Relationships of Factors for Successful ICT Projects Management

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***Abstract*—This study presents a framework and empirical analyses to measure relationships of factors for successful ICT projects management, by using the survey data from 1,678 managers and professionals working in a collaborative environment for Japanese software houses. The results of the research model using SEM show that there is a significant, strong and positive relationship between managers' roles and communication/atmosphere, accomplishment/challenge, and obstacles. Furthermore, communication/atmosphere is closely related to obstacles.**

Keywords—Managers' roles; communication/atmosphere; accomplishment/challnege; obstacles, SEM.

I. INTRODUCTION

As for project management in Information and Communication Technology (ICT) industry, the companies have strived to apply the most secure practice for ensuring the success of their projects. ICT projects reflect a dynamic team-based work structure; however, firms realize that designing and managing teams that work well together is a complex challenge [1, 2, 3]. The theoretical literature on ITC project management tends to assume that certain organizational rules, executive procedures, and environmental conditions are essential to the success of all types of projects. Meanwhile, management practitioners frequently ignore such general rules, because they are convinced that their particular projects pose entirely unique kinds of problems [4].

Projects vary greatly in terms of targets, duration, budget, staffing and difficulty. However, in all projects involve elements, such as communication, atmosphere, accomplishment, challenge and obstacles, need to be managed throughout the project life cycle. The project life cycle includes those phases; the initiation phase, the planning phase, the implementation (execution) phase, and the closing phase [5].

This paper empirically investigates relationships between managers' roles, communication, atmosphere, accomplishment, challenge and obstacles, within the collaborative environment, the ICT project team.

For estimating a fit between factors, advanced quantitative techniques of structural equation modeling (SEM) [6] have been employed. SEM has been established as an analytical tool, leading to hundreds of published applications per year. Overviews of the state of the method can be found in Cudeck et al.[7], Jöreskog [8], Millerand Form [9], and Shirai [10]. In this study, a suggested SEM model connects factors such as managers' roles, communication, accomplishment, obstacles by using a survey data of 1,678 Japanese software development managers and professionals.

This paper is organized as follows. Following the introduction on Section 1, Section 2 presents literature review on factors needed for successful ICT development teams. Section 3 outlines research model and hypotheses. Section 4 describes the data and variables. Section 5 presents the result of analysis. Finally, a summary of results are discussed in Section 6.

II. LITERATURE REVIEW

Successful project methodologies provide the framework for management cultures are based on trust, communication, cooperation, and teamwork [11].

A. Communication/Atomosphere

Communication is known as the most important component within any project. The project management literature frequently outlines the importance of good communication for success in projects [12, 13, 14, 15, 16]. The success of most projects, whether handled by a dedicated project team or a cross-departmental team, depends upon a set of crucial communication skills and techniques. Communication affects performance. Therefore, effective communication entrenchments are needed in order to get high-performance teams working on a project. Without well-established communication channels, it is likely that the project will fail. Successful project managers typically have good communications skills that include being able to effectively present the issues, listen and act on feedback, and foster harmony among team members. [1].

Charvat [1] suggests that there are three communication channels that managers need to establish once the project has started (See Fig. 1), and managing and improving these channels can dramatically increase chances of project success. Communication has long been documented as important for building and maintaining a productive interface between functional units.

Motivating people is a key activity of a project manager. The project management should be effective, initiating a collaborative and responsible working atmosphere within the project team and the partners. The project manager can create an atmosphere where informal communication is expected and reinforced.

Special attention has been paid to explain the concept of the project in order to create a single project vision and federate the team and the partners. According to Nash [17],

leaders distinguish themselves by strong will to win, focus on achieving the results, establishing the culture of readiness for changes, and creating an atmosphere of trust.

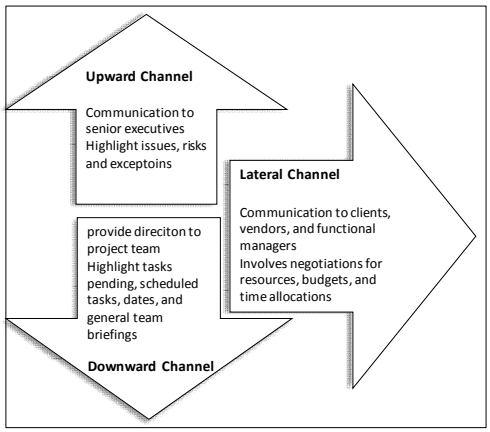

Fig. 1. Three communication channels (Based on Charvat, 2002)

B. *Roles of Project Managers*

Projects are managed in a work environment that is complex because each project is unique and dynamic [18]. In the context of project management, good leaders are required to assign appropriate importance to relationships, communicate their values, and at the same time pay suitable importance to processes [19].

Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. The project manager is the person responsible for accomplishing the project objectives [20].

In addition to working across functional and organizational environments, the project manager has other challenges such as providing leadership without documented, formal authority, and working in matrix organizations where unity of command is an issue [21]. Consequently, project managers are perceived to be leading a diverse set of people with little direct control over the team members [22].

C. *Accomplishment/Challenges*

Uniqueness, complexity, and unfamiliarity, are often considered as the characteristics of projects. Projects usually experience frequent personnel changes. People involved with projects are often dispersed when projects end, which creates challenges for generating, transferring, and sharing knowledge [23]. Projects are often associated with change, habitually facing resistance. Consequently, leadership is a determinant of success, as it provides vision and ability to cope with change [24]. The challenge for the project manager is to make best and most effective use of the team that is selected [25].

One of the challenges of project leadership is its limited role as a transformational leader. Helping subordinates develop to their fullest potential is an integral part of transformational leadership; however, projects may offer a limited role for transformational leadership from this perspective in traditionally functional hierarchy organizations [26]. A limited role is attributed to project formation and organizational structure that are different from those of traditional organizations, including the time-bound participation of people in multiple projects reporting to different project leaders. The project manager is the person who can challenge and who is responsible for accomplishing the project objectives.

D. *Obstacles*

In the IT sector, the results of the Chaos survey from The Standish Group in 2014 shows that 31.1% of all projects are cancelled before they ever get completed, while the average is only 16.2% for software projects that are completed on-time and on-budget. The failure has been posited to result from managers not implementing projects that align with the business strategy in global businesses [27]. Lyytinen and Hirschheim [28] identified 4 major categories of ITC failure; correspondence failure, process failure, interaction failure and expectation failure. According to Sauer [29], failure occurs when the level of dissatisfaction of supporters with a system rises to the extent when there is no longer enough support to sustain it. Problems in any of these three relationships will be the source of consequential difficulties for the other two, and unless the problems can be solved, this will lead ultimately to total withdrawal of support and system failure. Projects fail to meet time and cost targets due to people-related issues, such as poor morale, poor human relations, poor productivity, and lack of commitment [30].

III. RESEARCH MODEL AND HYPOTHESES

Based on literature, the author measures relationships of those factors for successful ICT projects management, including (1) managers' roles, (2) communication/atmosphere, (3) accomplishment/challenge, and (4) obstacles. In this study, a research framework was developed as shown in Fig. 2.

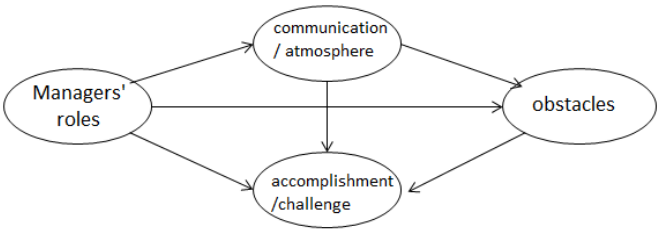

Fig. 2. A research framework

More specifically the author will investigate the following six hypotheses regarding an effective ICT management:

H1: Managers' roles will affect communication/ atmosphere.
H2: Managers' roles will affect accomplishment/challenge.
H3: Managers' roles will affect obstacles.
H4: Communication/ atmosphere will affect accomplishment/challenge.
H5: Obstacles will afect accomplishment/challenge.
H6: Communication/ atmosphere will affect obstacles.

In structural equation modeling, the author considers the causalities among all variables, especially between the result

and the latent variables. Latent variable enables us to find many compiled observed variables at the same time based on the notion of structure. This works for generating and verifying hypothesis to find factors and causalities.

IV. DATA

The survey was sent to several software development companies in Tokyo, Japan, from January 2002 to March 2002 [31], and amassed 1,678 valid responses. The questionnaire was sent by mail to project managers of each firm, and they delivered the questionnaire to each project member.

Since the survey was conducted through project managers of the companies where Enokida and Matsuodani [31] closely associated with, a response rate was close to100%. Most of the questionnaires are asked by a 4 point scale.

Table I shows the demographics of the data. 84% of the participants are male, and most of them are between 26 and 40 years old, having rich experiences in software development. One third of them are managing the project. There are short projects lasted less than one month, while more than 800 projects are going over one year long. A list of variables is shown in Table II.

Table III contains the Pearson correlation coefficient between all pairs of twenty variables with the two-tailed significance of these coefficients. All variables correlate fairly well and are statistically significant, and none of the correlation coefficients are particularly large; therefore, multicollinearity is not a problem for these data.

TABLE I. THE DEMOCRAPHICS OF DATA

Variables		N		N
Sex	・male	1,276	・female	265
Age	・25 or below	35	・26-30	499
	・31-40	656	・over 41	53
Affiliation	・user	676	・employee	500
	・software house	56	・consultant	33
	・individual entrepreneurs	13	・Others	40
Role within the project	・manager	521	・Professional	1,081
Professional experiences	・less than 2years	275	・3-5 years	428
	・6-10 years	416	・over 11years	563
Your work place	・disperse	772	・concentrate	807
	・others	16	-	-
Number of people at the work place	・less than 5 people	239	・6-20	595
	・21-50	388	・51-100	196
	・more than 101	278	-	-
Management style of the project	・top down	928	・independent	596
Length of your participation in the project	・less than 1 month	94	・less than 3 mo	212
	・less than 6 mo	200	・less than 1 yr	325
	・over 1yr	804	–	–

V. RESULTS

Testing the efficacy of the structural equation model was conducted by AMOS 22, and the major results of analysis are shown in Fig. 3. The path diagram highlights the structural relationships. In this diagram, the measured variables are enclosed in boxes, latent variables are circled, and arrows connecting two variables represent relations, and open arrows represent errors.

TABLE II. THE LIST OF VARIABLES FROM THE SURVEY

Roles of Project Managers	q7	Appropriate supports
	q8	Ambitious management
	q26	The good feeling, respect for the manager
	q21	Having good communication
	q6	Satisfied with the management and project policy
	q19	Resolved unclear role responsibilities
	q3	The project role is determined by the right man in the right place, it operated smoothly
	q33	Exactly fair evaluation
	q5	Project policy and management policy have been told
	q9	Sharing of necessary information
	q39	This project will be successful
	q11	Your role has been clearly explained
	q4	Responsibility on the project is appropriate
Communication/ Atmosphere	q24	Communication with members of other teams is good
	q25	Informal communication with project members is good.
	q22	Communication between teams of each of the project is a good.
	q23	Communication with team members is good
	q36	Satisfied with workplace relationships
	q27	Atmosphere conducive to aggressive behavior
	q40	Hope to work with the same leader and same members in the next project.
	q28	Cooperative atmosphere of "trying to achieve the goals of the job."
Accomplishment/ Challenge	q31	It is possible to increase one's ability
	q32	Increase your market value
	q1	Given a challenging worth work
	q38	A sense of accomplishment for the day-to-day work.
Obstacles	q37	Have ever received the unreasonable treatment.
	q17	By a sudden emergency, a trouble came to your work
	q18	There were difficult problems associated with the adjustment of the user and the vendor
	q30	Troubles happened by uncooperative members.
	q29	Because of the power relationships between organizations and members of the project, it is difficult to work.
	q14	Working under time pressure.
	q10	Disturbance sectionalism

TABLE III. CORRELATIONS OF VARIABLES

	q1	q10	q11	q14	q17	q18	q19	q21	q22	q23	q24	q25	q26	q27	q28	q29	q3	q30
q1	1	.210**	323**	-.025	.052*	.044	.239**	.295**	.287**	.255**	.246**	.244**	.278**	.328**	.367**	.203**	.366**	.215**
q10		1	318**	.119**	.243**	229**	.318**	.319**	.310**	261**	.239**	.243**	.320**	.340**	.369**	.409**	.363**	.372**
q11			1	.042	.111**	099**	.394**	.368**	.343**	312**	.291**	.288**	.325**	.391**	.421**	.280**	.404**	.211**
q14				1	.293**	259**	.151**	.065**	.080**	087**	.041	.051*	.046	.085**	.079**	.138**	.164**	.167**
q17					1	569**	.273**	.110**	.103**	107**	.022	.072**	.137**	.143**	.208**	.226**	.181**	.268**
q18						1	.300**	.110**	.104**	107**	.033	.052*	.140**	.101**	.159**	.208**	.165**	.256**
q19							1	.424**	.338**	276**	.272**	.290**	.456**	.363**	.417**	.350**	.448**	.322**
q21								1	.491**	405**	.434**	.479**	.675**	.506**	.436**	.319**	.370**	.251**
q22									1	483**	.636**	.551**	.413**	.494**	.467**	.409**	.352**	.319**
q23										1	.433**	.489**	.326**	.374**	.368**	.297**	.263**	.315**
q24											1	.614**	.360**	.401**	.362**	.287**	.238**	.207**
q25												1	.393**	.459**	.390**	.317**	.270**	.236**
q26													1	.489**	.458**	.335**	.409**	.310**
q27														1	.572**	.483**	.389**	.319**
q28															1	.466**	.460**	.359**
q29																1	.358**	.515**
q3																	1	.313**
q30																		1

	q31	q32	q33	q36	q37	q38	q39	q4	q40	q5	q6	q7	q8	q9
q1	.605**	.550**	.366**	.292**	.202**	.426**	.332**	.428**	.402**	.313**	.373**	.336**	.295**	.260**
q10	.281**	.284**	.296**	.329**	.344**	.256**	.297**	.247**	.332**	.298**	.353**	.330**	.271**	.350**
q11	.317**	.276**	.345**	.325**	.270**	.365**	.406**	.435**	.370**	.462**	.429**	.416**	.344**	.396**
q14	.029	.046	.096**	.148**	.320**	.090**	.182**	.081**	.094**	.054*	.200**	.106**	-.014	.124**
q17	.150**	.140**	.144**	.182**	.367**	.142**	.215**	.076**	.146**	.115**	.225**	.159**	.132**	.181**
q18	.103**	.116**	.113**	.161**	.347**	.128**	.238**	.103**	.140**	.104**	.233**	.165**	.132**	.154**
q19	.283**	.302**	.433**	.364**	.340**	.362**	.442**	.363**	.397**	.343**	.449**	.502**	.460**	.416**
q21	.281**	.271**	.485**	.432**	.303**	.358**	.379**	.349**	.443**	.391**	.414**	.602**	.499**	.357**
q22	.312**	.318**	.340**	.495**	.278**	.371**	.379**	.282**	.474**	.343**	.379**	.327**	.290**	.364**
q23	.281**	.250**	.284**	.530**	.265**	.292**	.266**	.295**	.471**	.233**	.254**	.303**	.209**	.300**
q24	.217**	.217**	.311**	.404**	.183**	.320**	.244**	.250**	.359**	.265**	.277**	.289**	.228**	.304**
q25	.244**	.251**	.336**	.486**	.254**	.349**	.294**	.278**	.422**	.290**	.287**	.317**	.251**	.276**
q26	.329**	.304**	.490**	.422**	.317**	.346**	.413**	.324**	.480**	.383**	.435**	.659**	.608**	.377**
q27	.357**	.357**	.404**	.489**	.344**	.356**	.380**	.345**	.493**	.401**	.406**	.416**	.365**	.379**
q28	.395**	.398**	.415**	.485**	.323**	.418**	.476**	.341**	.496**	.391**	.456**	.446**	.420**	.420**
q29	.275**	.280**	.323**	.505**	.463**	.300**	.340**	.294**	.459**	.261**	.357**	.343**	.307**	.329**
q3	.318**	.321**	.414**	.368**	.356**	.383**	.467**	.468**	.420**	.399**	.595**	.486**	.425**	.444**
q30	.336**	.238**	.278**	.412**	.452**	.229**	.294**	.250**	.384**	.218**	.307**	.300**	.273**	.267**
q31	1	.757**	.448**	.338**	.256**	.392**	.330**	.373**	.436**	.336**	.359**	.324**	.297**	.280**
q32		1	.458**	.323**	.240**	.413**	.332**	.350**	.406**	.318**	.383**	.328**	.323**	.263**
q33			1	.413**	.339**	.358**	.374**	.423**	.420**	.381**	.451**	.486**	.423**	.342**
q36				1	.414**	.341**	.361**	.331**	.612**	.305**	.382**	.387**	.323**	.331**
q37					1	.302**	.340**	.317**	.413**	.232**	.372**	.336**	.256**	.311**
q38						1	.441**	.362**	.451**	.333**	.452**	.392**	.329**	.305**
q39							1	.362**	.496**	.398**	.505**	.431**	.377**	.377**
q4								1	.398**	.353**	.423**	.406**	.313**	.309**
q40									1	.356**	.457**	.456**	.372**	.349**
q5										1	.559**	.444**	.415**	.392**
q6											1	.544**	.468**	.481**
q7												1	.712**	.450**
q8													1	.391**
q9														1

TABLE IV. RELIABILITY TEST

FIT indices	Recommended level	Research Model
CMIN/DF	CMCMIN/DF	6.954
CFI	>0.90 (Bentler, 1990)	0.900
IFI	>0.90 (Bollen, 1989)	0.901
RMSEA	<0.08(Browne and Cudeck,1993)	0.060
AIC	Smaller values suggest a good fitting (Akaike, 1974)	3220.622
p-value	>0.05	0.000

When SEM is used to verify a theoretical model, a better goodness of fit is required for SEM analysis [6]; the better the fit, the closer the model matrix and the sample matrix. By means of various goodness-of-fit indexes, including the comparative fit index (CFI) [32], the incremental fit index (IFI) [32], and the root mean squared error of approximation (RMSEA) [33], the estimated matrix can be evaluated against the observed sample covariance matrix to determine whether the hypothesized model is an acceptable representation of the data. In general, incremental fit indexes (*i.e.*, CFI, IFI) above 0.90 signify good model fit. RMSEA values lower than .08 signify acceptable model fit, with values lower than .05 indicative of good model fit [33]. The research model is shown in figure 3; CFI=0.900, IFI=0.901, RMSEA= 0.060 (see table IV). The Path Coefficient for both structural models suggested that the regression coefficient for all constructs show significance. Since all of the indexes satisfy the cut-off values, these results are regarded as acceptable.

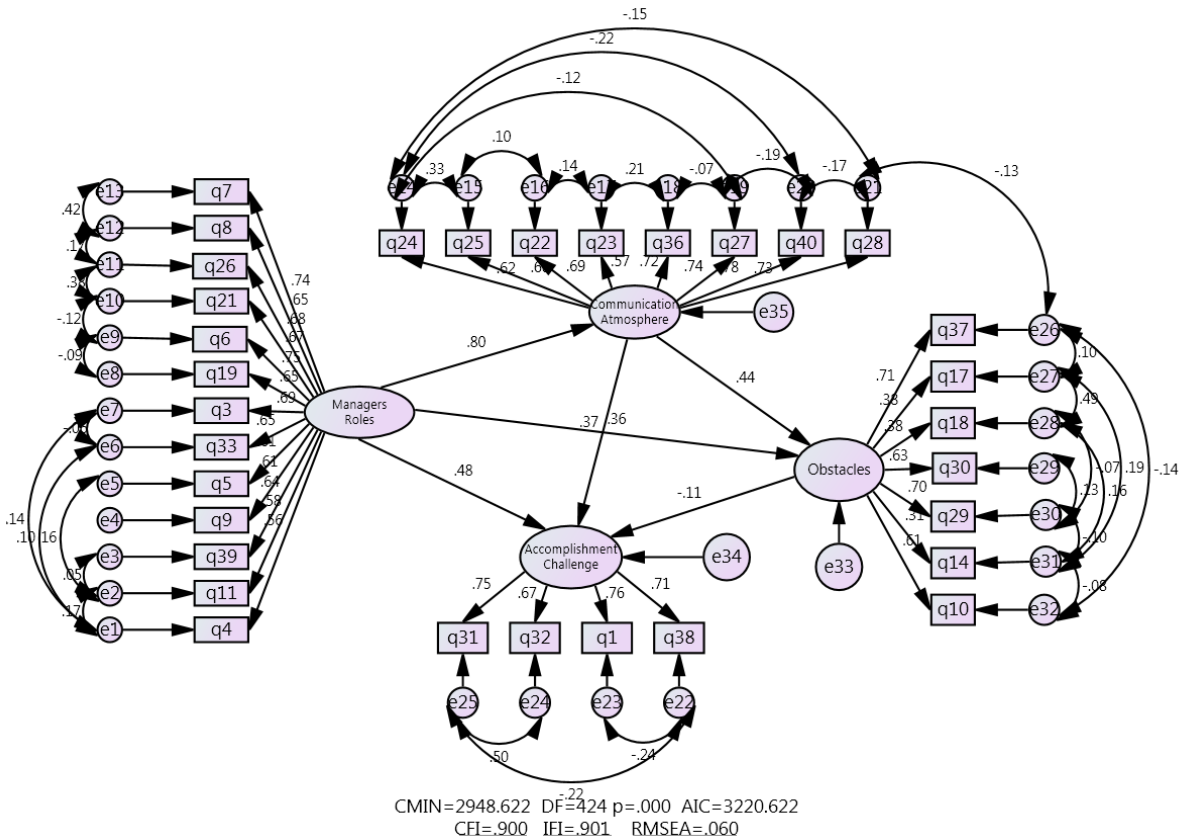

Fig. 3. A research model

TABLE V. THE PATH COEFFICIENTS OF RESEARCH MODEL

construct			Std. weight	Unstd. weight	S.E.	C.R. (t-value)	P value
Communication_Atmosphier	<---	Managers_Roles	0.803	0.939	0.053	17.803	***
Obstacles	<---	Managers_Roles	0.355	0.515	0.068	7.593	***
Obstacles	<---	Communication_Atmosphier	0.438	0.543	0.06	9.094	***
Accomplishment_Challenge	<---	Communication_Atmosphier	0.365	0.38	0.052	7.359	***
Accomplishment_Challenge	<---	Managers_Roles	0.481	0.585	0.061	9.585	***
Accomplishment_Challenge	<---	Obstacles	-0.11	-0.092	0.035	-2.655	0.008
q4	<---	Managers_Roles	0.559	1			
q11	<---	Managers_Roles	0.578	1.171	0.057	20.658	***
q39	<---	Managers_Roles	0.643	1.23	0.06	20.33	***
q9	<---	Managers_Roles	0.606	1.274	0.065	19.555	***
q5	<---	Managers_Roles	0.614	1.292	0.065	19.728	***
q33	<---	Managers_Roles	0.646	1.175	0.055	21.487	***
q3	<---	Managers_Roles	0.686	1.313	0.058	22.775	***
q19	<---	Managers_Roles	0.654	1.32	0.065	20.451	***
q6	<---	Managers_Roles	0.754	1.418	0.063	22.368	***
q21	<---	Managers_Roles	0.669	1.307	0.063	20.768	***
q26	<---	Managers_Roles	0.68	1.295	0.061	21.059	***
q8	<---	Managers_Roles	0.649	1.295	0.063	20.448	***
q7	<---	Managers_Roles	0.744	1.431	0.064	22.266	***
q24	<---	Communication_Atmosphier	0.617	1			
q25	<---	Communication_Atmosphier	0.601	0.946	0.039	24.089	***
q22	<---	Communication_Atmosphier	0.692	1.15	0.053	21.906	***
q23	<---	Communication_Atmosphier	0.569	0.902	0.047	19.14	***
q36	<---	Communication_Atmosphier	0.718	1.199	0.053	22.506	***
q27	<---	Communication_Atmosphier	0.739	1.262	0.057	21.952	***
q40	<---	Communication_Atmosphier	0.783	1.297	0.059	21.946	***
q28	<---	Communication_Atmosphier	0.734	1.221	0.056	21.665	***
q38	<---	Accomplishment_Challenge	0.708	1			
q1	<---	Accomplishment_Challenge	0.764	1.254	0.055	22.841	***
q31	<---	Accomplishment_Challenge	0.751	1.354	0.064	21.16	***
q32	<---	Accomplishment_Challenge	0.672	1.203	0.059	20.242	***
q37	<---	Obstacles	0.708	1			
q17	<---	Obstacles	0.375	0.563	0.041	13.807	***
q18	<---	Obstacles	0.384	0.523	0.038	13.633	***
q30	<---	Obstacles	0.625	0.921	0.044	20.799	***
q29	<---	Obstacles	0.704	1.075	0.047	22.789	***
q14	<---	Obstacles	0.308	0.429	0.04	10.671	***
q10	<---	Obstacles	0.608	0.86	0.043	20.048	***

A result of the research model for relationships among factors relating to an effective ICT management; (1) managers' roles, (2) communication/ atmosphere, (3) accomplishment/challenge, and (4) obstacles, shows the following six findings;

H1: There is a significant, strong and positive relationship between managers' roles and communication/ atmosphere.

H2: There is a siginificant and positive relationship between managers' roles and accomplishment/challenge.

H3: There is a siginificant and positive relationship between managers' roles and obstacles.

H4: There is a siginificant and positive relationship between communication/ atmosphere and accomplishment/ challenge.

H5: There is a siginificant, but weak and negative relationship between obstacles and accomplishment/ challenge.

H6: There is a siginificant and positive relationship between communication/ atmosphere and obstacles.

VI. CONCLUSIONS

This paper presents a framework and empirical analyses for the survey data from 1,678 managers and professionals working in the collaborative environment for Japanese software houses to measure relationships of factors, such as managers' roles, communication/atmosphere, accomplishment/challenge, and obstacles, for a successful ICT projects management. Effective and efficient project management is a critical success factor for any project. [34]

The results of the research model suggest that managers' roles are closely related to communication/atmosphere, accomplishment/challenge, and obstacles.

Furthermore, communication/atmosphere is closely related to obstacles, such as "Have ever received the unreasonable treatment (Q37)", "By a sudden emergency, a trouble came to your work (Q17)", "There were difficult problems associated with the adjustment of the user and the vendor (Q18)", "Troubles happened by uncooperative members (Q30)", "Because of the power relationships between organizations and members of the project, it is difficult to work (Q29)". "Working under time pressure (Q14)", and "Disturbance sectionalism (Q10)." The previous survey conducted by CompTIA in 2007 also suggested that poor communication is the number one cause of project failure, as communication is a component of a project at every stage, and once managers understand the objectives of the project, the expected results and the budget restrictions, they need to clearly communicate that information to everyone involved [35]. Poor communication from stakeholders is also listed as one of problems of IT projects delays, along with inadequate planning, a high degree of uncertainty due to a new technology, and constant changes in the scope [36]. A survey conducted by Mnkandla [37] also suggested that a good project communications plan is a key to project success.

The results of this study imply that the roles of managers are important for collaborative environments, and managers have to design their project teams carefully in order to maintain smooth project operation, and achieve a successful project completion.

A project team is generally quite a diverse group of people. Diversity within a project team can be cultural, geographical, organizational, functional, age related, level of education and so on. Project management communication within such diverse groups is a challenge at the best of times.

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