Q.*, vol. 11, no. 3, pp. 355–366, 1987.
- [6] A. R. Dennis and J. . Valacich, “Rethinking media richness: Towards a theory of media synchronicity,” in *Systems Sciences, 1999. HICSS-32. Proceedings of the 32nd Annual Hawaii International Conference on (pp. 10-pp). IEEE.*, 1999.
- [7] P. Shachaf and N. Hara, “Behavioral complexity theory of media selection: a proposed theory for global virtual teams,” *J. Inf. Sci.*, vol. 33, no. 1, pp. 63–75, 2007.
- [8] J. Fulk, “Social construction of communication technology,” *Acad. Manag. J.*, vol. 36, no. 5, pp. 921–950, 1993.
- [9] A. Sivunen and M. Valo, “Team leaders’ technology choice in virtual teams,” *Prof. Commun. IEEE* ..., 2006.
- [10] K. Chen, D. Yen, S. Hung, and A. Huang, “An exploratory study of the selection of communication media: The relationship between flow and communication outcomes,” *Decis. Support Syst.*, 2008.
- [11] M. M. Carvalho, “Communication issues in projects management,” in *PICMET: Portland International Center for Management of Engineering and Technology, Proceedings*, 2008, pp. 1280–1284.
- [12] P. To, C. Liao, and J. Chiang, “An empirical investigation of the factors affecting the adoption of Instant Messaging in organizations,” *Comput. Stand. ....*, 2008.
- [13] P. Sun and H. Cheng, “The design of instructional multimedia in e-Learning: A Media Richness Theory-based approach,” *Comput. Educ.*, 2007.
- [14] F. Calefato and F. Lanubile, “Communication Media Selection for Remote Interaction of Ad Hoc Groups,” *Adv. Comput.*, vol. 78, pp. 271–313, 2010.
- [15] M. Zack, “Electronic messaging and communication effectiveness in an ongoing work group,” *Inf. Manag.*, 1994.
- [16] L. Plotnick, S. Hiltz, and R. Ocker, “Media choices over time in partially distributed teams,” *Syst. Sci. (HICSS), 2012* ..., 2012.
- [17] C. Saunders and J. W. Jones, “Temporal sequences in information acquisition for decision making: A focus on source and medium,” *Acad. Manag. Rev.*, vol. 15, no. 1, pp. 29–46, 1990.
- [18] N. Kwon and A. Onwuegbuzie, “Modeling the factors affecting individuals’ use of community networks: A theoretical explanation of community-based information and communication technology use,” *J. Am. Soc. ....*, 2005.
- [19] S. Lo and T. Lie, “Selection of communication technologies—A perspective based on information richness theory and trust,” *Technovation*, 2008.
- [20] J. D’Ambra and R. E. Rice, “Multi-method approaches for the study of computer-mediated communication, equivocality, and media selection,” *IEEE Trans. Prof. Commun.*, vol. 37, no. 4, pp. 231–239, 1994.
- [21] R. C. King and W. Xia, “Media Appropriateness: Effects of Experience on Communication Media Choice,” *Decis. Sci.*, vol. 28, no. 4, pp. 877–910, Oct. 1997.
- [22] J. Snyder and J. E. Lee-Partridge, “Understanding communication channel choices in team knowledge sharing,” ... *An Int. J.*, 2013.
- [23] A. Klitmøller and J. Lauring, “When global virtual teams share knowledge: Media richness, cultural difference and language commonality,” *J. World Bus.*, 2013.
- [24] D. Walonick, “A selection from survival statistics,” *StatPac Inc. Bloom. MN*, 2010.
- [25] M. B. Watson-Manheim and F. Bélanger, “Communication Media Repertoires: Dealing with the Multiplicity of Media Choices,” *MIS Q.*, vol. 31, no. 2, pp. 267–293, 2007.
- [26] T. Niinimäki, A. Piri, C. Lassenius, and M. Paasivaara, “Reflecting the choice and usage of communication tools in global software development projects with media synchronicity theory,” *J. Softw. Evol. Process*, vol. 24, pp. 677–692, 2012.
- [27] P. J. Carlson and G. B. Davis, “An Investigation of Media Selection among Directors and Managers: From ‘Self’ to ‘Other’ Orientation,” *MIS Q.*, vol. 22, no. 3, pp. 335–362, 1998.