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Empirical analysis of the effectiveness of training programs

An Empirical Study of the Conditions for Successful Knowledge Transfer in Training Programs

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An Empirical Study of the Conditions for Successful Knowledge Transfer in Training Programs

Satoru Mikami [*] and Mitsuaki Furukawa[†]

Abstract

The shortage of qualified human capital is a major impediment to development. In the field of international development cooperation, training programs (TPs) have been widely employed to enhance the capacity of workforces in developing countries. This paper investigates the conditions in which TPs can contribute not only to individual human resource development but also to organization-level reform and innovation in developing countries. Regression analyses of TP monitoring records as well as follow-up e-mail interviews with former participants of ICT training programs sponsored by Japanese International Cooperation Agency reveal that bilateral communication between training participants and the dispatch organizations during the training plays a key role in increasing the probability of successful organization-level transfer of individual-level learning, irrespective of the original level of organization's absorptive capacity.

Keywords: training and dialogue programs, human resource development, development aid, transfer of training, absorptive capacity

1. Introduction

Human resources are one of the most crucial factors in the promotion of national economic growth. The shortage of qualified human capital is undoubtedly obstructing the development of third world countries. In the field of international development cooperation, training programs[1] (hereafter TPs) have been widely employed to enhance the capacity of workforces in developing countries. The Japan International Cooperation Agency (JICA) is one donor organization offering such programs. It has been conducting TPs for decades to assist capacity development as a long-term endogenous and a "holistic process encompassing multiple, interlinked layers of capacities" (Hosono et al. 2011, 180). JICA describes its Training and Dialogue Programs as "a form of technical cooperation that JICA carries out in Japan. Some of the knowledge that Japanese society has accumulated, including its background in areas such as organizational know-how and social systems, can only be understood through first-hand experience. The programs are an important means of technical cooperation that supports human resource development and resolving issues in developing countries."[2] Since 1954, when Japan joined the Colombo Plan, TPs have been expanded to include over 10,000 training participants from 140 countries annually (JICA 2013).[3]

Recent focus on aid effectiveness, the significance of which was recognized in the Accra Agenda for Action on Aid Effectiveness in 2008, has also prompted a renewal of interest in the role of capacity development in enhancing aid work. OECD/DAC (2006) defines capacity development as the process through which people, organizations, and society as a whole unleash, strengthen, create, adapt, and maintain capacity over time. Emerging donors such as

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[1] JICA labels its training programs as "Training and Dialogue Programs," to emphasize the interactive element of the program among the actors involved, particularly the interaction between the organizer and the participants and among the participants. In this paper, however, we will use the generally-used term "training programs."
http://www.jica.go.jp/english/our_work/types_of_assistance/tech/acceptance/training/ (access August 10, 2014)
[2] http://www.jica.go.jp/english/our_work/types_of_assistance/tech/acceptance/training/ (access August 10, 2014)
[3] The number of people who have been trained by JICA outside of Japan surpasses 20,000.

China and India, which play increasingly important roles outside of the traditional OECD/DAC framework, are extensively using TPs as one of the main pillars of their assistance as well. In short, TPs continue to be one of the most popular and established forms of international cooperation to this day.

At the same time, however, it is also important to note that there have been longstanding criticisms regarding the effectiveness of TPs. For one thing, there are some serious doubts about whether participants in TPs really learn anything by taking courses. Such doubts stem from cases in which civil servants in developing countries are sent to the training sites not because the trainings offered there will provide them with the skills and knowledge that the dispatching organizations need to acquire, but because trainings can be used as convenient rewards for political clients or a tactic to isolate political enemies from the workplace. Due to the lack of clearly specified training policy and training participant selection procedures, trainings have been frequently implemented in a chaotic way, contributing nothing to local capacity while wasting resources (Tessema et al 2005).

Moreover, even if training participants actually learn something during TPs, there has been a tendency for them to leave the public sector after the training. Tessema et al (2012) revealed that the public servant training programs offered to Eritrean government since its independence resulted in an internal and external brain drain due to lower salary levels in the public sector and the turbulent political climate, many government employees who received overseas training sponsored by World Bank were reported to have left the public sector and gone into private companies, NGOs or moved abroad, seeking higher salaries and better benefits. Although some may argue that the "deserters" still contribute to development as long as they remain within the country, this is hardly justifiable considering the chronic human resource shortage in the public sector.

Notwithstanding these criticisms against TPs as a form of development aid, not all TPs have been failures. There have been cases where training contributed to institution building in

developing countries. One example is the National Statistics Office (NSO) of the Philippines –

10% of its 3,000 staff employees are former participants of TPs offered by JICA. This

organization, whose responsibilities include collecting, analyzing and managing statistical data

in the country, has been sending staff to training programs provided by JICA since the 1970s, as

part of a program for enhancing the organizational capacity to operate international training

courses. This has led the office to design and implement its own training programs on statistics

for Myanmar, Cambodia, Laos and other countries, at the request of United Nations agencies,

based on what ex-participants have learned from TPs over the years.[4]

Another example of success was a TP named "Establishing and Managing Halfway

Houses" from 2006 to 2010. During the programs, training participants had opportunities to visit

Japanese prisons and learn about the latest prison management systems in Japan, such as

management of daily lives of prisoners, management of rehabilitation facilities, and vocational

training. The observation tour inspired participant discussion on how they could apply what they

saw to the relevant facilities in their home countries, and led to creative solutions such as

rehabilitation programs involving the private sector after returning to their home country.[5]

As these anecdotes show, the pessimistic view that "much administrative training

activity in developing countries has been a failure"[6] does not represent the whole story. The

truth is that there are both successes and failures. One problem is that practitioners of TPs are not

sure about the factors that separate successes from failures. While JICA has shifted its goal from

the impact on individual trainees to the impact on organizations and enabling environments, we

cannot find in a recently published guideline for JICA TPs, which relies exclusively on

qualitative approach, any well-grounded tips on how to achieve that goal (JICA 2012,.4).

The aim of this paper is to explicate this puzzle of TPs using a particular TP conducted

in Japan as an example. In so doing, however, we try to avoid becoming too idiosyncratic. Rather,

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[4] JICA 2014.
[5] JICA 2014.
[6] Cited in McCourt and Sola 1999.

utilizing accumulated knowledge on training from various disciplines, we try to abstract TPs and make them as comparable to trainings in other areas as possible, so that not only the uniqueness of the JICA TPs but also generalizable patterns can be illuminated. The structure of this paper is as follows: in the next section, we will review preexisting studies on training in the field of labor economics, development studies and business administration, pointing out that modifications to the existing analytical frameworks are necessary in order to conduct a study of TPs. Then, in the third section, we posit the hypotheses that on the factors which chiefly determine the probability that learning from training has ramifications at the organization level. Specifically, we expect that the probability will be dramatically increased by bilateral communications between training participants and the dispatch organizations during the training period regardless of the original level of absorptive capacity of the organizations. This argument of ours challenges the view that "the route between individual and organizational change is a one-way street: organizational change can lead to individual change, but not vice versa" (McCourt and Sola 1999, 71). The fourth section explains our research design, with the results reported in the fifth section. The last section presents policy implications as well as the limitations of our study and a possible agenda for future research.

2. Literature review

Research on training has been an inter-disciplinary endeavor that involves at least three areas of study: labor economics, business administration, and development studies. In the discipline of labor economics, we can find at least two streams of research that include "training" as a key word. One stream consists of studies of strategic interactions between firms and employees regarding the cost sharing of general training. General training, which is offered by firms with a view to increase labor productivity, is an opportunity for workers to invest in post-school self-education for their future career development. Therefore, training generates first and foremost conflict of interests between employees who have an incentive to leave the firm that paid for their training on the one hand and employers who need to recover the cost of training by exploiting the enhanced productivity of the training participants. Second, training generates tensions between firms in the same industry because the pool of trained workers can be seen as common goods for all companies in that industry, which inevitably generates incentives for free-riding: Firms can hire workers trained by other firms without paying the cost of training; however, if no firm shares the cost of training in the industry, all firms suffer from the shortage of qualified human resources. Finding equilibrium in such situations as well as the hidden roles played by some institutions – like certificate or turnover restriction – has been the chief area of study for this stream of research (Montizaan et al. 2013; Majumdar 2007; Acton and Golden 2003; Ashar et al. 2013; Acemoglu and Pischke 2000).

Another stream of research is the evaluation of government-sponsored job training for the unemployed. Researchers have tried to estimate the impact of training as precisely as possible within a usually non-experimental framework and evaluated government policy in terms of efficiency. Articles included in the special issue of *The Review of Economic Studies* in 1997 are cases in point (Eberwein et al 1997; Bonnal et al 1997; Heckman et al 1997; Hotz et al 1997). Many non-RCT methods like matching, difference-in-differences, instrumental variables,

and regression discontinuity were developed as a result of these inquiries. Most studies on training in development studies are an extension of this stream of research. Researchers applied both RCT and non-RCT estimation strategies to the donor-led trainings conducted in the developing countries, and discussed efficiency and effectiveness (Rola et al. 2002; Friis-Hansen et al. 2011; Davis et al. 2011; Todo 2010; Mano et al. 2011; Feder et al. 2004).

By contrast, researchers on training in the discipline of business administration have been more interested in the organization-level outcome of training, with the focus on areas such as firm performance and innovation (Chen et al. 2013; Dumas and Hanchane 2010; Chochard and Davoine 2011; Almeida and Carneiro 2009; Thang and Buyens 2008; Huang 2001; Clausen 2013). Even when dependent variables of inquiry are individual-level outcomes of training, these are always related to organization-level changes such as an individually perceived sense of innovation or *transfer of training*: whether training participants apply in their workplace what they have learnt in the training (Bates and Khasawneh 2005; Whelan-Berry et al. 2003; Baran et al. 2002; Quartey 2012; Lim and Morris 2006).

Another characteristic of the studies on training in the field of business administration is that they do not ask whether training *per se* has any impact or not. Rather they tend to be more interested in the conditions under which training becomes most effective. The three groups of factors that have been proven to matter in training effectiveness are: *trainee characteristics*, *training design*, and *work environment* (Baldwin and Ford 1988; Velada et al. 2007).[7] Liebermann and Hoffman (2008), for instance, show that practical relevance, rather than general satisfaction, enhances trainee motivation and the actual transfer of what they learn, while Van den Bosshe et al. (2010) reveal that feedback from multiple sources is a key factor in the transfer of learning. The third factor, *work environment*, is unique to the discipline of business administration of which importance in *transfer of training* has long been emphasized (Tracey et

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[7] There is even literature that exclusively concentrates on how to measure these variables precisely in different cultures (Holton III et al. 2000; Kirwan and Birchall 2006; Coetsee et al. 2006).

al. 1995; Rouiller and Goldstein 1993). However, some recent studies rejected the influence of supervisor support, one component of work environment, on transfer (Van der Klink et al. 2001) while other research revealed that supervisor support influences *transfer of training* only indirectly (Nijman et al. 2006).

As shown above, among the preexisting studies reviewed here, the analytical framework developed in the field of business administration is the most comprehensive one. In actual practice, past monitoring and evaluation reports of JICA training, which have relied exclusively on anecdotal episodes, constructed their argument utilizing this framework. Also, the main research question in the field of business administration -- the search for the conditions under which organization-level outcomes of training materialize -- has a lot in common with our concern: when do training participants successfully implement the action plans they design during the training period to resolve issues of within their organizations?

However, we cannot simply assume that their findings are applicable to the kinds of TPs we are studying. This is because, first of all, most studies in business administration use internal training as a sample in their empirical analysis. Even if the sample consists of employees from multiple firms, they are all usually from the same country: Korean conglomerates (Lim and Morris 2006), small and medium-sized enterprises in Taiwan (Huang 2001), print-media companies in Ghana (Quartey 2012), manufacturing companies in Turkey (Baran et al. 2002), Irish software companies (Acton and Golden 2003) or firms in Morocco (Dumas and Hanchane 2010). In contrast to such in-country trainings, TPs invite participants from all over the globe, which makes the analysis of TPs more difficult than can be examined through standard impact analyses. In addition, as a part of inter-governmental cooperation, TPs, particularly those by JICA, exclusively target human resources in the public sector, whereas samples of studies in business administration are either exclusively from private sector employees or a mixture of both public and private sector employees. The utility function of private sector training participants is expected to differ from that of public sector training participants, causing possible

differences in the motivation of training transfer. Third, organizations that send training participants to TPs sponsored by donors are not necessarily true believers in training effectiveness. There is a possibility that they send redundant work force members just because the cost of training can be externalized to foreign governments. By contrast, organizations included in the study of business administration have to pay the cost of training by themselves. They are inevitably eager to get a return from the investment in human resource development.

In short, it is unwise to assume that causal relationships applicable to such private training programs are the same in TPs in which participants' organizational affiliation and nationality are heterogeneous. With this unique configuration of training, training participants, and dispatching organizations in TPs in mind, we need to explore a method for empirical analysis that no one has attempted so far.

3. Hypotheses

Training can have direct consequences in terms of a trainee's emotive state, or feelings, such as satisfaction with the training and the resulting self-efficacy (A1) as well as trainee knowledge and/or skills (A2). These direct consequences can have ramifications for both the trainee themselves (B1) and the organization to which they belong (B2). What is crucial is the fact that these two ramifications (B1 and B2) are not necessarily compatible with, nor complementary to each other, as was pointed out in the pre-existing studies in the field of labor economics. For example, on returning home, a trainee may be able to increase their earnings by using the capability enhanced by the training. But, they might instead opt for the maximization of personal utility by changing their workplace or by immigrating to another country. Such behavior of an ex-trainee would bring no benefit to the dispatching organization or country. An organization that sends an employee will only be able to gain a TP dividend if the newly obtained knowledge or skills of the trainee are applied to the workflow and contribute to the enhancement of

operational efficiency. Organization-level ramifications can in turn influence the country in which the organization is located (C). Innovations introduced by organizations that send participants for training can subsequently be emulated by other organizations within the country, resulting in increases in national average productivity and hence contributing to the promotion of economic growth in the country as a whole.[8] The TPs are offered not for personal well-being but for the development of the country. In this paper, therefore, we focus on the second type of ramification (B2), which bridges trainee-level impacts (A1 and A2) and country-level development (C).
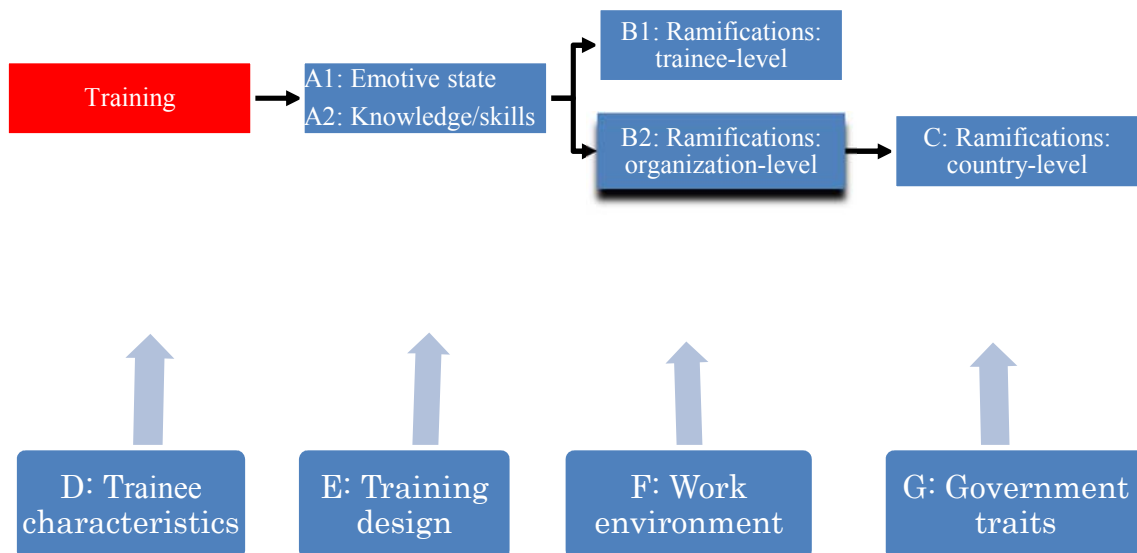
Figure 1. Causal chain surrounding TPs

Preexisting studies in the field of business administration have identified three groups of factors that may be related to these direct and indirect consequences: *trainee characteristics (D)*, *training design (E)*, and *work environment (F)*, which we have incorporated into the approach for this research. We examine the following three levels of factors; the first is the trainee-level factor (gender, age, work experience, pre-training capacity level, post-training capacity level,

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[8] The role of the state in national economic development is debatable and is beyond the scope of this paper. Here we simply assume that the more efficient state organizations are, the more likely the country is to develop if all other growth related factors are equal.

degree of capacity building during the training course, and in-class performance). The second is the course-level factor (training contents, length, class size, within-class sex-ratio, age variance, and nationality fractionalization), and the third is the organization-level factor (whether an organization had identified problems to be solved by the trainee beforehand and the availability of collaborators).These three levels of factors are related to our main concern (training ramifications in the organization). It is important to note that trainee characteristics as predictors of organization-level ramification include not only the pre-training attributes of training participants (D) but also trainee-level consequences of training, or *learning* (A2).

The challenge for us was to find out conditions under which an *open seminar style* training of individuals serves not only as a means toward their own career development (B1) but also as a driver of organization-level change (B2). Trainings that are intended to make a difference at an organizational level usually take the form of a *closed seminar style,* with certain commonly set goals within a homogeneous environment, such as chain stores of one company. However, organizations that send training participants to TPs spread all over the world and inevitably bring heterogeneity among classmates as well as distance between training participants and their respective organizations. TPs are similar to open seminars, where participants from various organizations join courses independently to find a solution for problems related to their own agendas. Likewise, each organization sending its member to TPs has its own problems (both actual and latent) for which training participants are expected to find solutions. Whether a participant can bring back any knowledge or capacity useful for the dispatching organization seemingly depends on two factors: the organization's absorptive capacity and the action plan written by the trainee. The former is concerned with whether the organization can specify an organizational agenda to be addressed by the trainee before it dispatches the trainee. The action plan, on – the other hand, is a proposal designed by each participant for their own organization at the end of the course. The relative significance of these

two factors, however, is based on the intuitive expectations of the practitioners of training however this has never been tested systematically.

To examine the organization-level ramifications of TPs, therefore, we need several modifications in the preexisting analytical framework. First, we have to add a fourth group of factors: government traits of the country in which the organization is located (G). The country-level factors we examine include degree of e-government (because, as discussed shortly, we use training participants in ICT courses as a sample), degree of political freedom, and the budget cycle. Second, considering the open-seminar style of TPs, we need to explicitly control for the characteristics of the tasks set by training participants and their organizations. This is because, in addition to the influence from the *work environment* (with factors such as absorptive capacity of the organization and the availability of collaborators), the difficulty of training transfer is expected to vary depending on the contents of the action plan.

Likewise, at the course level we need to pay attention to the possible psychological effects of class composition: the same degree of diversity (in terms of sex, age, nationality and culture) may have different impacts depending on whether the trainee belongs to a minority or majority group. Usually, heterogeneity reduces the efficiency of running the course at the training site. However, training participants may obtain inspiration during the course because of the very heterogeneity, and the intensity of inspiration may be expected to be greater for training participants who belong to minority groups in the class. Hence, we examine the effect of individual participants' majority/minority status (the age difference from the class average, the proportion of classmates from the same country/region, and the proportion of same sex classmates), in addition to the purely course-level variables on diversity.

Last, but not least, we should examine the possible effects of the measures taken to reduce the distance between the participant and dispatching organization in TPs: communication between participants and the dispatching organizations during the course. This factor, related to *trainee characteristics*, *training design* and *work environment* at the same time, is the most

important in a practical sense because the variable is amenable to intervention by donor practitioners, unlike in the case of other factors. The physical distance from the workplace disconnects training participants from their respective organizations, which is a double-edged sword: it can, coupled with the heterogeneity in the classroom, give the trainee an opportunity to discover what has been seen but has not been recognized in the usual working environment; at the same time, however, it can deprive the trainee of a sense of their organization's expectations. Given the fact that the ultimate decision-making power lies in the hand of the organization, no useful knowledge/skills are likely to be applied to daily operations unless they either fit with the organization's priorities or the organization can be convinced of its utility.

The problems caused by disconnectedness in TPs have long been recognized by donors, who then introduced a classic countermeasure: requiring the training participants to draw up an action plan in line with their organization's strategy at the end of the course. In spite of this innovation, however, in TPs, the *transfer of training* remains unsolidified. We, therefore, focus on a pre-emptive measure. Specifically, for an effective transfer, we insist, the communication between training participants and the dispatching organizations must remain very close throughout the course of the training. The rationale behind this is that the minimization of the gap between what a trainee learns and what their organization needs is only possible when the trainee can serve as a conduit between the training site and their own home organization. Once the gap widens due to the lack of communication, the training participants, on returning home, would have little incentive to contribute to overcoming the difficulties of persuading the dispatching organization to adopt their action plan because they are no longer under the direct supervision of the trainers and may opt to use what they have learnt for their own personal benefit instead.

If this hypothesis is relevant and the transfer of training is proven to be neither contingent on training participants' attributes nor on initial absorptive capacity of the organization – factors that are usually beyond the control of donors – then the facilitation of

bilateral communications between the training participants and their organizations during the training can serve as a powerful tool for donors to raise the probability that the action plan is really implemented at home by the former training participants. For these reasons, we test, first and foremost, whether the implementation rate of action plans varies depending on the communication taken between trainee and organization during the course. We also focus on the effect of pre-training problem identification by the dispatching organization, because many TDP practitioners intuitively assume that this is an important factor that contributes to a successful transfer of training. Other factors are treated as control variables. Our hypotheses can be explicitly stated as follows:

H1：The probability that TPs have ramifications at the organization level is larger if the organization that is sending participants to the training has specified the problems to be solved by the training participants beforehand.

H2：The probability that TPs contribute to the addressing an organization-level agenda is larger if bilateral communications between training participants and dispatching organizations, rather than unilateral or no communication, have been conducted during the course.

4. Research Design

4.1 Data

TPs are not exclusive to Japan. However, the need for data accessibility requires us to use monitoring data from JICA's TPs. Furthermore, from among various options of training programs offered by JICA, we selected ICT courses because this area greatly contributes to employment creation and has a significant potential to contribute to the development of the country.

Over the last two decades, ICT (information and communication technology) has changed people's lifestyles enormously, and its continuous innovation has provided an unprecedented boost to the world economy. Even in the public sector, where skepticism of electronic media and services was dominant until the end of the twentieth century (Potnis, 2009, 41), the idea of e-Government has gradually spread into every corner of the world, becoming one of the most significant innovations in the public sector (Fose 2002). Still, as we can see through the United Nations e-Government Survey,[9] the quality of online service delivery varies widely and progress has been extremely slow, especially in transitional and developing countries, largely due to poor infrastructure, high costs and various social and political barriers (Azad, Faraj, Goh, and Feghali 2010; Ifinedo and Singh 2011). Evidence has shown that successful utilization of ICT can reduce financial costs as well as transaction times, thereby improving internal workflow and enhancing the effectiveness of public sector institutions. Therefore, e-government has an important role to play, now and in the future, by contributing to the attainment of poverty reduction targets and other social and economic development goals (United Nations 2012).

JICA's Okinawa International Center (OIC) was quick to respond to this necessity and started to offer "e-Government promotion" courses for developing countries, targeting chief information officers (CIOs), project managers, database architects, information security specialists, and web application developers who work for ministries and/or agencies in central or local government authorities. The program is structured in a way that interested organizations can send training participants for each course, thereby covering all areas needed to construct an effective e-government system in three years. The aim of the programs is not only to improve the ability of training participants, but also to contribute to the implementation of an organization-level agenda in regard to e-government. Each course conducts pre- and

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[9] "E-Government" is defined by the United Nations (UN) as "utilizing the internet and the World Wide Web for delivering government information and services to citizens" (United Nations 2001, 1)

post-training objective tests and monitors training participants' performance not only during the training but also after finishing the course, by conducting follow-up surveys at three, six, and twelve months after completion. The sample we used for our analysis consists of 221 training participants, whose ICT training in OIC was conducted sometime between July 15, 2008 and June 14, 2011, excluding six participants who did not complete the training. Monitoring records by trainers contain participant attributes (sex, age, country, pre- and post-training test scores, contents of action plans, etc.) as well as course attributes such as class size, length, and contents. To supplement JICA's monitoring records, we sent e-mails to former training participants in April 2013, inviting them to participate. 108 ex-training participants (48.9%) agreed to undertake a semi-structured interview by e-mail in which we primarily asked about:

- whether they still work for the same organization,

- when they began working for the dispatching organization,

- whether the dispatching organizations had identified any problems they expected the training participants to solve through action plans prior to the training,

- how often training participants communicated with their organizations during the course, and

- whether action plans were implemented as they had proposed.

Due to the large number of unit non-responses as well as several item non-responses in the e-mail survey, the final sample size was reduced to 91.[10] However, the distribution of monitored variables of the subset is largely the same as those of the targeted sample, while most of the differences in means/proportions between the respondents and the non-respondents are not statistically significant. This suggests that the sampling bias is small, and therefore we can fairly safely generalize the results of our analyses based on the subset.

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[10] If at least explanatory variables were available for all observations, we would have been able to use a sample selection model instead.

To give a general picture of training, the following description of data, excluding information we gained via e-mail interviews, is based on all available observations while the correlation matrix among explanatory variables (discussed later) is based on the selected samples, because the chief purpose of the latter is to avoid multicolinearity in multivariate regression.

Table 1. Descriptive Statistics (variables from monitoring record only)

	Targeted sample (n=221)						Responded sample (n=91)						Difference [= responded (n=91) - remaining (n=130)]
	Min.	1st Q.	Median	Mean	3rd Q.	Max.	Min.	1st Q.	Median	Mean	3rd Q.	Max.	
female	0.00	NA	NA	0.28	NA	1.00	0.00	NA	NA	0.24	NA	1.00	-0.07
age	20.00	29.00	33.00	33.69	37.00	60.00	21.00	30.00	34.00	33.91	37.00	47.00	0.37
pre	18.75	50.00	59.26	59.44	68.75	93.75	37.50	54.58	62.50	62.81	72.45	87.50	5.73 ***
post	45.83	79.17	87.50	85.69	95.83	100.00	50.00	79.17	87.50	86.45	95.83	100.00	1.31
difference	-12.50	14.81	25.00	26.25	37.50	75.00	-12.50	12.50	25.00	23.64	31.25	60.00	-4.43 **
sbmean	87.21	94.33	96.25	95.89	98.00	100.00	87.21	94.39	96.45	96.11	98.11	99.58	0.37
management	0.00	NA	NA	0.37	NA	1.00	0.00	NA	NA	0.32	NA	1.00	-0.08
system.development	0.00	NA	NA	0.30	NA	1.00	0.00	NA	NA	0.27	NA	1.00	-0.05
training	0.00	NA	NA	0.22	NA	1.00	0.00	NA	NA	0.23	NA	1.00	0.02
database	0.00	NA	NA	0.17	NA	1.00	0.00	NA	NA	0.20	NA	1.00	0.05
apitems	1.00	1.00	1.00	1.33	2.00	3.00	1.00	1.00	1.00	1.29	1.50	3.00	-0.08
Philippines	0.00	NA	NA	0.20	NA	1.00	0.00	NA	NA	0.26	NA	1.00	0.10 *
Thailand	0.00	NA	NA	0.11	NA	1.00	0.00	NA	NA	0.08	NA	1.00	-0.05
Rwanda	0.00	NA	NA	0.06	NA	1.00	0.00	NA	NA	0.05	NA	1.00	-0.01
VietNam	0.00	NA	NA	0.06	NA	1.00	0.00	NA	NA	0.05	NA	1.00	-0.01
EGR2008	0.19	0.38	0.49	0.44	0.50	0.58	0.23	0.37	0.49	0.44	0.50	0.58	0.00
FH2008	6.00	25.00	39.00	45.45	61.00	99.00	6.00	25.00	58.00	47.31	61.00	97.00	3.16
disfisstart	3.00	28.00	185.00	137.30	200.00	338.00	3.00	34.00	185.00	136.20	200.00	338.00	-1.98
difendfis	5.00	14.00	96.00	109.80	200.00	344.00	5.00	14.00	99.00	110.00	198.00	344.00	0.26
near	0.00	NA	NA	0.28	NA	1.00	0.00	NA	NA	0.29	NA	1.00	0.02
days	65.00	67.00	84.00	86.00	104.00	110.00	65.00	68.00	95.00	86.86	100.00	110.00	1.45
tour	0.05	0.05	0.06	0.06	0.07	0.08	0.05	0.05	0.05	0.06	0.07	0.08	0.00
classsize	6.00	8.00	10.00	10.09	12.00	14.00	6.00	8.00	10.00	9.92	12.00	14.00	-0.28
femaleratio	0.09	0.17	0.25	0.28	0.42	0.50	0.09	0.17	0.25	0.28	0.42	0.50	0.00
sdage	2.37	3.56	4.61	4.89	6.06	8.53	2.37	3.56	4.43	4.75	5.84	7.98	-0.22
fractionalization	0.44	0.78	0.82	0.80	0.85	0.88	0.44	0.78	0.81	0.79	0.85	0.88	-0.01
agefromCM	-12.92	-3.78	-0.33	0.03	3.71	19.73	-12.92	-3.18	0.33	0.27	3.77	11.13	0.40
sames	0.09	0.50	0.73	0.63	0.82	0.91	0.09	0.50	0.73	0.64	0.80	0.91	0.01
samec	0.07	0.13	0.18	0.20	0.25	0.67	0.08	0.13	0.18	0.21	0.25	0.67	0.01
samer	0.08	0.25	0.42	0.41	0.57	0.89	0.08	0.27	0.44	0.41	0.56	0.89	0.01

Table 1. Descriptive Statistics (variables from monitoring record only)

Note: *** p < .01, ** p < .05, * p < .10.

female: dummy for female trainees; age: trainee's age at the time of training; pre: pre-training test scores; post: post-training test scores; difference: post-training scores minus pre-training scores; sbmean: average performance scores in the class room; management: dummy for participants in CIO course or in Project Management course; system.development: dummy for trainees whose action plan includes the aspect of "training"; database: dummy for trainees whose action plan includes the aspect of "database construction"; apitems: number of aspects included in action plan; Philippines: dummy for the participants from the Philippines; Thailand: dummy for the participants from Thailand; Rwanda: dummy for the participants from Rwanda; VietNam: dummy for the participants from Viet Nam; EGR2008: degree of e-governance level in the year 2008; FH2008: degree of political freedom in the year 2008; disfisstart: days between the start of fiscal month and the start of training; difendfis: days between the end of the training and the start of new fiscal month; near: dummy for trainees who had at least one colleague who returned to the same organization at about the same time; days: length of training; tour: the proportion of tour days in the entire training; classsize: size of training class; femaleratio: the proportion of female trainees within the class; sdage: standard deviations of age within the class; fractionalization: fractionalization index based on nationality; agefromCM: deviation age from the mean age in the class; sames: the proportions of the same sex trainees within the class; samec: the proportions of classmates from the same country; samer: the proportions of classmates from the same region.

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4.2 Descriptive statistics

Participants came from 44 countries in five regions: 48.4% from Asia, 17.6% from Africa, 14.0% from the Middle East, 10.0% from Central and South America, 6.79% from Europe, and 3.17% from Oceania. The country that sent the largest number of training participants was the Philippines (20.4%), followed by Thailand (10.9%), Rwanda (5.9%), and Viet Nam (5.9%). The degree of e-government in 2008 (variable name: *EGR2008*) ranged from 0.186 to 0.584, while the degree of political freedom and civil liberties in the same year (variable name: *FH2008*)[11] ranged from 6 to 99. Fiscal cycles, which can determine the financial feasibility of action plans, also differed from country to country. Time from the start of the fiscal year to the start of training (variable name: *disfisstart*) ranged from 3 to 338 days, with an average of 137.3 days, while time from the return from the training to the start of next fiscal year (variable name: *difendfis*) ranged from 5 to 344 days, with an average of 109.8 days.

Training participants were not randomly selected in these countries. Information on JICA trainings is usually disseminated through the recipient country's own mechanisms. The organizations that receive the information and those in the organizations who are allowed or recommended to participate in the trainings are factors that lie beyond JICA's control. The selection of the participants can be based either on merit or on privilege. In total, the number of organizations that sent training participants amounted to 122, or 3.743 organizations per country. The number of training participants sent from one organization ranged from 1 to 10, with an average of 1.811.

Of the 221 training participants 28.1% were women. Training participants' ages ranged from 20 to 60, with an average of 33.7 years old. They all worked in the public sector, engaging in ICT-related jobs. The average pre-training test score (variable name: *pre*) was 59.4 while that

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[11] This is a simple sum of sub-scores of political rights and civil liberties. Scores were retrieved from the web site of Freedom House. http://www.freedomhouse.org/ (accessed April 2013).

of post-training test score (variable name: *post*) was 85.7. The average performance score in the class (variable name: *sbmean*) ranged from 87.2 to 100, with a mean of 95.9.[12] Years of job experience, a question asked about in the e-mail interviews, ranged from 0 to 24 years, with an average of 7 years. 27.6% of training participants had colleagues who returned from training at OIC at approximately the same time (variable name: *near*).

In total, there were 24 classes during this period. Average duration of training (variable name: *days*) was 86 days, ranging from the shortest of 65 to the longest of 110 days. A five-day observation tour to related facilities in Japan was included in all courses, which means that tour days as a proportion of the entire length of the course (variable name: *tour*) ranged from 0.045 to 0.077, with a mean of 0.061. The size of class (variable name: *classsize*) ranged from 6 to 14, with an average size of 10.09. The proportion of female training participants within each class (variable name: *femaleratio*) ranged from 0.091 to 0.500, with an average of 0.279. Standard deviations of age within each class (variable name: *sdage*) ranged from 2.373 to 8.531, with an average of 4.885. The probability that two participants randomly chosen from the same class would have different nationalities (variable name: *fractionalization*) ranged from 0.444 to 0.876, with an average of 0.801.

Class-level heterogeneity in terms of gender, age, and national/regional affiliation, when perceived through the eyes of participants with different personal attributes, can be treated as individual-level variables: the proportion of same sex classmates (variable name: *sames*) ranged from 0.091 to 0.909, with an average of 0.629; age deviation from the class average (variable name: *agefromCM*) ranged from -12.9 to 19.7, with an average of 0.03; the proportion of classmates from the same country (variable name: *samec*) ranged from 0.071 to 0.667, with an average of 0.198; the proportion of classmates from the same region (variable name: *samer*) ranged from 0.077 to 0.889, with an average of 0.409.

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[12] The variable did not vary much as the high mean score indicates. However, we continued to use the variable to ensure that every available factor was examined exhaustively.

Contents of the courses have been classified into five groups: the course for chief information officers (20.8%), for project managers (15.8%), for security experts (14.9%), database architects (23.1%), and web application developers (25.3%). As noted above, JICA intended that the first two courses would be attended by managers (variable name: *management*) while specialists would participate in the latter three – however this was not necessarily the case.

At the end of the course, each trainee drew up an action plan that they committed to implement after their return to home country. Eighteen items were identified as possible aspects contained in an action plan. "System development" was the most popular item that training participants included in their action plans (30.3%), followed by "training" (21.7%) and "database" (16.7%). The average number of aspects included in the action plan (variable name: *apitems*) was 1.326. 71.6% of training participants said that, prior to the training, the organization had identified problems that training participants were expected to address in their action plans (variable name: *pre.training.problem.recognition*). 66.4% of training participants communicated with their organization bilaterally during the training (variable name: *bilateral communication1*). This figure increased to 75.0 % if the training participants who answered "not often" are also included in the category of "bilateral communication" (variable name: *bilateral communication2*). 66.0% of training participants reported that their action plans were adopted and implemented by their organizations. 17.6% of training participants had changed jobs by the time of the e-mail interview.

4.3 Estimation strategy

In testing the hypotheses using the sample, there are several points we should bear in mind. First, the structure of the sample is somewhat complicated. We have four level explanatory variables: country (government traits), organization (work environment), course (training design), and trainee (trainee characteristics), and they have only a partial hierarchy: training participants are

nested within courses, organizations and countries. Also, organizations are nested within countries. However, courses are neither nested within the organizations nor within countries. Neither organizations nor countries are nested within courses either. Training participants from the same organization participated in different courses. With these limitations in mind, we decided not to use multi-level analysis, which is the standard method used for analyzing hierarchical data.[13]

Second, our chief explanatory variables -- pre-training problem recognition by the organization and bilateral communication between trainee and organization during the course -- were not assigned randomly, which means that we cannot simply regard the difference in proportions as the impact. At least we need to control correlations among variables on the right hand side of the equation when estimating impacts of each predictor. Luckily, our main predictors are not correlated so strongly with each of the other control variables, as shown in Table 2. However, we can see several pairs of variables with high ($|r| \geqq 0.5$) correlations, such as those between the management-course dummy and the proportion of the tour within the course ($r=0.932$). These might produce misleading standard errors if we jumble all variables into one single multivariate regression. Also, the proportion of female participants and the proportion of the same sex classmates are arithmetically related even though the absolute value of the correlation coefficient was below 0.5.

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[13] See, Maas and Hox (2004).

Table 2. Correlation matrix of explanatory and control variables.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
A	1																																	
B	.181	1																																
C	.157	.806	1																															
D	.125	.009	-.044	1																														
E	-.070	-.003	-.006	.058	1																													
F	.023	-.087	-.099	.045	.075	1																												
G	.249	-.023	-.125	.159	.030	.212	1																											
H	.174	.053	-.017	.087	-.038	-.652	.603	1																										
I	.058	-.208	-.129	.130	-.095	.455	.448	-.024	1																									
J	-.056	.000	.038	.042	.605	.044	.002	-.035	-.016	1																								
K	-.042	-.027	-.113	.004	.376	.455	.166	-.243	.263	.218	1																							
L	.126	-.027	.012	.044	.071	.102	.021	-.020	-.039	-.062		1																						
M	-.061	.213	.123	.059	-.043	-.131	-.033	.082	-.075	.021	-.341	-.138	1																					
N	-.056	.051	.020	-.212	.010	-.201	-.028	.142	-.272	.060	-.276	-.310	.597	1																				
O	-.133	.050	-.049	-.094	.043	-.083	.033	.093	-.116	-.024	.093	-.274	-.264	-.210	1																			
P	.043	-.115	-.073	-.101	.108	.159	-.064	-.179	.009	.284	-.083	.067	.016	.081	-.183	1																		
Q	.022	-.114	-.098	.189	-.019	-.024	.188	.166	.099	.066	-.126	.149	-.016	-.152	-.157	-.142	1																	
R	.044	-.038	.022	-.022	-.142	-.078	-.109	-.021	.044	-.131	.044	-.044	-.016	-.118	-.122	-.142	-.074	1																
S	-.063	.167	.134	-.022	-.133	-.230	.071	.243	.132	-.150	-.055	-.044	-.323	.003	-.032	-.142	-.074	-.057	1															
T	-.036	-.281	-.263	-.030	.068	.082	.183	.075	.219	-.055	.190	-.087	-.185	-.038	-.153	.418	.227	-.380	.250	1														
U	-.032	-.277	-.197	-.125	-.036	.115	.088	-.026	.020	.268	-.190	.051	.054	.106	.127	.374	-.116	-.145	-.003	-.118	1													
V	-.007	-.012	-.045	-.083	-.042	-.040	-.115	-.057	-.166	.117	.048	-.071	-.120	-.149	-.037	-.020	-.110	-.020	-.030	.172	-.070	1												
W	.028	.055	.131	-.034	.062	.148	.061	-.074	.213	-.044	.376	-.233	.004	.238	-.023	.088	.030	-.030	.172	.155	-.031	-.568	1											
X	.019	.076	.125	-.239	.124	-.149	-.091	.051	-.055	-.034	-.218	.299	-.155	.224	.088	.177	-.108	-.150	-.004	.042	.139	.003	-.155	1										
Y	.072	.038	.086	.012	-.389	-.315	-.027	.235	-.187	-.034	-.884	-.247	-.185	.310	-.110	.134	-.011	-.004	-.076	.109	.208	-.048	-.359	.112	1									
Z	-.062	-.032	-.091	.000	.393	.359	.067	-.241	.217	-.245	.932	.128	.310	.127	-.185	.374	-.145	-.020	-.287	.250	-.219	.043	-.359	-.148	-.992	1								
AA	-.134	-.070	-.117	.050	.050	.151	-.030	.073	.073	.248	.030	.196	-.189	.046	.068	.049	.127	.174	.049	-.138	.065	.105	-.112	-.034	-.389	.072	1							
AB	-.003	-.223	-.168	.233	-.193	-.031	.136	.131	.214	-.015	-.260	.193	.046	-.128	-.072	.196	-.072	.174	.091	.155	.249	-.203	.016	-.034	.416	-.389	-.571	1						
AC	.053	.064	-.024	-.043	.320	.113	.122	.002	-.083	-.041	.467	-.402	.160	.195	-.095	-.011	-.124	.054	.129	-.076	.052	.179	.060	-.015	-.567	.558	.500	-.571	1					
AD	-.049	-.094	-.090	.049	.220	.082	.085	-.001	.162	.169	.170	-.272	.083	.117	-.163	.198	.141	.075	.129	-.161	-.027	.044	.080	.063	-.295	.280	.012	.013	.199	1				
AE	-.073	-.075	-.036	.130	.867	-.086	-.018	.057	-.132	-.115	-.012	-.108	-.092	.061	-.056	.198	.032	-.147	-.178	.153	.033	-.069	-.089	.167	-.005	.002	.158	.105	-.015	.159	1			
AF	-.181	-.049	-.017	-.836	.055	.060	-.147	-.163	-.115	.027	.150	-.071	-.029	.108	.150	.008	.054	-.154	-.064	-.021	.037	.180	-.015	.150	-.151	.149	.274	-.459	.222	.006	-.092	1		
AG	-.008	.021	.095	-.161	-.159	-.093	.029	.098	-.049	-.082	-.219	.175	-.151	.144	-.184	.349	-.062	-.157	-.075	.116	.124	-.073	-.033	.050	.314	-.305	-.274	.118	-.205	-.718	-.076	.045	1	
AH	.121	.047	.036	.026	-.165	.061	.127	.049	.112	-.112	-.024	.131	-.007	-.126	-.129	.192	.201	-.157	.188	-.044	-.094	-.114	.024	.053	-.046	-.114	.122	-.123	.069	-.019	-.151	-.025	.245	1

Note. A: pre.training,problem.recognition, B: bilateral communication1, C: bilateral communication2, D: female, E: age, F: pre, G: post, H: difference, I: sbmean, J: years.in.the.work.place, K: management, L: system.development, M: training, N: database, O: apitems, P: Philippines, Q: Thailand, R: Rwanda, S: VietNam, T: EGR2008, U: FH2008, V: disfisstart, W: difendfis, X: near, Y: days, Z: tour, AA: classsize, AB: femaleratio, AC: sdage, AD: fractionalization, AE: agefromCM, AF: sames, AG: samec, AH: samer.

Therefore, we take the following estimation strategy:

(1) From among 576 combinations of explanatory variables that exclude the ones with high multicolinearity, we choose six patterns in a way that all predictors could be examined at least twice (Table 3). In addition, by alternating the two versions of "bilateral communication" for each model, we get twelve models in total;

(2) Before starting estimation with these twelve initial models, we first conduct bivariate analyses to examine how each of the explanatory variables is, at first glance, associated with the outcome variable, the implementation of original action plan. In doing so, we use the spline smoothing method for continuous predictors to see if we need to assume any non-linearity in the subsequent multivariate regressions. The smoother we use is the cubic spline with 5 knots.[14] If the null hypothesis that the smoother is a straight line could be rejected, we can treat the effect as a non-linear function using the smoother in the subsequent multivariate analyses;

(3) Then we move on to the multivariate regressions using each combination. After initial specification we change the function form of smoothers that has 0 degrees of freedom to linear, and eliminate the variables with a variance inflation factor (VIF) of more than three to avoid multicolinearity. We repeat this procedure for every model.

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[14] We have chosen 5 knots taking rather small number of observations (=91) into consideration. The default of the package "mgcv" is 10.

	Explaining variables	Model1	Model2	Model3	Model4	Model5	Model6	Number of estimations
Main predictors	pre.training.problem.recognition	■	■	■	■	■	■	6
	bilateral communication 1	■	■	■	■	■	■	6
	bilateral communication 2							0
Country traits	Philippines	■	■	■	■	■	■	6
	Thailand	■	■	■	■	■	■	6
	Rwanda	■	■	■	■	■	■	6
	VietNam	■	■	■	■	■	■	6
	EGR2008	■	■	■	■	■	■	6
	FH2008	■	■	■	■	■	■	6
	disfisstart	■	■	■			■	4
	difendfis				■	■		2
Trainees traits	female	■	■	■	■			4
	age	■					■	2
	years.in.the.work.place		■			■		2
	pre	■	■	■			■	4
	post	■	■	■			■	4
	difference				■	■		2
	sbmean	■	■	■	■	■	■	6
Course traits	management					■	■	2
	days	■	■					2
	tour			■	■			2
	classsize				■	■		2
	femaleratio	■	■	■	■			4
	sdage					■	■	2
	fractionalization	■	■	■			■	4
	sames					■	■	2
	agefromCM			■	■			2
	samec				■	■		2
	samer	■	■	■	■	■	■	6
Task traits	system.development	■	■	■	■	■	■	6
	database	■	■	■	■	■	■	6
	training	■	■	■			■	4
	apitems				■	■		2
	near	■	■	■	■	■	■	6
	Number of variables	22	22	22	22	22	22	

Table 3. Initial six models of regression

5. Result

5.1 Bivariate analysis

We first report the results of a series of bivariate analyses.

<u>Main predictors</u>

The proportion of training participants who implemented their action plans after their return is

69.7 % when the organizations had identified problems to be solved before they sent training

participants. This figure is 13.7 % larger than the proportion when the organization sent training participants without having identified problem beforehand (56.0%). However, this difference is not significant in statistical sense (*p*=.326).

The proportion of action plans implemented by the training participants who communicated with dispatching organizations bilaterally during the course is 72.1%, which is 18.8% larger than the proportion of implementation by those who did not (53.3%). Again, the difference does not reach statistical significance (*p*=.123). Alternative operationalization of bilateral communication yields roughly the same result: 71% vs. 50%, and *p*=.121. The three bars in the far left in Figure 2 show the 95% confidence interval of coefficients of the dummies that represent pre-training problem identification and the two versions of bilateral communication. All point estimates (solid circle) are above 0, but 95% confidence intervals include 0.
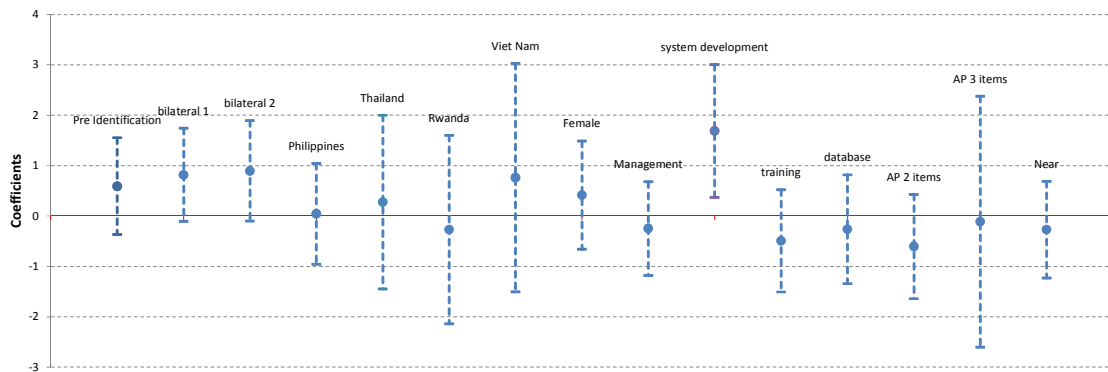
Figure 2. Results of bivariate analyses: Dummy variables
Note. Reference category of each dummy is the complement set of the category except for the dummies representing the number of action plan items, AP2 items and AP3 items, where reference category is trainees whose action plan contains only one item.

Government traits

The top four countries that have sent the largest numbers of training participants to OIC are the Philippines, Thailand, Rwanda and Viet Nam. The proportions of action plans implemented by training participants from these countries are 66.7% (the Philippines), 71.4% (Thailand), 60.0%

(Rwanda), and 80.0% (Viet Nam). Although training participants from Thailand and Viet Nam are more likely and those from Rwanda are less likely to implement their action plans, these differences are not statistically significant, as can be seen from the four 95% CIs of coefficients of country dummies in Figure 2.

Neither the degree of e-government nor the degree of political rights nor civil liberties of the country show any significant effect. Also, there is no necessity to consider non-linearity for these variables in implementing multivariate regression. The null hypothesis that linear and non-linear modeling of the effect of the degree of e-government are essentially the same is not rejected ($p=.298$). The estimated linear impact of the degree of e-government is 2.750, which is not significant ($p=.254$). The same applies to the impact of the degree of political rights and civil liberties of the country. The null hypothesis of no difference between non-linear and linear modeling is not rejected ($p=.219$) and the estimated linear coefficients (-0.015) is not significant ($p=.162$).

By contrast, the impact of time between the start of fiscal year and the start of training fits the non-linear models better than linear ones ($p=.006$) and shows a statistically significant impact ($p=.049$). The performance of training participants in terms of action plan implementation does not increase linearly according to the interval between the start of fiscal year and the start of training; rather, training participants who started the training about 150 days after the beginning of fiscal year show better performance than those who began 50 days or 240 days after the start of fiscal year (first left panel of Figure 3). On the other hand, non-linear modeling of the impact of time between the end of the training and the start of next fiscal year represents no significant improvement compared to linear modeling ($p=.448$). Linear model estimation of the impact is 0.002, which is not significant ($p=.451$). Since the influence of budget cycle is not our main concern, we will not go as far as to explore possible mechanisms behind this result. Instead, we just note this variable needs to be controlled for in estimating the impacts of our main predictors.

<u>Trainee characteristics</u>

Trainee gender, age, years in the workplace, pre- and post-training scores, the difference between the two scores, and the average performance during the course show no statistically significant impact. Continuous variables among these, except for the years in the workplace, do not need non-linear modeling.

The proportion of female training participants who implemented their action plan after their return is 72.7%, which is 8.9% higher than the proportion of male participants (63.8%). The difference is not statistically significant ($p=.607$). Non-linear modeling of the impact of participant age does not bring any statistically significant improvement compared to linear modeling ($p=.162$). The estimated linear impact is -0.053, which is not significant ($p=.207$). Non-linear modeling for the years employed in the dispatching organization represents statistically significant improvement compared to linear modeling ($p=.0378$), but the impact is not significant ($p=.621$).

Non-linear modeling of the impact of pre-training test scores is not significantly different from linear modeling ($p=.103$), and the estimated linear impact is negligable (coef.=-0.009; $p=.613$). Likewise, there is no need to assume a non-linear effect with regard to post-training scores, the difference between pre- and post-training scores, and the average performance of individual training participants in the class, with estimated linear impacts almost zero.

<u>Training design</u>

Participants in the two management courses (the course for CIOs and project managers) are not systematically different from other participants in terms of the outcome (the ninth bar from the left in Figure 2). Their proportion of action plan implementation is 62.1%, which is slightly lower than other participants (67.7%). The difference is not statistically significant ($p=.768$).

The impact of the length of course is non-linear (p=.047) but statistically insignificant (p=.189). Likewise, the impact of the proportion of tours within the course shows a curvilinear relationship (p=.031), which is not statistically significant (p=.184).

A statistically highly significant U-shape relationship is found between class size and the probability of action plan implementation (the upper right panel in Figure3). The non-linear model is a statistically significant improvement from the linear model (p=.003) and the impact itself is also significant (p=.047). Non-linear modeling of the impact of the proportion of female training participants in the class (second left panel in Figure 3) also indicates a statistically significant improvement from the linear model (p=.047) and the impact itself is significant (p=.045). The impact changes from negative to positive at around 0.3. The impact of standard deviations of age within the class (second right panel in Figure 3) also shows the necessity of modeling it as a non-linear function (p=.036). The impact is, however, only marginally significant (p=.093).

The same is true for the impact of fractionalization of nationality (bottom left panel in Figure 3). Null hypothesis of no-difference between linear and non-linear modeling is rejected (p=.009), but the impact is only marginally significant (p=.091). The proportion of the same sex classmates shows a reversed U-shape impact, which represents a significant improvement compared to linear modeling (p=.035). However, the impact itself is not significant (p=.281). With regard to the impact of age deviation from class average, there is no need to model the impact as a non-linear function (p=.558). The estimated linear impact (-0.028) is also insignificant (p=.559). The proportion of the classmates from the same country also do not require non-linear modeling (p=.645). The estimated linear impact (0.961) is not statistically significant (p=.649). The proportion of classmates from the same region (bottom right panel of Figure 3) is also neither significant nor non-linear. Non-linear modeling represents no statistically significant improvement (p=.251) and the estimated linear impact is -1.962, which is statistically insignificant (p=.135).

<u>Traits of task</u>

The probability of implementation also varies depending on the content of the task. 88.0% of training participants whose action plan included the aspect of "system development" implemented their action plan after their return while only 57.6 % of training participants did so if their action plan did not include the aspect. The difference is statistically significant ($p=.013$) as shown by the sixth bar from the right in Figure 2. The other popular aspects, namely, "training" and "database", show no such large difference in implementation rates. The proportions of implementation are 57.1% for "training" and 61.1% for "database." Each reference category's proportions are 68.6% and 67.1%, respectively. The fourth and fifth bars from the right in Figure 2 show that both differences are statistically insignificant ($p=.480$ and $p=.838$, respectively).

The number of aspects included in the action plan does not matter (the second and the third bars from right in Figure 2). The proportions of implementation of action plans are 55.0% when the plan contained two aspects and 66.7% when it contained three aspects. These figures are lower than 69.1%, the proportion of implementation of action plans that included only one aspect. However, these differences are not statistically significant ($p=.504$). There is also no significant difference (61.5% vs. 67.7%; $p=.753$) between training participants who had colleagues returning from training in OIC at approximately the same time and those who did not (the far right bar in Figure 2).
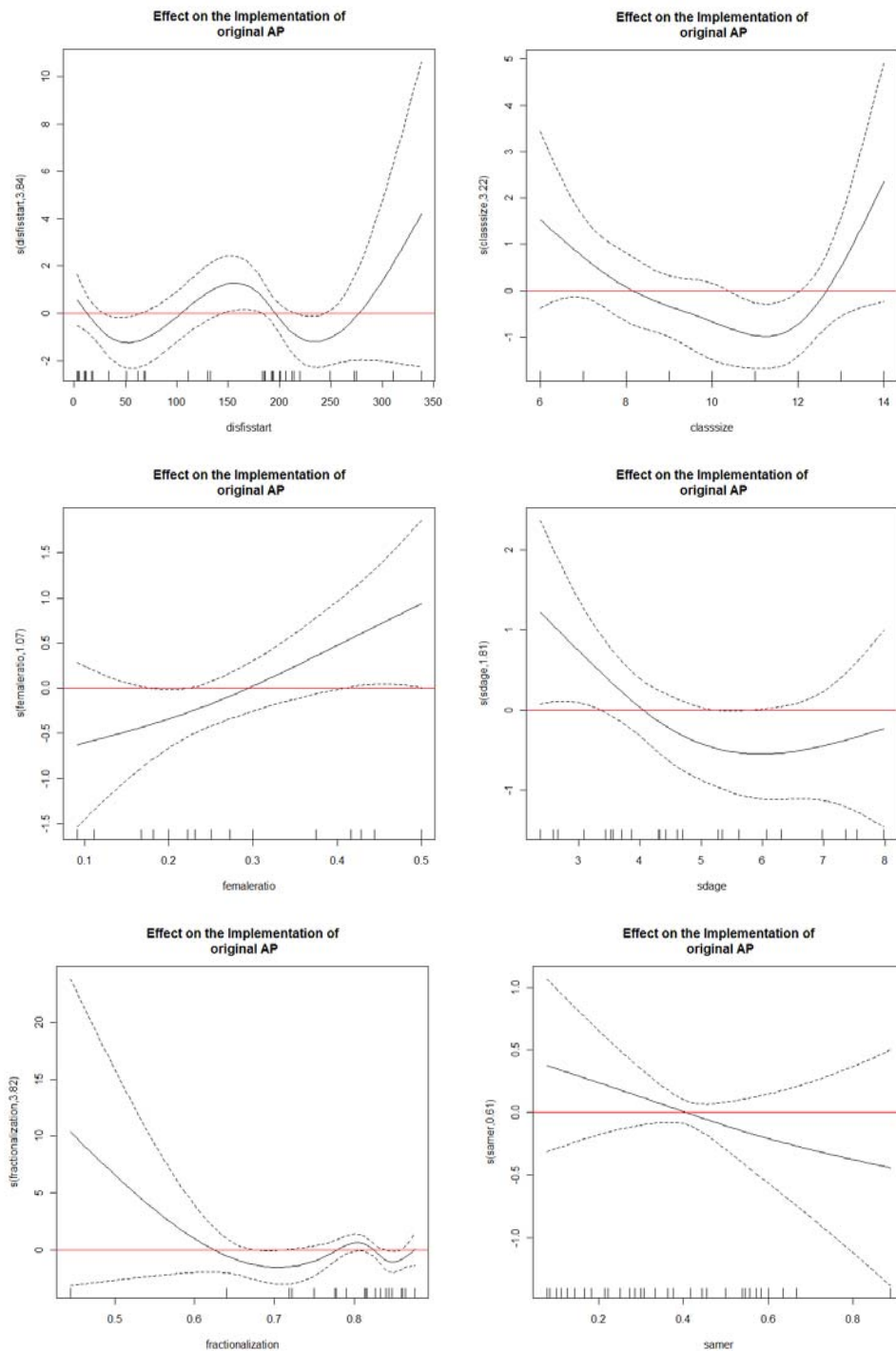
Figure 3. Selective results of bivariate analyses: Continuous variables

To summarize, as long as we simply observe the bivariate relations, our main concerns -- bilateral communication between training participant and organization and the pre-training problem identification by the organization -- are positively correlated with the implementation

of action plans, although statistical significance does not reach the 5% level. However, there are factors that show statistically significant correlations including non-linear relationships. There is just one dummy variable that shows a statistically significant impact on the outcome: whether the aspect of "system development" was included in the action plan. There are multiple continuous variables that show statistical significance in bivariate analysis:

- Time between the start of fiscal year and the start of training,

- class size,

- the proportion of female trainees in class,

- standard deviations of age, and

- fractionalization of nationality.

However, these effects including those of our main predictors might be products of superficial correlations. To enhance the robustness of the findings, we conduct a series of multivariate analyses. In so doing, we model the effects of the following variables as non-linear using the cubic spline with 5 knots to capture possible complex effects because, regardless of the statistical significance in bivariate analysis, non-linearity rather than linearity fits better for these variables:

- Time between the start of fiscal year and the start of training,

- years in the workplace,

- length of course,

- proportion of tours within the course,

- class size,

- standard deviations of age,

- fractionalization of nationality,

- the proportion of female classmates, and

- the proportion of the same sex classmates.

5.2 Multivariate regressions

We report here only the summary of results from 12 specifications. Detailed reports of the processes of each specification are described in the supplementary documents (available from the authors on request). Shaded areas in Table 4 are the variables that reach a 10% significance level. The only variable that is consistently significant across different models is the proportion of classmates from the same region as the trainee themselves (variable name: *samer*). The training participant who is surrounded by a larger proportion of classmates from their own region is more likely to fail in implementing an action plan after returning to their home country. Remember that this variable shows the same sign in the foregoing bivariate analysis. The estimated coefficients range from -7.30 to -4.77, which means that a 10% increase in the proportion of classmates from the same region as the trainee reduces, *ceteris paribus*, the probability that the trainee will implement their action-plan by 18.2% at a maximum. Among other factors related to course traits, class size and the proportion of female classmates, which both exhibit statistically significant effects in the foregoing bivariate analyses and are modeled as non-linear functions in the multivariate regressions, also indicate a fairly consistent effect across different models. We are agnostic on the mechanism behind these non-linear relationships, but we can at least suggest, based on the figures of the smoothers (not shown), that the female classmates should occupy 30 to 45% and the size of class should not be 11 or 12 if the probability of action plan implementation is to be increased.

The second most robust effect can be found in the contents of action plan – that is, whether or not it includes the aspect of "system development". The estimated coefficient ranges from 5.18 to 2.26. This means that, *ceteris paribus*, the probability of its implementation is at a maximum 33.6% higher than the mean probability of 66.0% in the cases where a trainee's action plan contains the aspect of system development. This finding is consistent with the result of bivariate analysis.

On the other hand, the effect of "pre-training problem identification" is not robust. Although signs are consistently positive, less than half of the specifications detect a significant effect. Given the positive but insignificant effect found in the bivariate analysis, we should be cautious about the effect. The estimated coefficients range from 1.52 to 1.64, which means that, *ceteris paribus*, the fact that organization identified the problems to be solved by the trainee beforehand increases the probability that the dispatched training participants will implement their action plans by 21.3% at a maximum from the mean probability of 66.0%.

By contrast, the effect of bilateral communication between the trainee and the organization during the course, which is also positive but non-significant in bivariate analysis, turns out to be significant in most multivariate specifications. Only the models 5a and 5b yield insignificant effects. Estimated coefficients range from 1.48 to 2.16. Therefore, *ceteris paribus*, the simple fact that a trainee communicates with the dispatching organization bilaterally during the training can increase the probability that the dispatched training participants will implement their action plan by 26.1%, at a maximum from the mean probability of 66.0%. It is important to emphasize that this effect is dependent neither on the choice of action-plan contents nor on whether the problem to be solved had been recognized by the dispatching organization beforehand, factors that are basically beyond the control of a TP supplier like JICA.

Another important finding is that, not only in bivariate analyses but also in the multivariate regressions, the trainee's traits do not matter. Gender and age as well as pre- and post-training scores are not significantly related to the probability of implementation of an action plan after they returned home. In other words, regardless of the individual capacity, the probability of action plan implementation can vary depending on the contents of the action plan, composition of the class, and how training participants communicated with the organization during the training.

Table 4. Results of multivariate regressions.

Group	Explaining variables	Model1a coef	Model1a p-value	Model1b coef	Model1b p-value	Model2a coef	Model2a p-value	Model2b coef	Model2b p-value	Model3a coef	Model3a p-value	Model3b coef	Model3b p-value	Model4a coef	Model4a p-value	Model4b coef	Model4b p-value	Model5a coef	Model5a p-value	Model5b coef	Model5b p-value	Model6a coef	Model6a p-value	Model6b coef	Model6b p-value
Main predictors	pre.training.problem.recognition	1.10	.172	0.77	.318	1.18	.120	1.51	.093	0.84	.278	0.62	.349	1.55	.069	1.63	.064	1.63	.054	1.642	.048	0.78	.280	0.75	.282
	bilateral communication 1	2.16	.014			2.02	.020			2.12	.014			1.67	.056							1.78	.027		
	bilateral communication 2			1.88	.045			1.76	.078			1.48	.061			2.09	.034	0.97	.189	0.762	.293			1.54	.056
Country traits	Philipines	1.50	.148	1.64	.116	1.36	.195	0.96	.345	1.10	.309	0.88	.288	d		0.80	.425	d		d		1.43	.143	1.06	.230
	Thailand	3.78	.041	3.03	.063	1.66	.281	0.67	.686	3.19	.061	0.70	.563	1.31	.410	1.32	.368	-1.15	.414	-1.001	.437	2.86	.065	1.27	.363
	Rwanda	-0.19	.904	-1.48	.325	-0.97	.488	-1.80	.252	-0.10	.947	-2.09	.110	-2.30	.146	-2.73	.109	-1.99	.147	-2.078	.127	-0.89	.537	-1.90	.161
	VietNam	1.02	.640	1.58	.471	2.40	.300	3.98	.128	0.93	.660	0.11	.953	0.35	.857	0.76	.702	2.03	.316	1.967	.310	1.55	.442	0.72	.673
	EGR2008	d		d		d		d				d				d									
	FH2008	0.00	.923	-0.01	.632	-0.01	.607	0.00	.804	0.00	.893	-0.03	.123	-0.01	.620	-0.02	.382	-0.02	.353	-0.019	.359	-0.02	.210	-0.03	.067
	disfisstart	s	.069	s	.093	s	.050	s	.168	s	.153											s	.157		
	difendfis											0.00	.630	0.00	.524	0.00	.885	0.00	.534	0.002	.665			0.00	.621
Trainees traits	female	-0.10	.912	0.35	.699	-0.36	.679	0.36	.714	-0.13	.886	0.37	.648	-0.19	.842	-0.09	.922					-0.03	.640	-0.08	.217
	age	-0.07	.358	-0.08	.286																				
	years.in.the.work.place					s	.318	s	.266									s	.250						
	pre	-0.07	.108	-0.03	.404	-0.02	.516	-0.02	.582	-0.04	.270	-0.03	.401									-0.03	.428	-0.02	.524
	post	0.00	.931	0.03	.549	0.00	.997	0.00	.940	0.01	.826	0.00	.956									-0.02	.692	-0.01	.866
	difference													0.03	.388	0.03	.367	0.01	.715	0.011	.655				
	sbmean	0.11	.581	0.03	.886	0.21	.245	0.04	.846	0.09	.667	0.09	.613	0.23	.224	0.21	.250	0.24	.140	0.185	.213	0.20	.281	0.09	.625
	management																	-0.66	.569	d		d		d	
	days	s	.095	s	.053	s	.157	-0.06	.147																
	tour									s	.149	31.99	.363	23.69	.588	23.97	.587								
Course traits	classsize													s	.015	s	.012	s	.113	s	.091				
	femaleratio	s	.044	s	.192	s	.135	5.44	.212	s	.056	s	.138	s	.071	s	.040								
	sdage																	0.15	.664	0.055	.852	s	.080	s	.297
	fractionalization	d		s	.416	d		s	.232	-1.90	.784	s	.186							0.197	.911	-1.26	.819	s	.232
	sames																	0.48	.791			2.99	.108	s	.164
	agefromCM									-0.05	.563	-0.09	.182	-0.06	.497	-0.08	.354								
	samec													-1.33	.704	-3.27	.401	3.22	.424	2.580	.505				
	samer	-7.30	.008	-5.66	.029	-5.84	.020	-5.26	.054	-5.60	.023	-4.77	.020	-5.90	.016	-6.17	.016	-6.14	.016	-5.543	.018	-5.22	.017	-4.99	.016
Task traits	system.development	5.18	.002	2.53	.071	2.88	.018	1.73	.205	4.55	.006	1.28	.220	3.56	.006	3.59	.005	2.79	.024	2.610	.023	2.26	.057	1.47	.164
	database	-0.75	.565	-0.29	.793	-0.38	.713	-0.37	.744	-0.01	.996	0.37	.709	0.50	.657	0.52	.651	1.04	.323	1.214	.229	-0.32	.752	0.06	.953
	training	-0.79	.426	-0.38	.675	-0.36	.686	-0.43	.666	-0.38	.683	-0.37	.648									-0.13	.878	-0.12	.889
	apitems_2													0.05	.950	0.59	.497	0.05	.953	0.085	.912				
	apitems_3													-0.84	.699	-1.03	.640	-0.90	.642	-0.490	.797				
	near	0.04	.962	-0.23	.806	-0.50	.589	-1.43	.188	0.17	.852	-0.20	.791	0.46	.606	0.25	.781	-0.60	.513	-0.567	.506	-0.32	.689	-0.41	.590
	sample size	91		91		91		91		91		91		91		91		91		91		91		91	

Table 4. Results of multivariate regressions.

Note. Logit estimates of partial coefficients and p-values are reported.

d: dropped, s: smoother

5.3 Robustness check

One problem of our estimation strategy is that the effect of the degree of e-government of the country cannot be tested jointly with other variables due to high VIFs. Therefore, we additionally test our main predictors controlling for e-government levels and several other variables that show fairly consistent effects. We also include the dummy for the course on management, which was jointly analyzed only once.[15] The result is shown in Table 5 and Figure 4.[16] The signs and significance level of the main predictors are consistent while the two added control variables are not significant.

	Estimate	SE	z	Pr(>|z|)		VIF
(Intercept)	-1.905	2.018	-0.944	0.345		
pre.training.problem.recognition	1.324	0.697	1.898	0.058	.	1.115
bilateral communication 1	1.752	0.713	2.457	0.014	*	1.411
EGR2008	4.306	3.552	1.212	0.225		1.204
management	0.391	0.751	0.521	0.602		1.055
samer	-3.757	1.850	-2.031	0.042	*	1.180
system.development	2.297	0.910	2.523	0.012	*	1.087
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	edf	Ref.df	Chi.sq	p-value		
s(classsize)	3.686	3.946	9.528	0.047	*	1.032
s(femaleratio)	3.309	3.760	9.467	0.043	*	1.192

Table 5. Result of multivariate regression controlling for the degree of e-government and contents of the course (dummy for management course)

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[15] Models 5a, 5b, 6a and 6b in Table 4 all included the "course of management" variable at the beginning of estimation, but only Model 5a could keep the variable until the end.
[16] We report here only the result using the first definition of bilateral communication because the result using another definition is substantially the same.
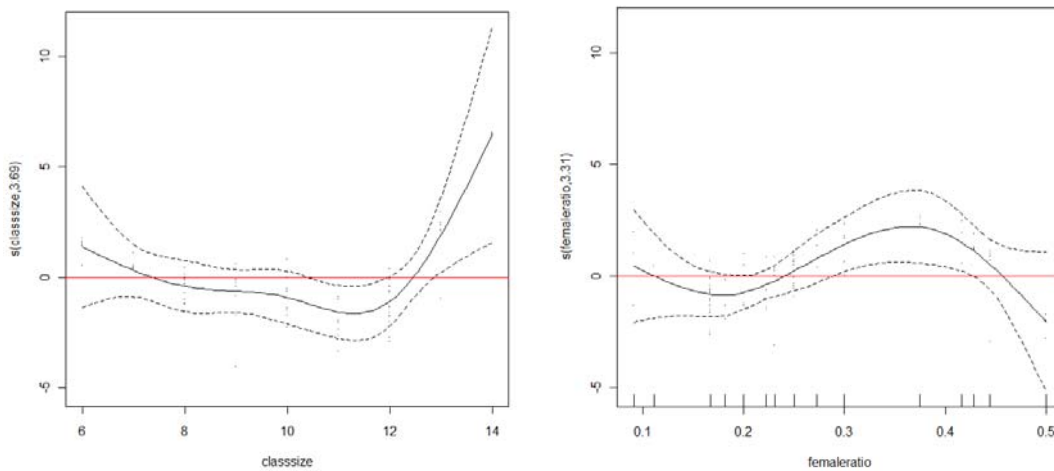
Figure 4. Shapes of the impacts of class size and the proportion of female classmates in the multivariate regression controlling for the degree of e-government and contents of the course (dummy for management course)

5.4 Supplemental anecdotes

In this section, we provide several cases that exemplify the importance of communication between training participants and their organizations during the training. One participant from Samoa, aged 29, had a clear mission that he was expecting to complete after the training for his organization before he left Samoa: to create a database system that would pre-collect data from the sources and create a web application to generate and present reports to users. He participated in the database course, deepened his understanding about Linux and related features (especially shell scripting). However, he rarely communicated with his organization during the course, and ended up finding that his organization had hired a database specialist from New Zealand to implement the solution that he had intended to implement upon his return. In consequence, this person lost the opportunity to implement his original action plan. Fortunately, his training was

not entirely wasted. He was able to use what he had learned to automate tasks and maintain the Linux systems in his organization.[17]

In another case, a trainee failed to implement his action plan despite the fact that his organization had pre-specified the problem to be solved. The dispatch organization, in the Philippines, lacked a viable information security management system (ISMS). Therefore a male trainee, aged 32, was sent to the security course in OIC with a view to creating an ISMS. However, no communication was conducted between the trainee and the organization during the course. He reported his action plan and received approval verbally. But during the time of implementation of his action plan, the organization pushed for another network-related project. He was appointed as project manager of this project and was not able to finish creating a security policy. He quit the job two and a half years later.[18]

By contrast, there are cases where training participants implemented an action plan despite the fact that their organizations dispatched them without any concrete plan. A local government officer from Indonesia, who participated in the course for CIOs, reported that the organization had no specific agenda to address in terms of ICT when they sent him to Okinawa. He himself identified the problem of underutilization of ICT equipment in 15 geographically separated offices, and wrote an action plan regarding human resource management policy and guidelines so that best practice and knowledge could be shared among all employees. He reported his plan and discussed it with colleagues via e-mail during the training, and successfully implemented his action plan after he returned to his country.[19]

A participant from an ICT department of the Ministry of Finance in a Middle Eastern country, where regular network malware and virus infections were reportedly causing data loss, attended the security course in Okinawa without any specific instructions from his supervisor. He realized that the lack of a clear operational security policy was the root cause of the problem

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[17] E-mail based interview in April 2013.
[18] E-mail based interview in April 2013.
[19] E-mail based interview in April 2013.

and proposed to his organization the creation of a daily operational policy to determine the role of each member of the operation team and training programs on information security for the operation team. He reviewed his action plan several times in collaboration with his supervisor and colleagues during his stay in OIC. Upon his return, he implemented his action plan and reportedly succeeded in reducing security problems.[20]

As these cases show, communication between training participants and their organizations during the course can play a key role in determining whether the action plans training participants prepared in the training will be adopted by the organization and contribute to improving the operation of their organizations.

5.5 Discussion

The quantitative and qualitative analyses above illuminate the importance of communication between the trainee and dispatching organizations during the courses. On the other hand, the absorptive capacity of the organization before the training – measured by whether the organization identified the organization's problems to be solved by the training participants prior to their dispatch – shows a weaker association with the probability of action-plan implementation. This result contradicts the common expectations of donor practitioners. The good news for them is that the effect of bilateral communication is independent of that of an organization's absorptive capacity, which means that practitioners of training programs need not surrender to the original level of absorptive capacity of the dispatching organizations. By facilitating communication between the participants and the dispatching organizations, they can make a difference. Facilitation of communication is necessary even when the absorptive capacity of the organization is deemed to be high at the outset. This is necessary because, if training participants are isolated from their workplace and fail to communicate with their own organizations, they are unlikely to notice any discrepancies that might emerge between their

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[20] E-mail based interview in April 2013.

original mission for training participants and their organizations' evolving priorities in a politically and/or economically volatile environment.

Practitioners' intuitive expectation that the probability that training participants carry out their action plans differs depending on the content of the training is supported by the statistically significant partial coefficient for the dummy representing the contents of action plan. Yet, this does not necessarily mean that training participants with easy action plans such as "training" are more likely to implement their proposals. The action plan with the highest feasibility was "system development".

Several course traits, some linear and some non-linear, turned out to influence the probability of action-plan implementation. Most notable is the negative effect of the majority status of a trainee in the classroom with regard to their region of origin. The robustness of the result (12 out of 12 models detected its influence) contrasts with the consistently insignificant influence of the degree of classroom fractionalization. As long as a participant belongs to the cultural majority, cultural exchange within the classroom, which is one of the important components of TPs, does not seem to improve his/her motivation for the *transfer of training*.

The result that no trainee characteristics, including *learning,* show statistically significant influence might be somewhat disappointing for training practitioners. However, it is highly plausible that even the best performing trainee can fail to implement his/her action plan if it does not match organization's priorities. In that case, the trainee would most likely internalize the benefit of training for their own benefit, not for their organization. For the enhancement of organization-level impacts from training, the facilitation of bilateral communication between trainee and organization is as important as support for individual learning.

6. Conclusions

This paper investigated the conditions under which TPs, the open-seminar style training for organizations in various developing countries, can work as a driver of organization-level change. Practitioners' intuition is that when absorptive capacity of the sending organizations is high *before* the training, action plans written by training participants tend to be realized after the training. Our hypothesis was that if training participants communicate bilaterally with their organizations *during* the training, the probability of action-plan implementation would be greater.

We used JICA's monitoring data and e-mail-based interviews to test these hypotheses. The target program was "e-Government promotion" courses carried out by OIC. Before conducting multivariate regressions, we first examined how each of the explanatory variables was associated with the variable of our concern: the implementation of the original action plan. We found that, at first glance, training tends to contribute to organization-level outcomes when a trainee's action plan includes the aspect of system development, or when the proportion of female classmates is larger. We also found two non-linear effects of continuous variables: class size and the days between the start of fiscal year and the start of training. The former showed a U-shaped relationship while the latter showed a cyclical pattern.

However, when we estimated the impact of each variable while controlling for the influence of other variables, a somewhat different picture emerged. The effect of the proportion of female classmates, which is almost linear in bivariate analysis, retained statistically a significant effect but changed its shape. It has a positive effect only when it ranges from 30 to 40%. Meanwhile, the non-linear effect of the class size remained almost the same. The linear negative effect of the proportion of classmates from the same region, which is insignificant in bivariate analysis, became significant in the multivariate regression. While the pattern that the action-plan implementation depends on the contents of the action plan remains the same, the

positive impact of absorptive capacity of the dispatching organization as well as the positive impact of bilateral communication between trainee and the organization, which are both insignificant in the bivariate analysis, turned out to be significant.

The finding that bilateral communication between trainee and the organization during the course has a positive effect for organization-level outcomes has a particularly important implication for training operations. Facilitation of communication between the trainee and the organization must start during, not after, the training. Follow-up support has long been a default component of TPs. But, it has been widely recognized that post hoc facilitation of an action plan via ex-trainees is no easy task. It is extremely difficult to change the direction of organizational policies and agendas once they have been determined. All too often, no budgetary resource is left for the action plan, which is proposed belatedly. Ex-training participants, who are eager to implement their action plans, especially when they are individually satisfied with what they have learnt from the training, gradually become exhausted with the effort involved in convincing their supervisors and colleagues. Given the fact that they are no longer maintaining direct daily face-to-face contact with the trainers, there is little incentive for them to continue their apparently futile efforts even if they personally remain grateful for the TPs they participated in. It is crucial for practitioners to encourage and facilitate training participants to maintain contact with their organization during the training. By doing so, TPs that are supply-driven in nature can be customized to fit the implicit or explicit demand of the dispatch organizations.

Of course, our study is based on an e-mail-based interview of only half of the ex-participants of a particular training offered by one particular donor. Although the respondent group does not differ from non-responded group in most aspects of monitored attributes, it does not guarantee that there are no differences between the two groups in terms of our outcome variable (implementation of action plan) and our main predictor (bilateral communication). It is too early to conclude that communication during the course can make

any TDP by any donor effective at the organization-level. To verify this hypothesis, it would be worthwhile to conduct randomized controlled trials using a variety of samples in various contexts. In such trials, measurements of dependent and independent variables need to be improved because this paper was unable to avoid potential bias stemming from its primary reliance on the self-reports of training participants.

In future research, there is a need to clarify the mechanisms by which bilateral communication between the training participants and their organizations will increase the probability of action-plan implementation. Our tentative interpretation needs to be substantiated by more solid evidence. Also, the reason why the mixture of training participants from various regions tends to be more effective in terms of implementation of action plan must be examined in detail.

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Abstract (in Japanese)

要約

本論文では、途上国における人材育成のための主要な援助スキームである研修員受け入れ事業が、人材育成のみならず、組織レベルの能力向上や業務改善に貢献するための条件を明らかにすることを目的とした。

　本研究の方法論に関しては、JICA が実施した ICT に関する研修員受け入れ事業を対象として、同事業に参加した研修員へのインタビューや研修モニタリング記録のデータをもとに、回帰分析を行った。その結果、研修中における研修員とその所属先との研修内容に関するコミュニケーションが、研修成果の組織レベル、事業レベルにおける波及効果向上に重要な役割を果たした（アクションプランの実施の確率を高めた）ことが明らかになった。