



Collaboration Environments for Construction: Management of Organizational Changes

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Abstract: The implementation of a new collaboration environment initiates many changes to an organization and to the end users as a result of the new way of working and the use of new technologies. Unless these changes are well managed at the organizational level, it will not be possible to achieve the full benefits expected from the implementation of the collaboration environment. This paper presents a framework for managing the organizational changes brought into construction organizations by the introduction of a new collaboration environment. The framework consists of five primary stages: initiation of change, development of change vision, planning of organizational change, implementation of change, and evaluation of change. The processes for each stage are detailed in integrated definition function modeling diagrams. The evaluators in construction organizations have found the framework to be successful in managing organizational changes. DOI: [10.1061/\(ASCE\)ME.1943-5479.0000231](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000231). © 2014 American Society of Civil Engineers.

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Introduction

Organizational and people related issues have been highlighted as major factors affecting the success of collaboration environments, and hence, project success (Allen et al. 2005; Erdogan et al. 2008; Nikas et al. 2007; Patel et al. 2012). The term “collaboration environment” refers to an environment created by using different collaboration tools and technologies in which all organizations involved in the construction project can communicate, exchange data and information, and conduct joint activities to realize the successful completion of this project. Wilkinson (2005) refers to an industry rule of thumb suggesting that 80% of the successful implementation of collaboration systems depends on tackling the personnel and process issues, whereas 20% is related to resolving the technology aspects. Shelbourn et al. (2007) approached collaborative working from a strategic management perspective and stated that effective collaboration results from the harmony of three key strategies: business strategy, people strategy, and technology strategy. Shelbourn et al. (2007) also defined six key areas to be addressed within each of these strategies to enable effective collaboration: (1) vision, (2) engagement, (3) trust, (4) communication, (5) processes, and (6) technologies. Alshawi and Ingirige (2003) proposed that equal attention should be given to the management of technology, process, people, and knowledge for the successful

adoption of a web-enabled collaboration environment for project management in construction. Vadhavkar (2001) stated that spatial setup, information technology, and organizational processes are the three primary elements that enable successful collaboration between globally dispersed teams.

The efficiency and effectiveness of a collaboration environment rely on the participation of all organizations in the project team. However, a new collaboration environment will result in many changes for both individuals and for the organization, which are rarely welcome. Most of the failures in achieving the full benefits expected from the implementation of collaboration environments arise from the people and process concerns related to these changes (Erdogan et al. 2008). The success of a collaboration environment not only depends on the collaboration technology introduced to the organization, but is also highly influenced by how this technology is introduced. Unless supported by the relevant people, process, and change management strategies, the stand-alone implementation of collaborative information technology (IT) will not enhance collaborative working. This research focused on these issues and aimed at developing a framework that manages the organizational changes arising from the introduction of a new collaboration environment.

This paper reviews previous work on organizational change management and the related theoretical concepts, and presents a framework developed to manage the organizational changes arising from the introduction of a collaboration environment. This framework is referred to as the management of organizational changes (MOCHA) framework. The processes and subprocesses of the framework are explained in detail and presented in integrated definition function modeling (IDEF0) models. An evaluation of the framework is provided and conclusions drawn from the research are presented.

Organizational Change Management

Organizational Change

Organizational changes are changes to organizational processes; changes in organizational functions; changes in values, beliefs,

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and human behavior; and changes in power distribution and the way organizational issues are influenced (Cao et al. 2000). All of these are interconnected and affect one another. Organizational changes can be initiated by many factors that can be categorized under two primary headings: external and internal factors. These factors are summarized in Table 1.

Construction organizations implementing collaboration environments experience most of the internal factors listed in Table 1; hence, they need to manage organizational changes. The decision about how these changes will be conducted depends on the type of change. Table 2 summarizes different classifications of organizational changes that are commonly discussed in the literature.

According to the characteristics of change, an organization goes through different forms of change. As shown in Fig. 1, an incremental change that is made in anticipation of future events is called tuning. A strategic change in anticipation of external events that will require this change is referred to as reorientation. The incremental changes conducted as a reaction to external events are called adaptation, whereas reactive strategic changes are referred to as re-creation.

Changes can also be categorized according to the way the change is implemented in the organization. According to Jick and Peiperl (2003), there are three perspectives on change, as shown in Fig. 2. Developmental change is a continuous process of change, whereas transitional change involves a period for transition between the old and new states of the organization. Transitional change can also involve developmental change. The three-stage organizational change model described by Lewin (1952) is a good example of transitional change. Transformational change may involve both developmental and transitional changes.

Table 1. Reasons for Changes at Organizational Level

External reasons	Internal reasons
Changes in environment	Changes in goals and values
New technologies	Changes in technical system
Changes in the marketplace	Changes in organizational structure
Changing customer expectations	Changes in management philosophy
Changes in competitor activities	Changes in psychological system
Changes in quality and standards	Changes in managerial system
Changes in legislation	Changes in organizational culture
Changes in prevailing political values	Changes in systems of internal power and control
Changes in the economy	—
Demographic changes	—
Ecological changes	—
Changes in cultural factors	—

Note: Data from Voropajev (1998), Love et al. (2002), and Smither et al. (1996).

Table 2. Classification of Organizational Changes

Criteria	Organizational changes	
Differences in organization attributable to change (Tichy 1983)	Strategic changes Nonroutine, nonincremental, and discontinuous; alter the overall orientation of the organization	Nonstrategic changes Do not affect the overall orientation of the company or result in drastic differences
Speed of transformation in the organization (Cao et al. 2000; Cummings and Worley 2005)	Incremental/gradual Routinely necessary for any organization to adapt to its environment	Radical/quantum changes Necessitates thorough reexamination of all facets of organization
Initiation nature (Burnes 1996)	Emergent changes Driven from bottom up; is an open-ended and continuous process of adaptation to changing conditions	Planned changes Result of action research and analysis of social and organizational problems in question
Initiation nature (Burnes 1996)	Emergent changes Same as above	Anticipated changes Not planned by organization, but occurrence is expected

When organizational change is investigated considering the period between the present and future states of an organization—in other words, states before and after the change with respect to the rate of integrated change—three different approaches to change have been identified by Felkins et al. (1993). These approaches are shown in Fig. 3.

Approach A shows a directed change conducted at deliberate speed and intention. Although this approach can have some competitive advantages, if conditions alter during the change, the time may not be enough to gather information and feedback for the integration of directed and nondirected processes. Approach B also shows a deliberate change, but includes some intentional stops during the change to analyze the movement and process to integrate the nondirected elements during the transition. Approach C addresses both directed and nondirected change processes through looping cycles of continuous feedback, monitoring, and assessment, and is believed to initiate more positive long-term results than the other two approaches.

Theoretical Approaches in Organizational Change Management

The roots of research on organizational change management can be traced back to the works of Taylor and Hawthorne in the early years of the twentieth century (Roethlisberger and Dickson 1939). The basis of Taylorism, also known as the scientific management approach, is that work can be divided into subunits or specializations. It is believed that there is one best way to perform a task and that each subunit of a task should be conducted by people capable of doing so in this standardized best way. The studies of Hawthorne, on the other hand, follows a humanistic approach, drawing attention to group behavior, relations among group members, and relations between group members and management. Understanding the linkages between an individual, their role among the other members of the group at the workplace, and the degree of independence given to the group is considered an initial step to effective performance.

Contingency theory is distinguished from most organizational theories proposing one best way to structure an organization (Donaldson 2001). According to contingency theory, each organization has different circumstances such as environment, organizational size, technology, and organizational strategy. These circumstances are referred to as contingencies and the theory states that the best performance will occur when the organizational characteristics fit these contingencies (Burns and Stalker 1961; Chandler 1962; Child 1973; Robey and Sales 1994). When contingencies change, the organization will need to change to fit its organizational characteristics to the new contingencies.

	Incremental	Strategic
Anticipatory	Tuning	Reorientation
Reactive	Adaptation	Re-creation

Fig. 1. Types of organizational change (data from Jick and Peiperl 2003)

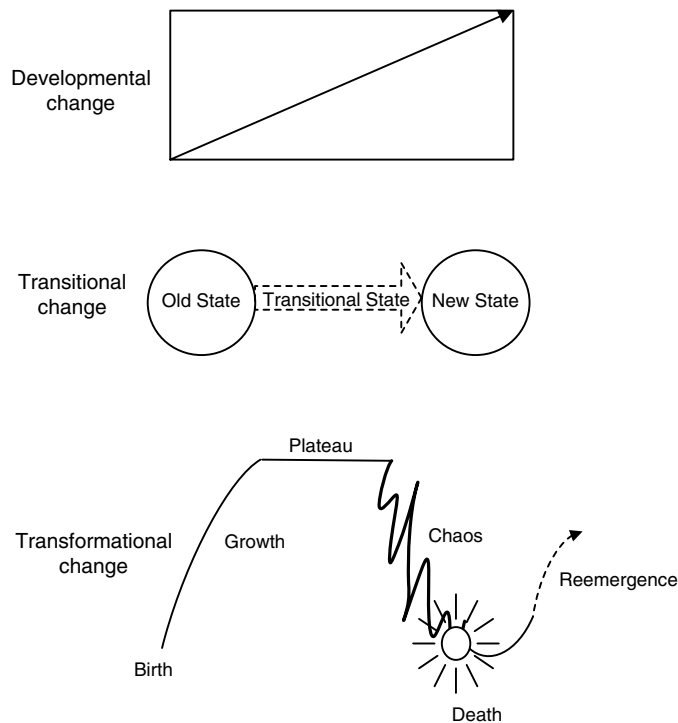


Fig. 2. Three perspectives on change (data from Jick and Peiperl 2003)

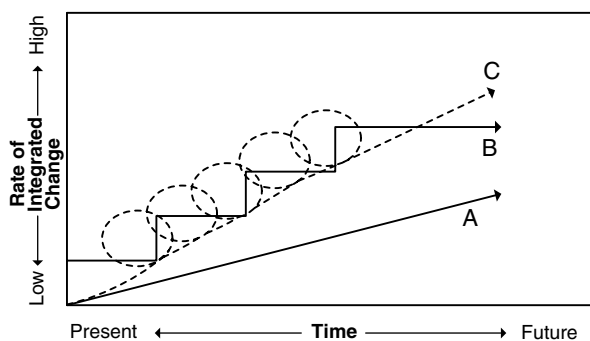


Fig. 3. Approaches to change (data from Felkins et al. 1993)

Another theory associated with organizational change is systems theory. According to systems theory, to understand the survival, adaptation, and performance of an organization, the dynamics of environment–organization relations should be considered as a system (Wilson and Rosenfeld 1990). From the perspective of change management, a system can be defined as “an assembly of components, which are related in such a way that the behavior

of any individual component will influence the overall status of the system” (Paton and McCalman 2000). Therefore, the systems approach to change investigates many different dimensions of an organization. The systems approach has resulted in the development of many models, which can be grouped into two groups: intervention models and organizational development models.

Intervention models focus on proposing systematic guidelines in clearly defined steps for implementing organizational change, whereas organizational development models are more related to soft concerns and use behavioral science technology, research, and theory. The intervention strategy model (Paton and McCalman 2000) and hard systems model of change (Senior and Fleming 2006) are examples of intervention models.

The classical three-stage change model of Lewin (1952) is considered to be one of the first organizational development models. This model has been displaced by more detailed adoption models, including organizational learning models, through many research efforts by Warner Burke (1994), Senior and Fleming (2006), Senge (1992), and Sterman (2000).

This research uses the contingency theory to explain the need for organizational change management as a result of implementing a new collaboration environment. Two contingencies will be affected by the introduction of the collaboration environment: a new working approach and a new technology. The organization will need to adapt its characteristics to fit the organization to the changing contingencies, and hence, conduct organizational changes. The MOCHA framework is intended to be used for conducting a planned change, similar to the planned change in the organizational development models; hence, it makes use of feedback and correction loops that form a critical part of organizational learning. The framework also uses the change agent concept in these models. The change agent is the person who is responsible for the effective implementation of change. Problem owner, facilitator, project manager, master of change, and change champion are other terms used to refer to the change agent (Cummings and Worley 2005; Warner Burke 1994; Paton and McCalman 2000). However, the framework does not identify only one leader assuming the title of change agent. The MOCHA framework uses a change guiding team to conduct the organizational changes following the see–feel–change approach of Kotter and Cohen (2002), explained in the next section.

Leading the Change

For the success of collaborative working, it is important to have good and inspirational leaders holding people together and motivating team members for collaboration (Dossick and Neff 2010). Leading the change is considered to be another very important dimension in organizational change management. Most changes are introduced by the analysis–think–change approach:

1. Analysis: data collection and analysis are conducted on problems, solutions, or progress;
2. Think: the analysis results are investigated and a selection consistent with the necessary change is made from the ideas; and
3. Change: the chosen ideas are implemented.

Despite their common use, scientific approaches may not always be the best way to manage changes involving people. Kotter and Cohen (2002) suggest that to get people involved in the changes or to encourage people to adopt the introduced changes, the see–feel–change approach works better than the analysis–think–change approach. Displaying the problems or solutions through the use of eye-catching, compelling, and dramatic situations allows people to visualize the problems (see). These visualizations provide useful ideas that will engage the emotions (feel), and these emotionally charged ideas change behavior or reinforce changed behavior

Table 3. Eight Stages to Achieve a Large-Scale Change

Step	Action	New behavior
1	Increase urgency	People start telling each other, "Let's go, we need to change things!"
2	Build the guiding team	Group powerful enough to guide a big change is formed and start to work together well
3	Get the vision right	Guiding team develops the right vision and strategy for the change effort
4	Communicate for buy-in	People begin to buy into the change, which shows in their behavior
5	Empower action	More people feel able to act, and do act, on the vision
6	Create short term wins	Momentum builds as people try to fulfil the vision; fewer resist change
7	Do not let up	People make wave after wave of changes until the vision is fulfilled
8	Make change stick	New and winning behavior continues despite the pull of tradition and turnover of change leaders

Note: Data according to Kotter and Cohen (2002).

(change). This approach can be achieved by following the eight stages explained in Table 3.

Jick and Peiperl (2003) proposed another framework consisting of 10 stages called the 10 commandments of implementing successful organizational change. This framework is considered to be a combination of both the see–feel–change and the analysis–think–change approaches. These 10 stages are:

1. Analyze the organization and its need for change;
2. Create a shared vision and a common direction;
3. Separate from the past;
4. Create a sense of urgency;
5. Support a strong leader role;
6. Line up political sponsorship;
7. Craft an implementation plan;
8. Develop enabling structures;
9. Communicate, involve people, and be honest; and
10. Reinforce and institutionalize change.

Although some of the stages in the frameworks by Jick and Peiperl (2003) and by Kotter and Cohen (2002) are similar, Jick and Peiperl's 10 stages begin with the analysis stage, an approach heavily criticized by Kotter and Cohen (2002) because of three limitations: (1) in most cases, extensive analysis reports are not necessary to understand that something is not working; (2) analytical tools work best when parameters are known, assumptions are minimal, and the future can be predicted clearly; and (3) good analysis changes the thoughts of people, but does not motivate them to a great extent. Hence, the approach of Kotter and Cohen (2002) starts with creating a sense of urgency, leading the people to visualize the need for and importance of the change. Jick and Peiperl (2003) focus more on the role of a strong leader, whereas Kotter and Cohen suggest a guiding team. The MOCHA framework follows the see–feel–change approach of Kotter and Cohen and uses the eight stages as the primary principles behind the framework. The framework also uses the guiding team approach suggested by Kotter and Cohen (2002).

Framework for Management of Organizational Changes

Objectives and Rationale for the Framework

The primary problem in the implementation of collaboration environments is related to people and organizational issues, rather than technical issues. Results of a multicase study identified 13 primary organizational issues for the successful implementation of collaboration environments (Erdogan et al. 2008):

1. Criticality of the implementation of the collaboration environment for the project success;
2. Binding clauses in the contract regarding the use of the collaboration environment;

3. Agreement between parties on the use of a collaboration environment;
4. Trust factor between the organizations and trust in the system;
5. Security of organizational data;
6. Top level commitment;
7. User resistance to change;
8. Early user involvement;
9. User friendly interface;
10. Training;
11. Consistency of data format, types, and standards;
12. Use of common conventions; and
13. Efficiency of the collaboration environment.

These issues are linked to each other and should be approached as a system when implementing a collaboration environment. Using a systems thinking approach, it has been shown that there is a need for a detailed organizational change management approach to simultaneously control all of the factors affecting the success of collaboration environments. This informed the development of an organizational change management framework for the implementation of collaboration environments in construction projects.

The need for organizational change management during the implementation of collaboration environments was also justified by using contingency theory. However, there is very little research in the construction industry, which presents a clear methodology to conduct this organizational change management.

The MOCHA framework was developed to bridge this gap and provide a methodology to guide each organization to initiate an organization specific change management approach to conduct the organizational changes required for the implementation of collaboration environments. Specific objectives associated with this aim are:

1. To manage the changes brought into organizations by the introduction of a new collaboration environment;
2. To increase attention on the people and organizational concerns for collaborative working; and
3. To prevent and manage resistance to change and cope with other barriers to the implementation of collaboration technologies associated with change.

The MOCHA framework focuses on change management and the implementation of a collaboration environment at the organizational level. It is aimed to address the organizational and people concerns in each organization through a change management approach, with an ultimate aim of improving the collaboration across construction projects through reducing the barriers and addressing the problems that are considered to be the primary reasons for failure.

The framework should be used by middle and senior level management. The people to use MOCHA can be business managers, project managers, IT managers, research and development department managers and employees, collaboration champions, team leaders, and end users.

Overview of the MOCHA Framework

For the success of the project collaboration, all organizations involved in the project should participate in the collaboration environment and follow the same procedures. Each organization needs to manage the organizational changes initiated by the new collaboration environment to adjust their current processes and encourage their employees to properly use the new systems. The amount of required change will depend on how familiar the organization is with the new collaboration technology, tools, or methodologies, and their level of compatibility with the current organizational processes and the organizational working culture. The MOCHA framework consists of a set of processes that guides the organizations to come up with an organizational change management solution.

The conceptual MOCHA framework was developed by using the IDEF0 process modeling approach because of its capability to represent different levels of details in parent and child process diagrams and because of the familiarity of construction professionals with the technique. IDEF0 is a technique that represents functions, activities, or processes in a structured way, making use of the inputs, controls, outputs, and mechanisms (ICOMs) of an activity. An activity shown in a diagram can be broken down into further activities and shown in a separate diagram, which is called a child diagram.

The top level activity of an IDEF0 model is called the A0 process and is shown in an A0 diagram. This diagram shows the primary objective of the model, showing the A0 process together with all ICOMs. The A0 process is later broken down into subprocesses, which are shown in an A0 diagram. The A0 level process of MOCHA is called “manage organizational change due to implementation of a collaboration environment” and is shown in Fig. 4. The text shown under the box, “MOCHA/A0,” indicates that this activity is broken down into subprocesses and presented in a child diagram that has a node number of MOCHA/A0, shown to the bottom left of the diagram.

The MOCHA framework consists of five primary stages, which are shown as five activity boxes in the MOCHA/A0 diagram

presented in Fig. 5. The first stage is called the initiation stage, in which the need for organizational change is defined. The second stage focuses on defining a change vision. In the third stage, an organization change management plan is developed. The fourth stage focuses on implementing the identified changes according to the plan developed during the third stage; the last stage focuses on evaluating the performance of the collaboration environment implementation and change management.

The circled “f.PL” symbol shown in Fig. 5 (and later in Figs. 6–10) is used to differentiate an input or a control that is decided on by all organizations on the project and that is binding for all organizations. These cannot be decided at the organizational level, but they affect the decisions made at the organizational level. Some of the activities in the MOCHA framework are focused on producing organizational requirements and needs for the collaboration environment or any organizational views on some aspects of collaborative working in an attempt to shape the collaboration solution agreed upon at the project level.

The five primary processes are further broken into some subprocesses. When developing the subprocesses, the considerations included the organizational concerns in the implementation of a collaboration environment and the relationships between these concerns, determined through the interpretation of the case study results (Erdogan et al. 2008), and a literature review on organizational change management. All of these processes are shown in Table 4 as a node index (also referred to as a node tree), which is a listing showing all nodes in an IDEF0 model in outline order. Each of the five processes and their subprocesses are explained in the following sections.

Initiate Organizational Change Management: MOCHA/A1

The first process of MOCHA starts the change management process by identifying the key players, capturing relevant information, and defining changes likely to be required as a result of planning

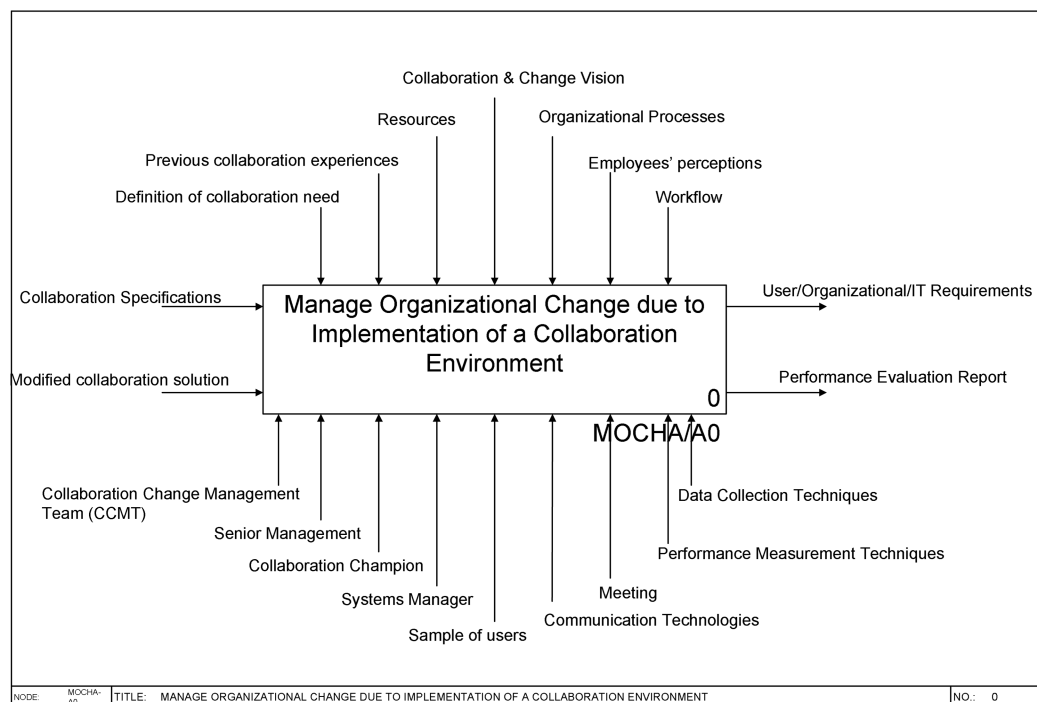


Fig. 4. MOCHA model: A0 process

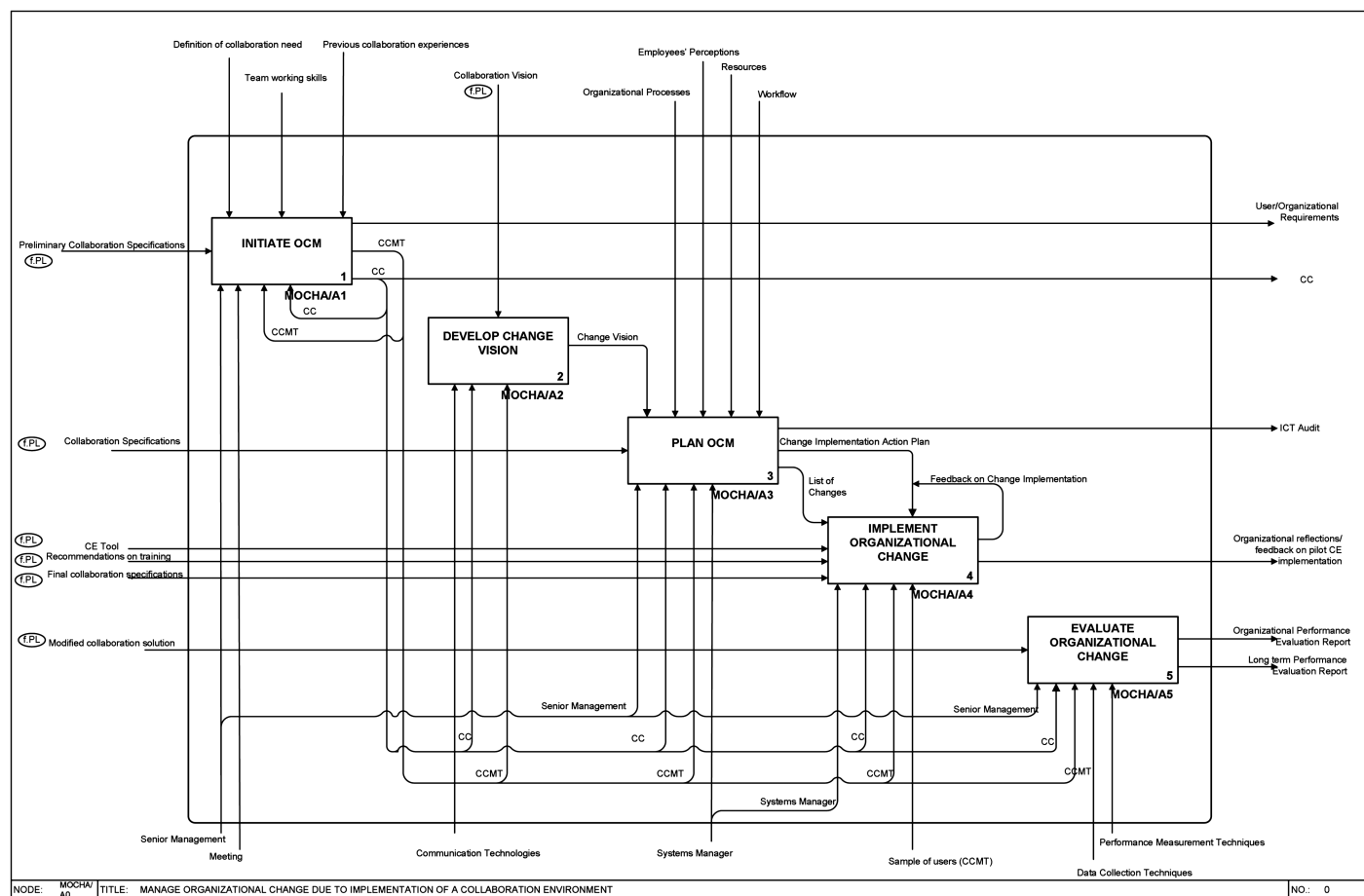


Fig. 5. MOCHA model: A0 level

and implementing the collaboration solutions. It consists of three subprocesses, which are shown in Fig. 6.

The first step is to build the change implementation team. When the need for collaboration is communicated to the organizations participating in the project, each organization should appoint a suitable champion as their representative in the collaborative venture. This champion is referred to as the collaboration champion (CC) and is responsible for all collaboration related tasks in the organization. The responsibilities of the change champion/agent role used in the organizational change management literature, in addition to the collaboration responsibilities, are conducted by the CC. The CC should manage the implementation of the collaboration environment in the organization and should ensure that the organization participates in the project according to the collaboration standards and procedures defined by the project organization. The CC will also be responsible for managing the changes in the organization introduced by the collaboration environment and should try to achieve a smooth adoption period for the collaboration environment, together with the collaboration change management team members. The CC will coordinate all collaboration activities in the organization throughout the project, direct the collaboration change management team (CCMT), members of which are also identified in this process, and work together with the IT/systems manager.

Once the CC is identified, the next task will be to initiate the formation of the CCMT. The CCMT consists of a sample of users in an organization appointed by the CC and/or senior management to enable the link between the users and the CC. This team may include representatives from operational, technology, and senior

management levels. Within the CCMT, it is important to have a representative from each group in the organization that is likely to be affected by the change. The CC is a core member of the CCMT and will be attending all CCMT meetings.

The CCMT is one of the key elements of the organizational change management framework and is a result of a user involvement approach. The team plays an active role in capturing user and organizational requirements, communicating change, and determining the changes in the organization attributable to the collaboration environment. It also participates in all processes in the implementation and evaluation of the collaboration environment. Involving representatives of the people who will be affected from the change in the change implementation stage will help the adoption of the change because that change will no longer be interpreted as a change imposed on them. Having a right to speak directly about the change, or indirectly through the CCMT, will give the users a feeling of ownership of the change.

The next step is to communicate initial change. Initial changes are identified after the preliminary collaboration specifications are defined. It is important to communicate these to employees early in the process, to give them adequate time to understand and adjust, and hence, to reduce their resistance to the changes (Balogun and Hope Hailey 2004). Erdogan et al. (2008) also suggested that the earlier the users are involved in the design and implementation of the collaboration environments, the less resistance will occur.

Details and the size of the change will not be clear at this stage because the collaboration specifications in the project have not yet been detailed or finalized. However, a sense of urgency for change needs to be created in the organization; hence, even if the details of

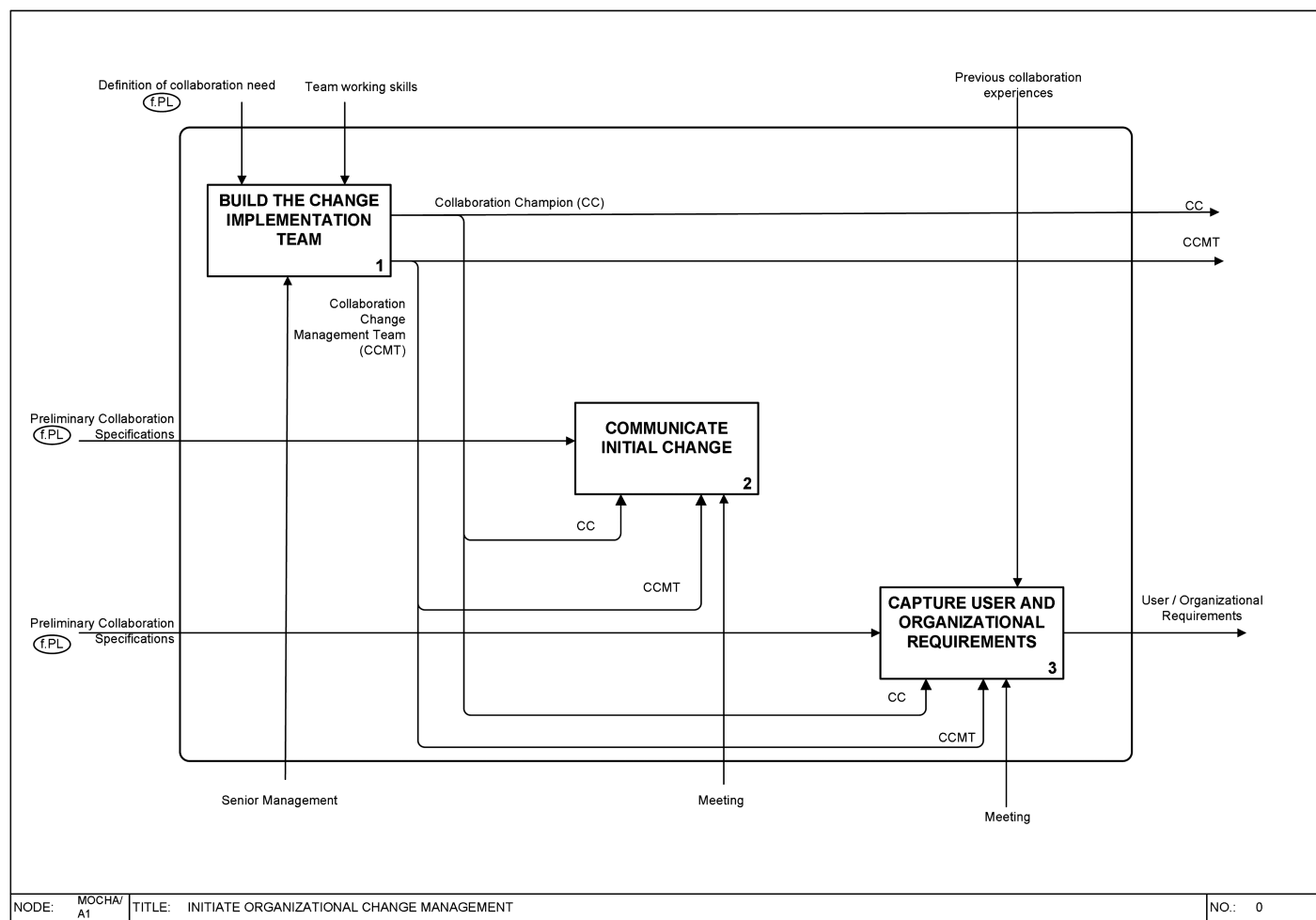


Fig. 6. MOCHA/A1: initiate organizational change management

the change are not known, the fact that there will be some change in the organization should be shared with employees.

The next step in this process captures the user and organizational requirements for the collaboration environments that will be used during the development of the collaboration solution. The CC and CCMT will be using their previous collaboration experiences to identify the expectations from the collaboration environment and will inform the collaboration management team. It is important to have a formal process of identifying the user and organizational requirements; this will enable the collaboration environment to address these requirements to meet expectations and to reduce the resistance that may rise because of beliefs that the change is not in the best interests of the organization or that the change is not aligned with the core values and needs of the organization.

Develop Change Vision: MOCHA/A2

The second process of MOCHA starts as soon as a collaboration vision and strategy are agreed upon between all organizations in the project. Each organization will investigate this collaboration vision and, considering their organizational characteristics, will define the need for organizational change, develop a vision for this change, and communicate this vision to the employees. The IDEF0 diagram for MOCHA/A2 is shown in Fig. 7. Three subprocesses of MOCHA/A2 are explained in the following.

The first step is to define the need for organizational change. Based on the collaboration vision communicated to the organization, the CC and CCMT will decide whether there is a

need for organizational change and then define its extent and implications.

The next step is to define the change vision. Following the definition of a need for organizational change, the CC and CCMT will develop a change vision that is aligned with the shared collaboration vision. This vision is similar to the change vision presented by Kotter and Cohen (2002). The vision should be clear enough to be quickly understood by the employees. If the right vision can be developed for the change effort, future steps will be easier to agree on.

The third step is to communicate the change vision. Vision and strategies are not only for the guiding team: they should be communicated for both understanding and gut-level buy-in, with the goal of ensuring that as many people as possible will act to make the vision a reality (Kotter and Cohen 2002). Therefore, the change vision identified in the previous subprocess should be communicated in the organization by the CC and CCMT. Communication technologies are used as a means of conducting this process.

Plan Organizational Change Management: MOCHA/A3

The third process of MOCHA focuses on planning how the organizational change should be managed. This process is conducted parallel to the planning of the collaboration solution. The process provides the results of an information and communication technologies (ICT) audit to the collaboration management team to develop collaboration specifications to be used on the project. These specifications are used by the CC and CCMT to plan the required

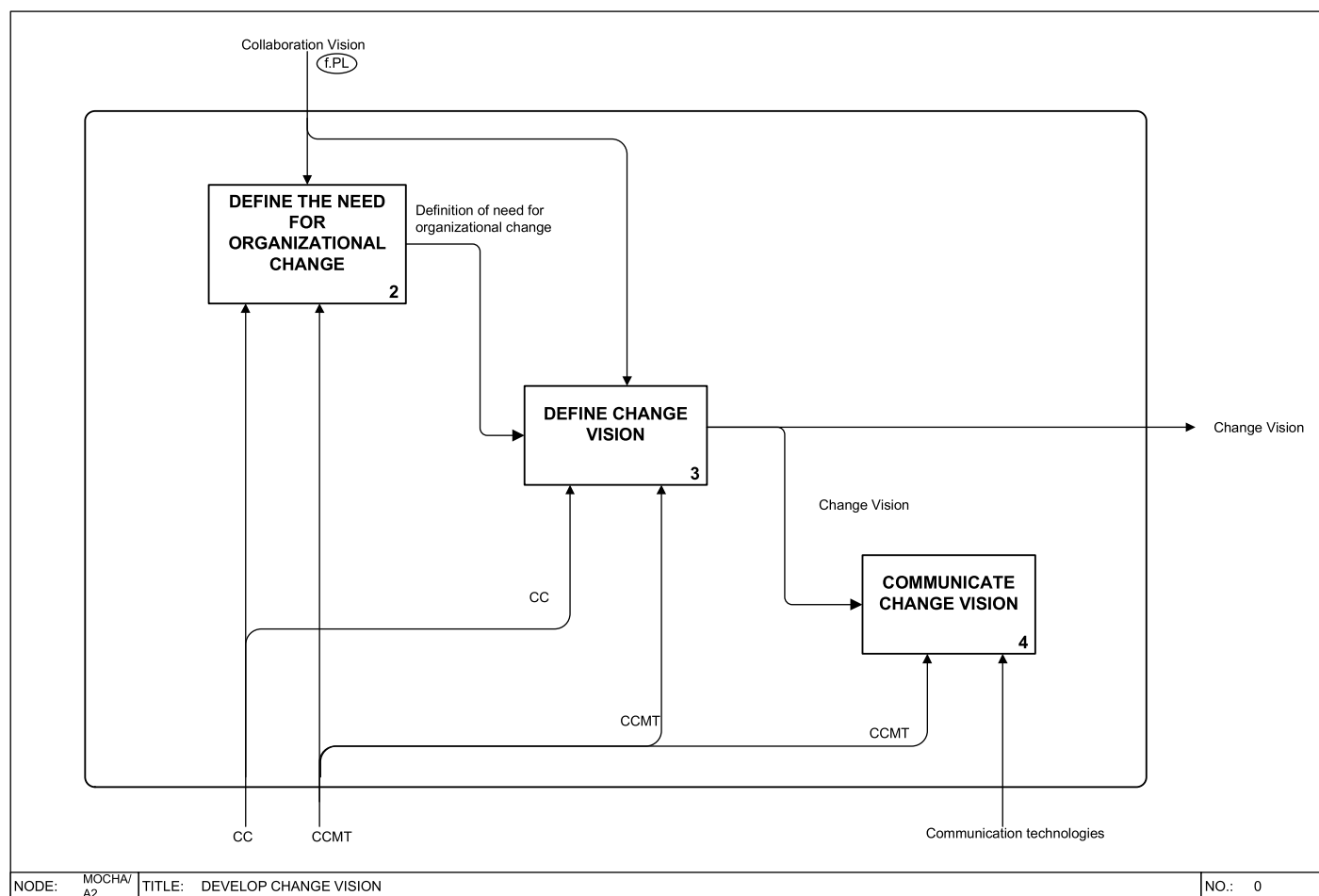


Fig. 7. MOCHA/A2: develop change vision

organizational changes. MOCHA/A3 consists of three subprocesses, which are shown in Fig. 8.

The first step is to define the current tools and needs for the ICT. The current ICT tools in use are established and summarized by the systems manager and CCMT in the form of an ICT audit report for each organization. These are considered by the collaboration management team members to identify new technical requirements when planning the collaboration solution.

The next step is to identify required organizational changes. When the collaboration specifications defined at the organizational level of the project are communicated to the organizations, each organization should conduct an analysis to identify their impact on the employees' perceptions, organizational processes, ICT tools and technologies, and the workflow structure of the organization. Taking these factors and the change vision into account, the CCMT and CC identify the organizational changes required to implement the collaboration specifications. The output for this process is the list of changes.

The final step is to plan the organizational change. Once the required organizational changes are identified, the CC and senior management should develop a plan for how this change will be implemented, considering the change vision and the resources. This plan is called the change implementation action plan.

Implement Organizational Change: MOCHA/A4

The fourth process of MOCHA is aimed at finalizing the collaboration solution through a pilot implementation, conducting training, and finally implementing the collaboration solution on the project.

It consists of three subprocesses, each of which modifies the change implementation action plan by using the feedback obtained at each step. The IDEF0 diagram for MOCHA/A4 is shown in Fig. 9.

The first step is to pilot and refine change. This process implements a pilot of the collaboration environment and conducts the changes required for this. The changes are implemented according to the change implementation action plan developed in the previous process. Only a sample of users are involved in the pilot; it is recommended to use CCMT members for this sample because they have already been involved in capturing user and organizational requirements and know what is expected from the collaboration environment. Furthermore, including the CCMT members for the pilot will increase the likelihood of having a thorough examination of the collaboration environment while keeping an eye on the organizational change management processes. The system manager should also be involved in this process to cover the technical aspects of the pilot.

Conducting a thorough pilot process will prevent an unexpected need for major changes during the implementation of the actual project. The pilot implementation is expected to provide feedback on two areas. The first feedback is related to the change implementation procedures of the organization, which will be used to modify the change implementation action plan. The second feedback is related to the collaboration environment implementation. The organizational reflections and feedback about the pilot CE implementation constitute the output of this process, which is communicated to the project organizational level and used to determine the alterations to the collaboration solution.

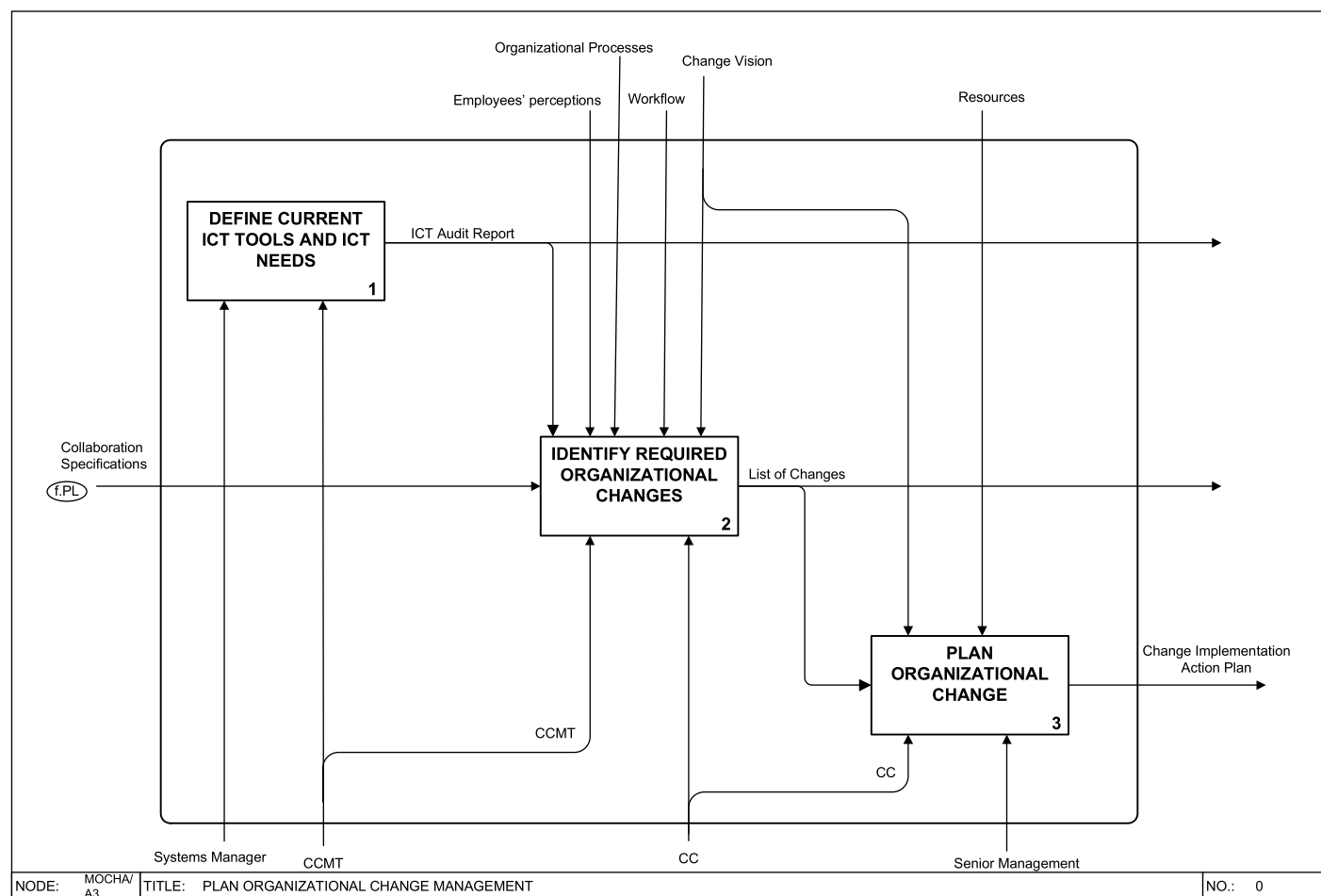


Fig. 8. MOCHA/A3: plan organizational change management

The next step is to conduct training. Training is conducted following the recommendations defined by the CCMT. The CC and systems manager should be involved in this process. Training must be aligned with the change implementation action plan and should be considered as a combination of training on the use of the collaboration environment tool and training on the collaboration standards and procedures detailed in the collaboration specifications. During the training, some feedback on change implementation is also obtained. This feedback is used to alter the change implementation action plan.

The final step is to implement change. This process starts the implementation of the final collaboration plan and associated changes fixed after the pilot implementation at the project organizational level. The systems manager, CC, and CCMT should be the primary actors for this process. This process allows the start of the use of the collaboration environment on the construction project. During this step, feedback on change implementation is obtained and used to revise the change implementation action plan.

Evaluate Organizational Change: MOCHA/A5

The last process of MOCHA is aimed at evaluating the adoption of organizational change in the short and long terms, and facilitating organizational learning during the implementation. MOCHA/A5 consists of five subprocesses, as shown in Fig. 10.

The first step is to obtain short-term results on collaboration. A short-term performance evaluation should be conducted within each organization to check whether the collaboration environment is working efficiently and to identify any bottlenecks or barriers

that should be removed. The organizations should also evaluate whether the organizational change is accepted by employees and whether there are any alterations to be made in the change implementation action plan. This process is conducted by the CCMT and CC using appropriate data collection and performance measurement techniques. The results are documented as the organizational performance evaluation report, which is sent to the project organization level for a further interorganizational evaluation of the collaboration environment performance.

The next step is to implement the altered collaboration solution. The short-term evaluation of the performance of the collaboration solution will result in some alterations in the collaboration solution at the project organization level. Each organization will implement this altered solution. The CC and CCMT will conduct this process, taking into account the short-term results of the change management performance.

The third step is to alter the change management procedures. As previously stated, the organizational performance evaluation focuses on both the collaboration environment and the organizational change. The modifications required in the collaboration solution are determined at the project organization level, whereas the modifications required in change management procedures are independently conducted in each organization. This process determines these modifications to the change management procedures and is conducted by the CC and CCMT. The output of the process is the altered change implementation plan.

The penultimate step is to evaluate long-term results. At the end or close to the end of the project, the long-term implications on the

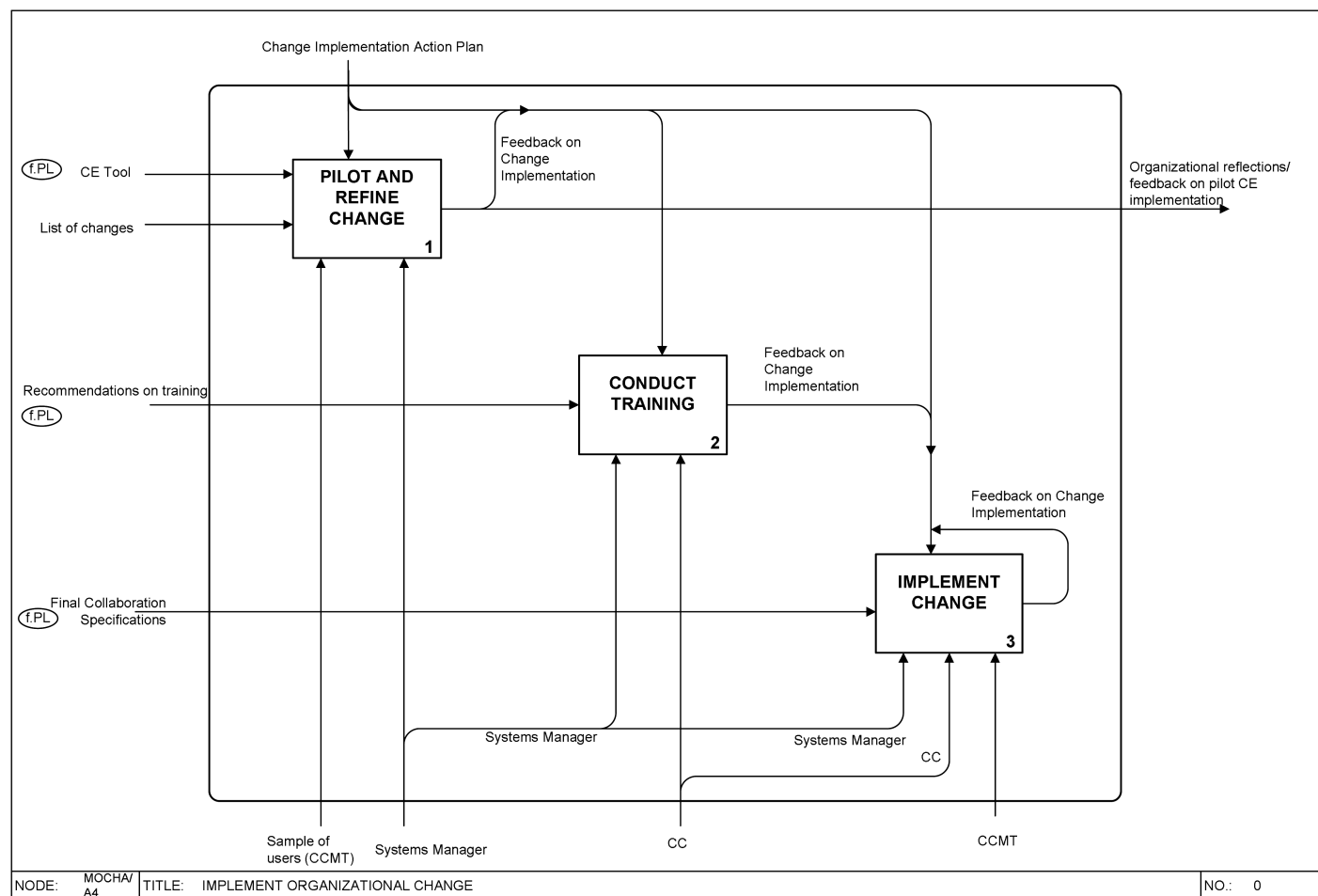


Fig. 9. MOCHA/A4: implement organizational change

change management are evaluated by the CC and CCMT using appropriate performance measurement techniques. The results of the evaluation are documented as the long-term performance evaluation report.

The final step is to document organizational learning. The aim of this process is to document and save strategic data that will be beneficial for future organizational change management attempts in the form of guidelines or recommendations. During any change implementation, organizations go through an implicit or explicit learning process. Best practices, required alterations, and corrected mistakes all form lessons learned during the implementation, which should be captured throughout the implementation. The CC and senior management conduct a final evaluation of these captured lessons at the end of the project and the CC documents the organizational learning.

Evaluation of Framework

Evaluation Methodology

The primary purpose of evaluation research is not to discover new knowledge, but to study the effectiveness of a practical action enhanced by the existing knowledge (Babbie 1995; Clarke 1999). An evaluation was conducted to validate the MOCHA framework. The aim was to assess the overall effectiveness of the framework, the extent of its ability to manage the organizational changes resulting from implementing a collaboration environment, and the extent of its ability to facilitate the implementation of collaboration

environments. The evaluation also aimed at obtaining the recommendations of industry professionals for further improvement of the framework.

The design of the evaluation research considered many factors. Construction companies should start using the MOCHA framework as soon as the need for an IT-enabled collaboration is communicated to the collaborating parties, and continue using the framework until after the completion of the project. It was not feasible to implement the MOCHA framework on a real project for the evaluation because this would require all collaborating parties to agree to continuous data collection for up to two years, in addition to providing researchers full access to the processes of the case study organization and the power to interfere with the implementation of the changes. Implementing the framework for a small-scale change on a short pilot project would also be inappropriate because the partial implementation of the framework would not evaluate the full potential of the framework, which addresses all collaboration and change processes in detail throughout the life cycle of a project. The infeasibility of a real case study evaluation and the limitations of small-scale implementation to evaluate the framework called for an alternative validation method.

The evaluation was conducted by consulting the experts in construction companies who are in charge of leading the type of organizational changes that MOCHA framework is meant to manage. Based on their previous experiences, these experts were all capable of assessing the potential effectiveness of the framework. It was decided to triangulate the qualitative and quantitative approaches and to obtain evaluation data through a mix of different

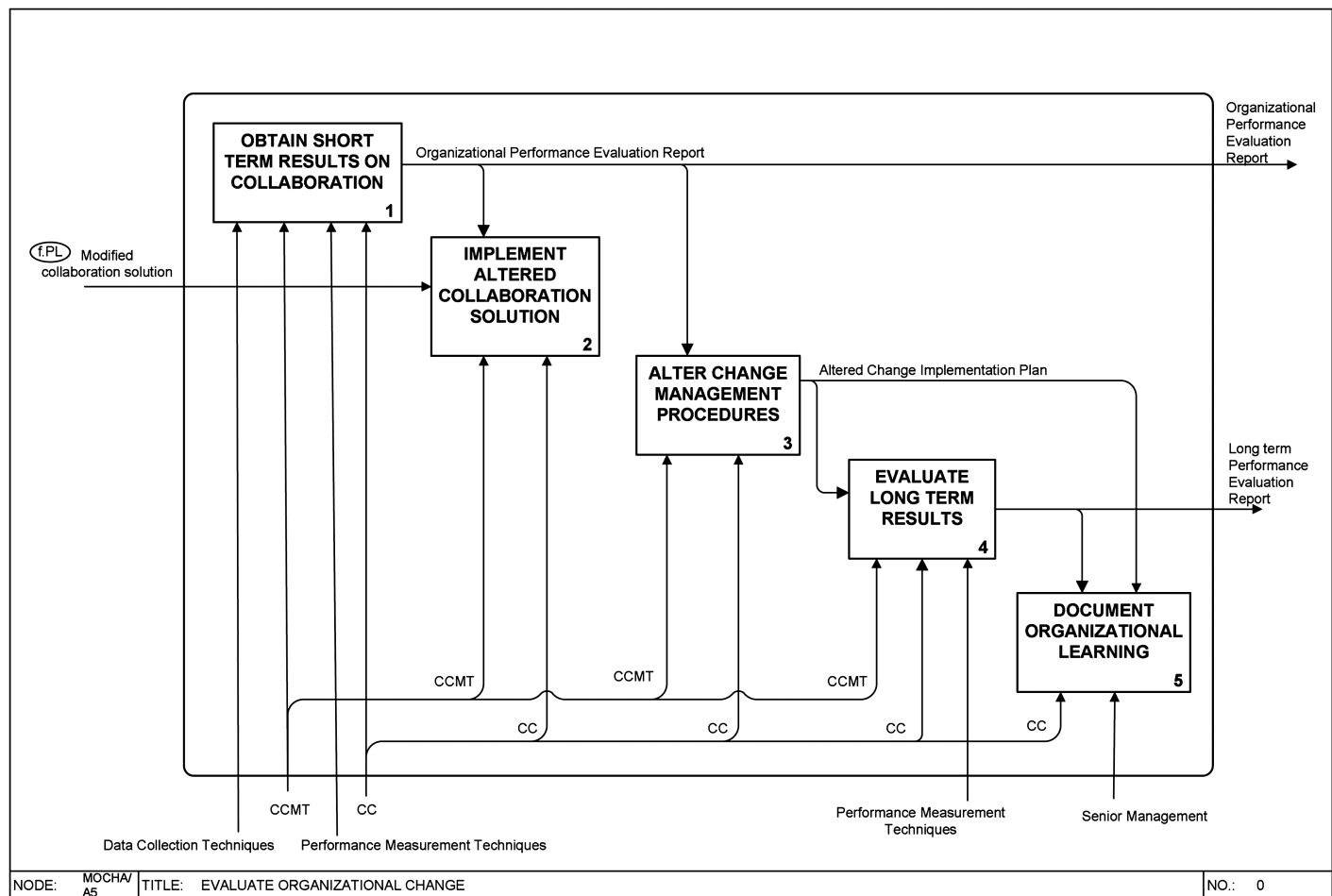


Fig. 10. MOCHA/A5: evaluate organizational change

Table 4. Node Index for MOCHA Framework

Diagram reference	Description and activities included
MOCHA/A0	Manage organizational changes attributable to implementation of a collaboration environment
MOCHA/A1	Initiate organizational change management - A11 Build change implementation team - A12 Communicate initial change - A13 Capture user and organizational requirements
MOCHA/A2	Develop change vision - A21 Define the need for organizational change - A22 Define change vision - A23 Communicate change vision
MOCHA/A3	Plan organizational change management - A31 Define current ICT tools and needs - A32 Identify required organizational changes - A33 Plan organizational change
MOCHA/A4	Implement organizational change - A41 Pilot and refine change - A42 Conduct training - A43 Implement change
MOCHA/A5	Evaluate organizational change - A51 Obtain short-term results on collaboration - A52 Implement altered collaboration solution - A53 Alter change management procedures - A54 Evaluate long term results - A55 Fit the change into organization culture

data collection methods. Discussions, questions and answers, and a questionnaire were utilized during meetings arranged with eight construction organizations to evaluate the MOCHA framework. These eight organizations consisted of two contracting companies, two architecture companies, three consultancy companies, and one real estate (design management) trust organization collaborating with one of the consultancy companies. Six of these organizations had also participated in the earlier part of this research, which identified the enablers of the key success factors and the barriers to the implementation of collaboration environments. These findings had informed the MOCHA framework; hence, it was intended to use the same organizations to determine the extent to which the MOCHA framework managed to address the concerns discussed in the previous stage of the research. A total of 13 construction professionals participated in the evaluation. They were chosen from senior level managers who had been involved in the implementation of the collaboration environments, actively participated in the collaboration environments, experienced the difficulties and barriers, and made decisions to overcome these barriers.

Hour-long evaluation sessions were arranged with each company. The evaluation process conducted with each company is shown in Fig. 11. The evaluators were presented a brief summary of the research and examined the IDEF0 diagrams of the MOCHA framework, explaining all processes and subprocesses. This was followed by an informal discussion session and questions and

answers with the evaluators. These sessions provided qualitative data on the framework. When the discussion was over, the evaluators were provided with a questionnaire that consisted of closed and open-ended questions. This questionnaire allowed the collection of qualitative and quantitative data. The questionnaire consisted of three sections:

1. Background information section, which requested information about the evaluator's name, job title/position, experience in the construction industry in terms of years, company name and address, and e-mail or contact number;
2. MOCHA framework section, which consisted of 11 closed questions that assessed the effectiveness of the organizational level processes in managing the organizational changes resulting from the implementation of collaboration environments; and
3. MOCHA framework general comments section, which consisted of four open-ended questions asking about the benefits of the MOCHA framework, barriers to its implementation, potential improvements that can be made to the framework, and further comments of the evaluators.

Responses to the questionnaire were further discussed with the respondents to determine a richer picture through qualitative data. Using a triangulation of quantitative and qualitative research methods during the evaluation allowed researcher bias to be avoided through the use of quantitative data collection while obtaining a deeper understanding of the concepts through qualitative data collection.

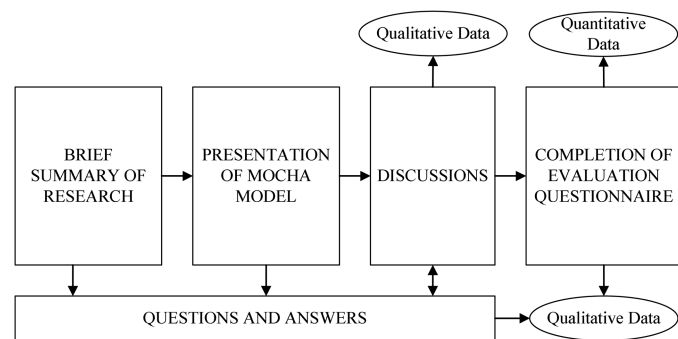


Fig. 11. Evaluation process in the meetings

Evaluation Results and Discussions

The quantitative analysis results obtained from the closed questions in the questionnaire are shown in Table 5, which presents the responses in terms of the percentage of evaluators with regard to the assessment scale. The assessment scale used in the questionnaire was based on a Likert scale and ranged from 1 to 5, which represented a range from poor to excellent. The average ratings obtained for each question are also shown in Table 5.

The usefulness of the framework was rated as 4.1 in the questionnaire. The results in Table 5 show that the mean ratings were higher than 3.5 for 9 out of 11 questions in this section, which means that the mean rating for 85% of the questions was higher than 3.5. The remaining two questions that had the lowest mean ratings in the questionnaire were related to the extent of high-level user involvement that can be ensured in construction projects and the extent of the usefulness of MOCHA in managing employee resistance. Although these questions received lower ratings than the other responses (3.2 and 3.1, respectively), both ratings are above the satisfactory level. However, this response calls for further research on transformational dynamics at the user level and further detailing of the framework considering these dynamics at the user level.

The open-ended questions in the questionnaire and the discussions after the presentation of the framework allowed further understanding of the responses given to the closed questions presented in Table 5. For example, one of the evaluators rated the questions significantly lower than the other evaluators. This evaluator worked as a design manager in the research and development (RD) department of a contracting company. In most questions, there were contradictions with this evaluator's colleague from the same company. Some questions were marked as 1 or 2 by this evaluator, whereas another evaluator rated the same issues as 4 or 5. The reason for this difference between two evaluators from the company became clear in the analysis of the qualitative data. This evaluator was of the view that no methodology or framework could be a solution to the change management or collaboration process in the construction industry. According to the evaluator, each methodology introduced to manage the change would also be considered "a new set of tasks," and hence, "a change itself." This evaluator thought that employees would resist this new set of tasks and would not contribute to the change management process. Stating that their

Table 5. Evaluation Responses to MOCHA Framework

Number	Evaluation questions	Rating (%)					Mean rate
		1: Poor	2: Fair	3: Satisfactory	4: Good	5: Excellent	
1	How useful do you consider the overall framework?	—	—	15	62	23	4.1
2	How easy is it to follow the IDEF0 process models in MOCHA?	—	—	46	38	15	3.7
3	To what extent can MOCHA improve the benefits obtained from the collaboration tools and technologies?	—	—	8	92	—	3.9
4	To what extent do you believe that building a CCMT is helpful in managing organizational change?	—	—	23	46	31	4.1
5	To what extent can MOCHA ensure top level commitment to organizational changes?	8	—	31	54	8	3.5
6	To what extent can a high level of user involvement in MOCHA be ensured in construction projects?	—	15	54	31	—	3.2
7	How useful is MOCHA in managing employee resistance to change?	8	—	69	23	—	3.1
8	How well does MOCHA encourage increased user involvement in change management?	—	—	31	62	8	3.8
9	How well can MOCHA capture employee requirements and wishes?	—	8	38	46	8	3.5
10	How convinced are you that MOCHA should be used at the organizational level for change management?	—	8	23	46	23	3.9
11	How would you rate the usefulness of MOCHA in managing organizational changes?	—	8	31	54	8	3.6

company had already tried to implement different collaboration technologies and methodologies in different ways and that they were not accepted by the employees, regardless of the methodology in use, the evaluator suggested that the MOCHA framework would not be perceived any differently. On the other hand, the second evaluator was of the view that the collaboration environments and procedures that the company had tried to implement in the past were not accepted only because they were imposed on the employees with no user involvement during the planning process. This evaluator thought that if the previous changes were introduced following a methodology similar to MOCHA processes, they would have been accepted without any problems.

The evaluators were further asked about what they particularly liked about the framework and what they considered to be its primary benefits. All evaluators agreed that the primary benefit of the framework was that it provided organizations with a smooth logical process to follow for organizational changes conducted during the implementation of collaboration environments. It was perceived as a well-considered system by all organizations, which would guide the collaborating parties to conducted organizational changes resulting from the implementation of the collaboration environments. They were also of the view that this framework may also be used to guide the implementation of other types of organizational changes, if carefully tailored.

The evaluations also allowed the identification of some barriers to the implementation of the MOCHA framework in construction organizations. One of the evaluators suggested that construction organizations may think that they are following these processes, even if they are not. One evaluator suggested that some construction professionals may think that adopting this methodology will be enough for success, and may actually underestimate the actual contribution required from people to make the collaboration work. Another barrier was related to the pilot implementation. Two evaluators suggested that some organizations may consider the pilot implementation too costly. One evaluator, as explained previously, thought that the framework itself might be considered as a change. Although the number of evaluators suggesting each barrier is limited to one or two among the 13 evaluators, it is still worth considering these barriers before implementing the framework in an organization and taking necessary actions to tackle them.

Using a triangulation of quantitative and qualitative research methods during the evaluation helped the researcher in many ways. Conducting a quantitative data collection, researcher bias was avoided, which can be more difficult to avoid in qualitative data collection. By using qualitative data collection, the researcher had a chance to better understand the quantitative data and to examine other dimensions that might not have been captured in the questionnaire. The evaluators cannot be expected to provide purely objective data during the qualitative or quantitative data collection. This is not a weakness of the research methodology; on the contrary, the subjective data obtained from the evaluators increased the richness of the data, allowed the capabilities of the MOCHA framework to be understood for achieving its aim, and provided guidance for further research. The overall analysis of qualitative and quantitative data obtained through the evaluation meetings indicates that the MOCHA framework was found to be successful by the evaluators.

Summary and Conclusions

This paper presented a study on organizational change management in construction organizations as a result of the implementation of collaboration environments. Related theoretical concepts and

previous work on organizational change management have been reviewed, and the need for an organizational change management approach, to achieve the full benefits expected from the implementation of collaboration environments, has been justified by theoretical concepts in organizational change management and by previous work on construction collaboration environments. The MOCHA framework presented in this research addressed this need and provided a logical process, which was developed by using the IDEF0 modeling approach. The MOCHA framework guides construction organizations in managing and implementing these organizational changes with an aim to improve the efficiency and effectiveness of the collaboration environments. The framework was evaluated by a sample of construction professionals and was accepted as an effective guide for adopting the process in each organization and managing organizational changes required for the collaboration environment. Conclusions drawn from the research are listed in the following.

- The success of collaboration environments not only depends on the collaboration environment introduced to the organization, but is also related to how it is introduced. Therefore, the change management required for implementation should be considered carefully.
- The MOCHA framework provides a methodology guided by organizational change management principles to manage how collaboration environments are introduced into the organization.
- The collaboration change management team introduced by the MOCHA framework has the potential to manage the resistance of employees to change by enhancing user involvement, capturing the user requirements effectively, and communicating the change, therefore creating a sense of ownership of the change among the employees.

This research presented the MOCHA framework, which focused on change management at the organizational level. Further research will be conducted at the user level to better understand the transformational dynamics users experience during the implementation of a collaboration environment.

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