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Emerald Article: Managing meta-learning in offshore software development environments

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Managing meta-learning in offshore software development environments

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Abstract

Purpose – The purpose of this paper is to investigate the current glocal (global and local) environment to answer the following research questions: How does the glocal environment influence software exporting industries in India? How is the evolving "sticky" knowledge from individuals and teams assimilated into organizational knowledge repositories? What management practices have been learnt and applied for advancement of knowledge portfolios in the offshore software business market?
Design/methodology/approach – An interpretivist research design is used to gain insights into organizational learning processes adopted by offshore software vendors for assimilating evolving knowledge into knowledge repositories.
Findings – This paper describes the influence of the current glocal environment on software exporting industries in India and presents a model for organizational learning to assimilate knowledge and build effective representations of emerging knowledge artifacts. The authors employ the concept of meta-learning (or "learning about learning") to analyze the recursive nature of organizational learning processes.
Practical Implications – The proposed model of meta-learning explains how software organizations build on individual and team competencies to build core competencies. The model helps us to understand how organizations advance their learning processes and upgrade their knowledge repositories.
Originality/value – The paper offers new perspectives on how organizations reflexively monitor their knowledge processes to advance their knowledge portfolios. It identifies adhocratic and bureaucratic management processes for assimilating the evolving "sticky" knowledge from individuals into organizational knowledge repositories. This paper contributes to the growing body of literature that emphasizes ongoing learning from individual to collective level in the knowledge industry sector.

Keywords India, Outsourcing, Computer software, Learning organizations, Knowledge management, Meta-learning, Glocal, Recursive learning, Team management, Artefact management, Knowledge repositories

Paper type Research paper

1. Introduction

Environmental conditions and industry characteristics largely shape a firm's strategies to develop patterns of learning and asset (tangible and intangible) accumulation, when they create products and services for disparate markets (Lei *et al.*, 1996). The emerging dynamic markets in offshore outsourcing have introduced a society driven by interaction between global and local industries collaborating for products and services. These products and services are created for global clients, but in the local conditions of the vendor country. This has given rise to a new term, "glocalization," which refers to the balance between global standardization and local flexibility for re-defining strategies to build shared knowledge (Svensson, 2001). A related concept, termed "negotiated culture" (Walsham, 2002) identifies a learning attitude by client and vendor outsourcing organizations belonging to different cultures, in which both strive to

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improve their understanding of each other. In this manner, organizational learning takes place, new opportunities are identified and new skills learnt. For instance, knowledge of clients can help vendors spot opportunities such as export of ancillary products and services bundled with existing product exports (Ghemawat and Hout, 2008). To translate organizational learning into core competencies, firms must continually invest in learning efforts to upgrade firm-specific resources and skills (Lei *et al.*, 1996).

The term "meta-learning" (or "learning about learning") has been used to describe the evolving and recursive nature of organizational learning. Meta-learning involves double-loop learning by taking low-level learning established within normal routines to higher levels aimed at creating new insights, heuristics and collective knowledge consciousness (Lei *et al.*, 1996). Meta-learning has been described in another study as a "nonlinear dynamical model" to bring new thinking and learning into organizations (Losada, 1999, p. 179). Losada has characterized meta-learning as a function of the organizational environment, comprising advocacy, inquiry, creativity and connectivity. Meta-learning advocates a positive learning environment by encouraging organizations to have an inquiring attitude, create firm-specific assets and connect them with the organization's knowledge base. A proper balance between advocacy (governance) and inquiry (learning attitude) allows organizations to meta-learn when they "acknowledge their internal strengths and weaknesses, so that they can match opportunities in the external business environment" (Losada, 1999, p. 190).

Nonaka and vonKrogh (2009, p. 637) reiterate that knowledge creation depends upon "how organizations foster creativity, create opportunities, change and enable innovation." The knowledge consists of tacit and explicit elements, which interact over a knowledge continuum comprised of four processes: socialization, externalization, combination and internalization (referred to as the SECI model) (Nonaka and Takeuchi, 1995). This interaction of tacit and explicit knowledge elements leads to new learning. Individual subjective experiences or "sticky" knowledge is first articulated (socialization), then moved into concepts (externalization) that are combined with existing information (combination) and finally result in new knowledge assets (internalization) that are shared with wider groups and teams. In this manner, individual skills (e.g. ideas, concepts, experiences) are accumulated and converted into firm-specific assets (e.g. component libraries, document templates, checklists) to upgrade core competencies and be assimilated into organizational knowledge repositories.

This study empirically investigates the concept of meta-learning and knowledge creation in the current outsourcing software development environment. Continuous learning provides the basis for a sustainable competitive advantage, and knowledge-based organizations know this. In particular, for knowledge-intensive firms, learning at organizational and individual level is of prime importance (Voberda *et al.*, 2010) to enable them to build knowledge portfolios which provide them with a basis for a sustainable competitive advantage. However, in offshore outsourcing environments, such as software development, different technical, social and cultural experiences add complexity to learning processes (Sahay *et al.*, 2003). This complexity can be traced to two attributes of knowledge; its fragmentation and its "stickiness" (i.e. how tacit knowledge is held in the minds of individuals) (Tiwana, 2003). Organizational learning evolves as "sticky" knowledge from individuals (software engineers) is first extracted and captured into intermediate product deliverables. Evolving knowledge leads to definition of new assets and best practices, which are added to existing knowledge repositories for re-use in other offshore projects by different groups (teams). What

holds best for today may not be the best for tomorrow, and organizations have to review current practice to re-define best practices as they move up the learning curve and mature with experience (Rottman and Lacity, 2004).

Members of organizational communities use many socially recognized types of communicative actions (or genres) in their everyday interaction to communicate with each other (Yates *et al.*, 1999). The meanings of these actions (e.g. specialized vocabulary, informal language, observable actions) are recognized only by members within that community. They represent institutionalized norms within organizations, which shape the characteristics of ongoing social interactions as members routinely enact these actions for particular purposes (Yates *et al.*, 1999). Within the linguistic genres encountered during the conduct of this study, communicative terms included "artifact" for tangible assets, "adhocratic" to signify opposite of bureaucratic, "poke" for ask, "file transfer protocol" (FTP) for transferring information in one package, and "sitting on the bench" to imply a person is currently not involved in any project. Such genres serve as an institutionalized template to reflect common knowledge, expectations and norms within members of that community (Yates *et al.*, 1999).

The purpose of this study is to examine how organizations meta-learn to build organizational knowledge repositories and upgrade core competencies. An empirical investigation of six software vendors based in India was undertaken to understand learning efforts used by practitioners in the dynamic offshore outsourcing environment. Vendors' perspectives have been complemented with academic literature on offshore outsourcing and knowledge management to derive a comprehensive model illustrating the process of meta-learning. Because organizational learning is very much a social and real-life process, the genres (local vocabulary) used by the participants have been used extensively to extend the model.

Three research questions are posed:

(1) How does the offshore environment influence software exporting industries in India?

(2) How is the evolving "sticky" knowledge from individuals and teams assimilated into organizational knowledge repositories?

(3) What management practices have been learnt and applied for advancement of knowledge portfolios in the offshore software business market?

Having set the focus of our study by posing the research questions, we begin with a synthesis of existing literature describing the changing global and local environments in the offshore outsourcing industry. Knowledge management theories are discussed to explain how organizational learning processes take place to build core competencies in emerging software development offshore markets. Next, the research design used to answer the questions is presented, followed by brief descriptions of six case study offshore vendor organizations. Next, the theoretical basis is complemented with empirical data obtained from the case studies to develop a comprehensive model for meta-learning. In our conclusion, we discuss the ways by which organizations meta-learn from past experiences and build their knowledge portfolios. Finally, we present the limitations of the study and propose directions for future research.

2. Theoretical background

Globalization has linked local markets situated in different time zones enabling a free flow of knowledge. This is especially relevant in the software industry, which since the

late 1990s has witnessed major changes in software exporting nations (e.g. China, India), and Indian exporters presently lead the software offshore outsourcing marketplace (Ramasabbu *et al.*, 2008). Offshore outsourcing has opened India's exports and software development represents approximately one-third of India's service exports (Eppinger and Chitkara, 2006). Further, having a national association or consortium helps to promote the nation's industry abroad; and National Association of Software and Service Companies (NASSCOM) has helped the branding (in the marketing sense) of the Indian software export industry (Carmel, 2003).

Multinational companies have deployed large financial resources in the knowledge sector (e.g. R&D) with the relaxation of Indian government policies on trade liberalization allowing direct foreign investments. In view of the demand for software services, export zones such as Software Technology Parks (STPs) have been created in which local businesses have set-up a pool of common resources. Having to export in competition with the rest of the world in new products, software designs and process technologies involving quality improvements, local businesses are adopting new business models (Dahlman, 2007). The local businesses in STPs offer services to each other for building products and services for global clients. These STPs are geared toward exporting their own products and, to take advantage of these benefits, many businesses have established their own STPs (RajKumar and Dawley, 1998). However, international norms relating to infrastructure requirements, protection of intellectual property and legal systems are still limited in many exporting nations (Dahlman, 2007).

In a distributed setting such as offshore software development, information and telecommunication technologies are used to bring together teams spread across geographical, organizational and/or temporal settings (Powell *et al.*, 2004). Both local and global influences interact over ICTs, as the teams exchange "a significant amount of localized knowledge," which in turn is influenced by the global environment, such as software platforms or application tools used by offshore clients (Sahay *et al.*, 2003, p. 132). Software development is built upon a system of practices that is extracted from individuals and software teams as they go through iterative development cycles to combine evolving knowledge assets into project deliverables. Each development cycle has two types of knowledge: the explicit knowledge that can be laid out formally across teams and the tacit, less formal knowledge regarding local work practices of individuals, such as preferences in design and programming choices (Heeks *et al.*, 2001). With the progression of each cycle, team members inform each other about local work practices to generate new artifacts which are then reviewed by teams and integrated into knowledge portfolios. However, in a distributed workplace, the learner cannot watch the expert (Sahay *et al.*, 2003), hence the process of conversion from tacit to explicit (and vice versa) and assimilation from individual to collective (and vice versa) is a challenging task. To develop effective representations of artifacts, organizational governance must recognize knowledge specialization among individuals and have beliefs about the team's capabilities and responsibilities (Kanawattanachai and Yoo, 2007). This creates learning between teams as they realize and utilize common artifacts leading to innovation and competence management (Bunderson and Boumgarden, 2010). Accordingly both teams and artifacts form important components in organizational learning process.

2.1 Team component

Team management involves understanding social as well as technical influences, so that the "sticky" knowledge extracted from teams can be communicated across

organizational boundaries. There are two interacting forces in this component; bottom-up (pull) activities within teams and top-down (push) policies from management.

The interdependent nature of software development work implies that team members use collective ways of organizing relevant knowledge, such as wikis and blogs, which are ideal for teams spread across different locations and time zones (Herman, 2003). As wiki inventor Ward Cunningham points out, blogs have brought out the story telling nature in all of us, and most of us have something to contribute, whether it is knowledge, insight, experience, a comment, a fact, an edit, a link or some other content (McAfee, 2006). Team members learn during the process of development and reflect upon that learning in their writings and discussions, thus, knowledge is pulled up via informal writing and discussion forums. Another pulling approach to capture knowledge is through regular project reviews to re-consider past and present best practices at the end of each project. The reflective nature of project reviews aids learning, as project experiences are shared and bottlenecks identified leading to re-definition of best practices. The knowledge accumulated through bottom-up activities is documented in top-down procedures such as standardized templates and checklists. The revised documents are then pushed down to the workforce through rules and policies. In this way, knowledge that had earlier been pulled up from the workforce is pushed back down. The continuous process of questioning and re-considering existing premises fosters organizational knowledge creation (Nonaka and Takeuchi, 1995) and illustrates team learning.

Pushing approaches identified in existing literature are through use of control measures to allocate tasks and objectives within the workforce. Different types of controls to obtain favorable results have been described, namely behavior-based, performance-based, schedule-based and collaborative clan-based (Gosain *et al.*, 2005; Ouchi, 1978). To motivate team members to share their work habits and develop shared perceptions, management mandates certain kinds of behavior for nourishing a collaborative culture; applauds individual and team achievements by rewarding performances and encourages goal-based outcomes for conforming to quality and schedules. Other controls to integrate tasks and objectives across organizational units are coordination mechanisms, such as standards, plans, and formal or informal mutual adjustments (Sabherwal, 2003).

Another aspect of good management practice involves training staff on required technologies, and ensuring that an individual's professional status matches with their responsibility and workload. Good management implies being proactive rather than reactive. Proactive management will anticipate the possibility of losing staff before their "notice" is given, and will have practices in place to reduce the impact of staff turnover on project schedules. Practices such as training and mentoring staff so that the team is not overly reliant on any one person help reduce the impact of attrition (Cullen, 2002).

2.2 Artifact component

Artifacts refer to the tangible elements used by organizations to measure and capitalize the knowledge acquired. From this perspective, organizations develop knowledge-intensive artifacts to exercise a proactive, strategic and technological watch by implementing competency management, such as knowledge preservation, return on experience, knowledge tracking for process improvement and core competencies management (Grundstein, 2002).

Having a planned formal methodology in place helps organizations to effectively manage their evolving knowledge artifacts (Mingus, 2001). Pushing practices such as

project status meetings, incremental releases and configuration management to the workforce are key to improving quality and control processes for global software development projects (Agarwal *et al.*, 2001; Heeks *et al.*, 2001; Murray, 2002).

Documentation further helps in reflecting the currency of emerging artifacts within the development team (Herbsleb and Moitra, 2001), and by implication, poor documentation can cause issues in management of artifacts. Managing artifacts involves reviewing documentation by specialists, recording incidents and tracking their solutions, and establishing standards for backups and project designs. In this manner, individual learning held in a person's mind is pulled up and preserved in organizational knowledge repositories (libraries and databases) so that they can be pushed down and be absorbed by others in the organization (Baskerville and Dulipovici, 2006). Takeuchi and Nonaka (2002) identify conversion of explicit concepts from tacit knowledge (or externalization) as key to knowledge creation, among the four modes (socialization, externalization, internalization and combination).

Furthermore, use of tools and measurements helps organizations become more aware of their capabilities. Balanced scorecards are one commonly used tool to track progress of deliverables and evaluate organizational performance in quality, cost and timeliness (Kaplan and Norton, 2002). With measurements, organizations can accurately determine whether realistic estimates have been made on project schedules, what new changes have been made to project scope by clients or teams, what the team's satisfaction level is at various stages of development, whether any training programs are needed, and if appropriate project management tools are being used (Gane, 2001).

Measurement of organizational processes can also be done through the use of some process maturity model. The Capability Maturity Model (CMM) developed by the Software Engineering Institute is a popular model used by software industries (Adler *et al.*, 2005; Ramasabbu *et al.*, 2008). However, it is generally agreed that, along with process improvement, CMM brings bureaucracy and reduces autonomy, and this reduces motivation in the workforce (Conradi and Fugggetta, 2002; Crocca, 1992). Moreover, many organizations do not have such international accreditations and they have pushed other controls to evaluate their performances. Regardless of the method used, it is important for organizations to manage the project value chain and build tangible artifacts.

3. Research design

The aim of this research is to explore real-life processes of organizational learning in the light of existing theories. Sahay *et al.* (2003, p. 36) suggest an interpretivist research design to understand the subjective nature of business practices used for offshore software development which requires a "shared understanding of each other's products, processes, and work practices." Klein and Myers (1999, p. 69) note that interpretive field studies involve sense making of events "through social constructions such as language, consciousness, shared meanings, documents, tools, and other artifacts." Observations and semi-structured interviews have been used during the conduct of this study, since interviews permit the development of a personal narrative (Cochran, 1990) to unfold stories addressing consciousness and shared meanings to particular work events. Observations complemented the interview data and took the form of sitting with team members during project meetings, picking up on non-verbal actions, and by examining related project documents and tools to understand the reality of organizational learning processes.

Six software vendor organizations participated in the study. The organizations selected are major players in software exports, and were based on purposeful sampling methods (Patton, 2002). The vendors were intentionally sought based on characteristics of the organization: industry type, company size, offshore partnerships, geographic coverage and so on (Patton, 2002). Of these organizations, two (L1 and L2) are large, while the remaining four (M1, M2, M3 and M4) are medium sized. Participants spanned vertical levels and functional groupings, including chief executive officers (CEO), chief technology officers (CTO), chief operations officers (COO), vice-presidents (VP), project managers, developers responsible for ongoing projects and employees from quality assurance and human resources departments. An overview of the six organizations is shown in Table I.

The NVivo software tool was employed to code interview data and track attributes related to common themes, as it became difficult to match attributes across these six cases. Bazeley (2007) encourages the use of qualitative software tools such as NVivo to help in managing the logistics of pieces of interview data, and adds that such tools do not hinder the interpretive capacity of the researcher. He compares the researcher using qualitative software tools to an artisan using his tools, "as the good artisan knows how to make his tools sing" to produce a creative piece of work (Bazeley, 2007, p. 10). Contextualization of various elements of interview data helped in inter-coding and categorization of attributes regarding vendor strategies for organizational learning. For instance, attributes such as decentralization, rewards, experience and insecurity emerged for the category "empowering teams."

4. How learning leads to meta-learning

Previous research has identified governance, communication, coordination and control tools for collaboration, team strengths and capabilities, knowledge repositories and knowledge preservation as determinants affecting knowledge processes (Heeks *et al.*, 2001; Herbsleb and Moitra, 2001; Jennex and Adelakun, 2003; Kishore *et al.*, 2003; Krishna *et al.*, 2004; Mockus and Herbsleb, 2001; Rottman and Lacity, 2004; Sabherwal, 2003; Tiwana, 2004). While there is extensive literature written on these individual

Organization	M1	M2	M3	M4	L1	L2
Head office	Minneapolis USA	Toronto Canada	Pacifica California	Vizag India	Pune India	Pune India
Knowledge center	Pune India	Pune and Bangalore India	Pune India	Vizag and Hyderabad India	Pune India	Pune India
Number of employees	90	100	200	170	1,800	1,500
Memberships, export zone locations, patents and certifications	~STP export zone ~Patents	~STP export zone	~STP export zone	~NASSCOM ~STP export zone ~CMM-lvl 3 ~ISO 9001: 2000	~NASSCOM ~CMM-level 5 ~ISO9001: 2000 ~PCMM lvl 5 ~BS7799-2: 2002	~NASSCOM ~Safe harbor certification ~CMM-lvl 5 ~ISO9001: 2000

Table I.
Overview of organizations

aspects, limited research has been conducted to determine their interconnection within a knowledge-intensive environment such as offshore software development. We investigated their interconnection from theoretical literature and empirical data findings to get a deeper understanding of organizational learning processes.

In the words of one practitioner in our study, meta-learning is defined as continuous learning about the management of knowledge assets, by "tailoring of individuals, teams, training, tools, designs, technology, and targets which cannot be just FTP-ed." The vendors identified certain learning to be essentially "bureaucratic," like pushing of documentation, measurements and milestone scheduling, and certain learning as "adhocratic," like pulling up of information from informal blogs and discussion forums of distributed team members, sharing of responsibilities within teams, and spot payments for performance rewards to encourage knowledge sharing, among others. Meta-learning is based upon push and pull processes as past learning experiences are analyzed to understand what implications they have for defining future best practices.

The workforce (teams) and organizational tools (artifacts) interact incrementally in an ongoing learning process and both have an impact on each other. An analogy to the importance of workforce v. artifacts was described by one practitioner in our study as being like a horse and a cart. He said that putting artifact ahead of its workforce was like putting the cart (artifact) ahead of the horse (workforce), and asking the cart to pull the horse. However, the importance of the cart cannot be ignored, as it carries the load (knowledge) and maintaining a balance between both is crucial. The link between teams and artifacts are individuals who on being informed via governance structures generate new artifacts which are preserved in knowledge repositories. Reflection on artifacts by teams leads to new learning on future best practices.

Learning implies moving from one's comfort zone to the competency zone, then moving beyond to have a learning edge over other competing organizations (Armour, 2006). However, "organizational learning does not translate into a core competence" (Lei *et al.*, 1996, p. 553); rather, firms must utilize and convert the learning efforts into firm-specific assets and continually update knowledge repositories. The evolving knowledge is continuously pushed down and pulled up with new learning from different project experiences. This is the stage of "meta-learning," where organizations move beyond their comfort zone and learn how to be better informed, how to generate new corporate assets as they reflect on how to maintain their core competencies. The meta-learning model is shown in Figure 1.

The model for meta-learning emerged during discussions with practitioners, and their comments provided interesting themes on organizational learning. One theme is the importance of adhocratic and bureaucratic processes in meta-learning. Another theme is to place more importance on teams as compared to artifacts, as artifacts are supporting tools for teams who are the knowledge creators. Third, continuous learning is the core link and involves pushing and pulling practices, with participation of individuals from all areas of specialization within the organization (i.e. software professionals, project managers, senior management, quality assurance personnel and human resource personnel). Finally a positive market environment supporting exporting industries by offering benefits such as reduced customs regulations and levies is said to have a direct impact on utilization of resources to facilitate meta-learning.

5. Getting behind the components: what organizations do

This section explicates extant literature addressing organizational learning and knowledge management theories by looking at practitioner practices in managing their

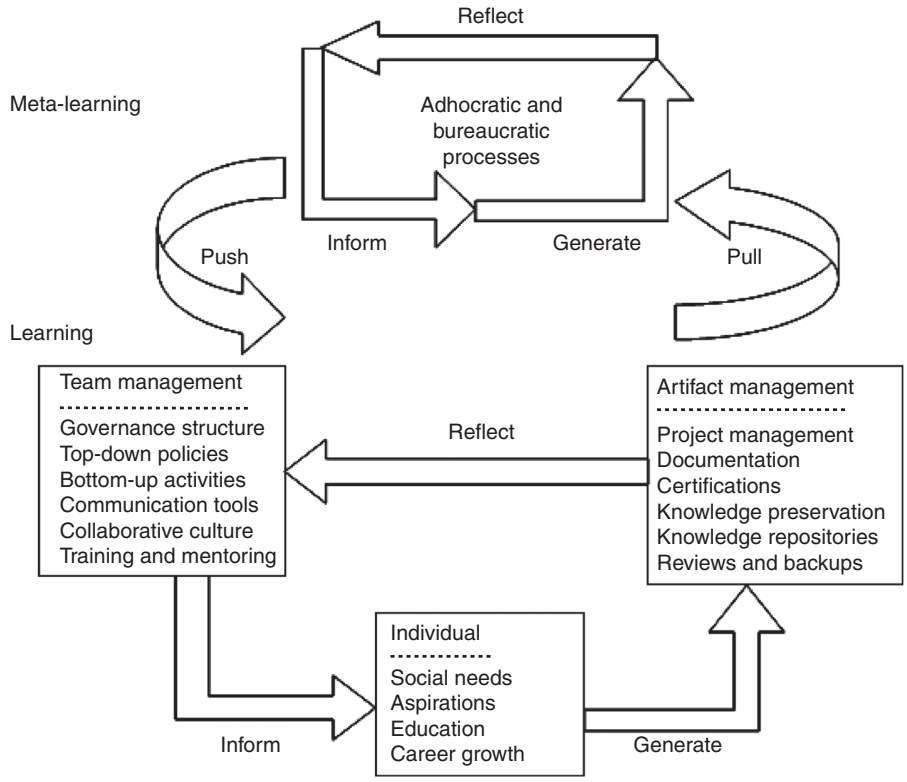

Figure 1.
Model for meta-learning

dynamic environments. How do organizations assimilate evolving knowledge and expertize from individuals, teams and artifacts to further increase learning, innovation and overall performance? Further, how are knowledge environments belonging to different global and local places integrated into practices at individual and organizational level to "renew, augment, and adapt [the firm's] core competence over time?" (Voberda *et al.*, 2010, p. 935). Studies have identified managerial practices involving social integration, participative decision making, power relationships, reward systems, and systems of human resource management practices and policies. However, empirical studies on exploitation of knowledge from dynamic environments, leading to intangible outcomes at individual and organization level constructs are limited (Voberda *et al.*, 2010).

Offshore software development is a recent phenomenon in export markets involving knowledge-intensive work environments. Interviews with six vendor organizations revealed that dynamic offshore environments have led them to identify new managerial interventions and learn from past project experiences to better manage corporate assets comprised of people and artifacts. These include changes in power structures, recognition of team member's performance before the six monthly reviews, integration of work and authority with technology, more efficient record keeping, use of tools for performance measurement and finally assessment of technical competencies to re-define best practices as each project offers some new learning. Organizations update their knowledge portfolios as they evaluate past experiences to

understand how to be better informed and integrate individual skill sets to generate coherent artifacts which are then reflected upon by cross-functional teams to build new knowledge from existing knowledge.

The following subsections elaborate on these organizational learning processes. Extensive use of interview quotes has been used in this section to bring the practitioners' viewpoint to the readers.

5.1 Empowering teams

Because sharing of knowledge is very much a social endeavor; the need to empower teams through some decentralization of authority is accepted by all organizations. Organizations have changed their previous bureaucratic processes to adhocratic processes. A telling remark by one developer aptly describes the changing behaviors in the knowledge industry:

> Now it is my mind skills which are required, rather than machine skills – so they cannot be bureaucratic and control us anymore.

Another key to empowering teams is rewarding the team members. The teams are encouraged to share their experiences in project review meetings, and are awarded special recognition prizes for their contributions. The project review meetings are followed more formally in internationally certified organizations (i.e. L1, L2 and M4).

The project manager of L1 added that younger team members are quicker to share their successes or failures than the 35 + age team members. He attributed this to the change in age balance of the team, in which the average age has reduced by ten years in the software industry over the last decade, resulting in more apprehension and insecurity in the senior age bracket. Being certified at the highest level (i.e. level 5) in People Capability Maturity Model (PCMM), L1 value their people, are keen to empower employees who have spent many years in the organization, and are sensitive to the social and career development needs of the workforce. L1 has the lowest attrition rate, which is 10 percent lower than the prevailing national figures of 25-30 percent, and displays charts in the offices reporting employee retention rates, number of job applications received and other employee satisfaction metrics (which are accumulated through anonymous surveys).

The data reveal that to bring about a knowledge-based view, organizations are tapping into individual skills and expertize, and creating an environment fostering knowledge sharing. In this way, individual competencies are pulled up to build the firm's core competencies.

5.2 Educate and motivate

Each of these organizations recognizes the impact of having a young, ambitious, intelligent, but potentially disgruntled workforce. Motivated employees lead to a long-term commitment. They have each defined slightly different ways of maintaining a balance of individual and organizational aspirations, so that a "window of opportunity" exists for both. Some practices are: executive MBA courses for employees in large organizations; personality development courses with role playing to bring fun within learning in both large and medium organizations; performance awards such as having a variable component in pay to encourage workers for more active participation in creating knowledge artifacts and spot awards (valuable contribution certificates with prize money) for meeting deadlines or low defect rates, among many others.

A verification of the learning attitude of the young software professionals is evident by this remark from a young developer from organization M2:

> This is my time to learn and learn new things – I will go wherever the learning is, and of course where the money is.

Another view on motivating the workforce is to send developers to client destinations, as experiencing another culture is considered a strong motivational factor by the management:

> Our programmers develop a complex if they are not sent overseas, so we send them after three years. If we don't, someone else will (Project Manager; L1).

These organizations have reflected on the intellectual and social needs of their employees, and have provided a work environment conducive to satisfying these needs. This has resulted in a motivated and active workforce that is eager to learn, share artifacts and experiment with new designs, further enabling innovation.

5.3 Document to build explicit knowledge

All six organizations believe that knowledge artifacts need to be maintained by keeping process documents up-to-date, and this is sometimes considered more important than just solving the problem:

> If it can't be documented, it cannot be transferred. We need to explain our actions (Project Manager; L2)

The chief technology officer of L1 joked about their heavy documentation in both paper and electronic form:

> We are still in the signature raj[1]. So, paper work cannot be ruled out.

M4 also uses strict documentation processes to capture workflows across geographical boundaries. Moreover maintaining up-to-date documentation is a compulsory requirement for the internationally certified organizations (L1, L2 and M4), and accordingly, we also find this to be the case. The non-certified organizations (M1, M2 and M3) have been found to be less formal with documentation:

> We don't worry too much on documentation – it is inbuilt within the software development process (CEO; M3).

The developers also drilled into ongoing project repositories to show the authors how visual aids with color coding displays are used to highlight various events in work flows. These displays indicate "next milestone meeting, list of attachments, comment density of the build and code inspection reports". Similar practices on documentation have been described by senior management of M1 and M2. Interestingly, developers too accepted that documentation is essential to capture knowledge:

> The documentation is essential for the company – so we have to do it. We don't mind it […] the good and the not so good go together (Developer; M2).

> Organizations are not comfortable in "just getting the work done"; rather they have defined background strategies to accumulate (pull) tacit work practices into explicitly documented work flows. In this manner, they upgrade their technical capabilities with new artifacts to build in-house expertise and capabilities. These artifacts are embedded into organizational repositories and institutionalized (pushed) into future product development processes.

5.4 Build knowledge processes through accreditations

The large organizations have many international accreditations, and consider them essential for retaining knowledge. Certifications help to reduce the impact of staff attrition, as work processes are formally documented in detail, thus making the management aware of project milestones, current status of targets and also of each member's present responsibilities. This helps in transferring work to a new member, if an employee quits the organization with just a week's notice. However, they also said that accreditations bring bureaucracy, but maintained that being large they need bureaucratic processes to survive.

Three of the four medium-sized organizations do not have international certifications, and said that they have no intentions of getting certified. They each maintain self-discipline in their processes and do not consider certifications necessary:

> We sell expertise and not TVs […]. We have found the extraordinary in the ordinary and have been granted a dozen patents. We don't need these other certifications (CEO; M1).

> Certifications are linked to an organization's maturity and are OK for big organizations, which have a lot of cushion- lot of support, but are not for medium-sized organizations like us […]. We maintain our knowledge confidentiality, and do not let it spread around (COO; M2).

> Certifications aren't necessary. They are just overheads (CEO; M3).

The findings reveal that although international accreditations ensure benefits such as standardization of work practices, they also come with a lot of associated "baggage". The medium-sized firms have defined internal processes to manage their knowledge work flows, but large-sized firms consider certifications critical for managing their evolving work artifacts involving big projects across different business units. They have learnt from past project experiences, and said certifications help to streamline work flows, such as correct versioning of artifacts, discipline in use of templates and checklists, use of shared repositories, and others, which enables them to push artifacts across distributed teams.

5.5 Define measurements

Some measurement practices in use are the total time required for project completion, the number of staff employed for each project and the size of project. With regard to these practices, we find that the medium-sized organizations use more informal processes, compared to the large organizations:

> Having too many measures makes it counterproductive, and will not be appreciated as it brings in bureaucracy. So we grow slowly, and measurements come in as we grow to become more and more structured (COO; M2).

> We cannot set too many structures and standards for developers and measurements of processes, and rely more on past experiences (Project Leader; M1).

> Each product has new constructs, new abstracts and new implementations – we cannot measure everything (Project Leader; M3).

> We do our best for measurements, but for certain things we rely on our past experience, rather than a specific number […] but we use measurements as support tools (Project Manager; M4).

The large organizations use formal measurement yardsticks such as cascades of balanced scorecards and function point (FP) metrics to help them make estimations:

> Function points help us to quantify in detail, like 1 FP is equal to 12 hours or 1.5 person days. This helps us allocate work better (Project Manager; L2).

Organization L1 explained how one learning experience helped them to build core competencies in aircraft design. An earlier incorrect estimate made for a very complicated design for an overseas client had resulted in "zero profit". However L1 teams said that the learning experience provided by the project led them to develop new knowledge artifacts about complex aircraft modeling and this has further led to new ventures with other major aerospace conglomerates.

Thus, large-sized organizations consider that detailed measurements of performance characteristics (e.g. effort in hours, re-work time, complexity of modules and percentage of errors after release dates) help them to identify weak processes and take remedial action. This helps them to control resource allocation and build core competencies. Smaller organizations also use support tools to control workflows and measure performance, but they prefer to use less-intensive measurement methods.

5.6 Learn, re-learn and meta-learn

Continuous learning is considered relevant by all six organizations, and they each have defined practices for improving their performances. The intense competitive pressure from both domestic and international markets means that they have to continually seek ways to improve the performance for each project:

> Success breeds on success. You cannot fail because if you fail once you go back a lot. Failures are not because of technology. Failures are because of relationships, methodologies, and processes (COO; M2).

Management has attached social meanings to individual goals and ambitions so that individuals are personally motivated to add value to knowledge repositories. Accordingly practices have been adopted to extract occupational knowledge from the individual to the team to the organizational level. Technology-mediated processes are used to capture ongoing issues in intermediate project deliverables, which are analyzed later by cross-functional teams.

Recursive learning of past successes and failures is also done through project reviews soon after completion of projects when memories are still fresh, and these reviews generally extend for a day or two. Reviews help organizations to meta-learn or learn about learning processes. These sometimes result in re-definition of best practices, or identification of areas where some of the processes either did not work, or could be improved. Interestingly, L1 have named their review group team "K-NEXT," implying the continuation of, or "the next," knowledge.

Another aspect of organizational learning is that meta-learning helps to foster closer relationships between senior management and the technology specialists, resulting in informal relationships between them. Organization L2 also encourages informal social gatherings of senior and junior management by what it terms as "Pizza and Coke Meetings."

Similar practices to assimilate learning from past experiences have been described by the four medium-sized organizations. However, their approach to learning processes has been described by the term "adhocratic," rather than bureaucratic. The larger organizations admitted that they use bureaucratic processes for improvement, but also emphasized the use of adhocratic processes to gather tacit knowledge.

6. Meta-learning outcomes

Empirical evidence presented in the previous section has provided in-depth details on managerial practices at individual and organizational levels in evolving markets. Organizations learn and meta-learn as they update practices for creating an environment to foster creativity, improve organizational routines and processes, and create opportunities in competitive offshore markets. The themes identified from field data for meta-learning are pulling (adhocratic) and pushing (bureaucratic) processes. These processes are used to integrate knowledge professional teams with evolving artifacts (e.g. documents, balanced score cards, survey results) recursively to create "collective knowledge consciousness" (Lei *et al.*, 1996).

Pulling processes involve fostering an individual and organizational learning environment so that the evolving artifacts are interpreted and integrated into knowledge repositories. Team members are encouraged to share their problem-solving strategies through financial rewards and other special recognition prizes. Peer reviews are held for each software project, further bringing about a collective responsibility among team members. Pushing processes include definition of coding standards, documentation of checklists and templates, quality indicators and other measurements to help identify new processes for adding value. Some organizations believe that international certifications (CMM and ISO) help to streamline and improve work processes. The organizations reflexively monitor their processes as new artifacts evolve when team members share project experiences and build new artifacts. This promotes a learning attitude where individuals and teams feel accountable for improving knowledge processes.

The case findings have demonstrated how meta-learning encourages organizations to learn continuously. Field data has revealed the interrelation between advocacy, inquiry, creativity and connectivity (Losada, 1999) in evolving dynamic environments. Governance (advocacy) structures have changed from "bureaucratic" to "adhocratic," as management realizes that to expand knowledge portfolios; knowledge has to be pulled up from the workforce. Individuals are encouraged to expand their skills and have an inquiring attitude, which helps organizations create new artifacts. These artifacts are added to the knowledge bases and pushed back through organizational routines as practices are refined with new learning. Over time, organizations build core competencies and identify new business opportunities. Based upon how organizations are connected with the dynamic environments, meta-learning traps them into high, medium or low performance (Losada, 1999).

The model for meta-learning (Figure 1) indicates practices for recursive learning in knowledge-intensive environments. The growing knowledge economy, offshore market demands and labor workforce have led to highly dynamic environments. As a result, organizations are utilizing learning, technological expertize and skills development (Lei *et al.*, 1996; Prahlad and Hamel, 1990) to define their knowledge strategies. The enablers to meta-learning are implementing flexible governance structures to foster innovation by encouraging teams to exchange ideas and create knowledge artifacts. Performance measurement methods with reward systems have been implemented to build expertize in new technologies, enabling firms to align their core competencies with emerging technologies in offshore global markets.

The first research question on how the offshore environment influences software exporting industries in India has been answered by the local government's support to help them become global players with long-term export potential. Local governments have initiated tax benefits such as reduced customs regulations and levies to

export-oriented software industries. Infrastructure facilities have been provided at subsidized rates to software export zones for medium-sized firms. Further, the national consortium (NASSCOM) informs software firms of new export opportunities and foreign partnerships, and gives guidance on better utilization of available government incentives.

The second research question, to understand how the evolving "sticky" knowledge held in the mind of team members is assimilated into knowledge repositories, has been answered by creating an environment that fosters knowledge sharing and changing of power relationships within organizations. Individuals and teams are encouraged to contribute to knowledge repositories through informal discussion forums, financial rewards and participation in knowledge groups. Knowledge industries cannot afford to be bureaucratic any more, and have re-defined roles to give teams more autonomy and motivate them to share their expertize with other team members. This fosters creativity and enables team innovation. However, certain practices considered essential for maintaining organizational knowledge artifacts have been acknowledged as being bureaucratic. For instance, international quality accreditations (e.g. CMM and ISO) are institutionalized by large organizations which dictate strict standards and procedures to be followed. However, such quality accreditations are institutionalized only in large organizations. The medium-sized organizations are not keen to have the baggage that comes with accreditations, and have defined their own disciplined practices for building knowledge repositories. It is interesting to note that these practices have acceptance by the workforce, who realize that some bureaucratic practices are essential for keeping up with international standardization in the emerging global market. Earlier studies have also suggested a combination approach involving participative control (adhocratic) and directive control (bureaucratic) has a positive effect on learning and fostering innovation (Gebert *et al.*, 2010).

Finally, with regard to the third research question, we conclude that learning is a continuous and recursive process. Given the dependence of knowledge organizations on individual skills, they have adopted a mix of adhocratic and bureaucratic processes central to their learning. In this manner, organizations learn, re-learn and meta-learn, as they apply pull and push processes to combine different skills and know-how to build firm-specific assets for re-use. "Meta-learning is systemic, complex and dynamic" (Lei *et al.*, 1996, p. 550). Organizations continually evaluate their learning processes for managing knowledge components (individuals, teams and artifacts) to upgrade individual and organizational competencies for advancement of knowledge portfolios.

7. Conclusion

The purpose of this study has been to explain organizational learning processes and develop a comprehensive model outlining the meta-learning phenomenon in knowledge-intensive firms. The model has been substantiated by published literature and empirical findings and provides insights from practitioners engaged in the offshore software development industry. To maintain a basis for sustainable competitive advantage, organizations have created an environment which nurtures knowledge sharing by encouraging individuals to voluntarily share their skills and expertize. As the groups (teams) collectively apply their skills, they leverage from shared experiences to create new knowledge assets (artifacts) to define/refine best practices, further enabling innovation and building core competencies.

As with any research there are limitations to this study. The limitations call for further research to be conducted that will extend the current work. This study is

limited to learning processes for six case studies in one country context. Future work can provide greater robustness when extended to a bigger sample of cases or different country contexts. However, the study has provided new insights on practice methods used in some knowledge industries to encourage continuous learning and bring about process improvements. The results from this study suggest that knowledge-based organizations have realized that they can no longer be complacent, and are making efforts to build competencies to take advantage of market opportunities in the prevailing offshore environment.

Note

1. "Raj" means "rule" in the local dialect (Hindi). This is derived from the word "Raja" which means "King" or "Ruler."

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