Abstract—Workplace learning is a contextual and dynamic procedure. Compared with traditional learning in school environment, workplace learning is a continuous process of knowledge acquisition, sharing and application in a workplace context. To improve flexibility and cost-effectiveness, E-learning has been utilized as a popular learning approach. However, existing workplace E-learning systems are generally designed without considering the needs of workplace learning. They fail to connect learning and working in a consistent way. This study aims to investigate the mechanism of developing an effective workplace E-learning system by aligning learning with the needs derived from organizational mission and personal development request. To achieve the objective, we propose a KPI (Key Performance Indicator) supported approach to workplace E-learning systems development. KPI helps achieve our objective by: 1) aligning learning with organizational mission as well as employees’ development possibilities, 2) organizing and managing learning resources in line with key expertise to be built in the work context, and 3) facilitating knowledge acquisition, application and sharing by linking these activities with relevant expertise or work context. A KPI model with KPI-based learning system architecture is developed, with an example for demonstration.

Index Terms—Workplace Learning, E-learning, Key Performance Indicator

I. INTRODUCTION

Nowadays, knowledge has developed into key factors of enterprise success. Professional skills and experience of individuals are playing an increasingly significant part in organizational development. Under this context, workplace learning has been given increasing attention. Satisfied learning outcomes would be achieved when learning approaches are aligned with learning characteristics. A number of organizations have developed corporate universities in the aim of disseminating organizational culture and advancing employees’ work skills and learning skills [8]. To small or medium-size businesses, it is less likely for them to afford their own corporate universities [5]. As a result, E-learning is emerging as a popular learning approach which has been utilized by organizations in recent years, mainly due to its flexibility and cost effectiveness. However, E-learning is currently performed poorly in motivating employees to learn in the workplace context. Most workplace E-learning systems are generally designed without considering the needs of workplace learning. They fail to align learning with organizational mission, or link learning with key capability building in the workplace context.

This study aims to investigate the mechanism of developing an effective workplace E-learning environment that can engage learners in the e-learning environment, by aligning learning with the learning needs derived from organizational mission and personal development. To achieve the objective, we establish a systematic understanding of workplace learning based on relevant theories and practice and from various perspectives. Based on the understanding, we examine the requirements on workplace learning as a rationale for workplace E-learning development. After identifying the requirements, we propose a KPI (Key Performance Indicator) based approach to workplace E-learning systems development. The reason why we select KPI as the solution is also examined. A KPI model with KPI-based learning system architecture is developed, with an example used for demonstration.

II. BACKGROUND

Workplace learning is used to refer to learning activities in a working environment. Learning is carried out in a workplace to fulfill needs derived from the working context. Learning can take place in every working scenario in a workplace. It occurs when an employee is reading company rules; when an apprentice is observing a mentor manipulating a machine; or when colleagues are exchanging ideas relevant to a task. Holliday defined workplace learning as the consequence of employees’ willingness to satisfy individual, group and whole workplace needs [3]. Its processes and outcomes involve changes in the meanings that employees connect to their workplace, feelings and value, knowledge and understandings, and skills relevant to a particular workplace.

A. Relevant Theories

The significance of workplace learning leads to increasing research interest in this area. Workplace learning belongs to the domain of adult learning, has a fairly large intersection with vocational learning, and is quite distinct from conventional academic or school learning. Workplace learning is an interdisciplinary topic which can be viewed from a variety of perspectives, such as education, human resource management, sociology, cognitive psychology, etc. There are abundant theories relevant to workplace learning. The following is four of them which lay the theoretical foundation of this study.

Situated Learning theory believes knowledge is defined under a specific setting or context and facts are determined by cultural standards and social practices [10]. In workplace settings, knowledge used by individuals to solve problems is derived from daily activities in organizations. With the similar viewpoint, Community of
Practice [6] has described workplace learning as a process of “changing participation in the culturally designed settings of everyday life” and indicated that knowing is created and intertwined with doing and knowledge emerges during practices in communities. Proponents of the Organizational Learning theory consider learning-organization construction as a practice for corporations to gain an age in business competition. Relevant research includes endeavors in defining a learning organization, exploring operational guidelines for practice, and measurement and assessment of an organization’s learning level [2]. In the Adult Learning theory, Malcolm Knowles identified three learner characteristics pertinent to learning motivations: first, adults are goal-oriented and they know explicitly what they want to obtain when enrolling in a course; second, adults are relevancy-oriented, and can apply the knowledge learned to their work or other tasks and see the meaning of learning something; third, adults are practical, and it is less likely that they will be interested in a lesson which is not relevant to or unhelpful to their work. Each of these four theories gives emphasis to a certain perspective of learning on the work and provides valuable guidance to workplace learning practices.

B. Workplace Learning Practice with E-learning

There have been plenty of methods used to conduct workplace learning, e.g. corporate university, on-the-job or formal courses, internal or outsourcing training, E-learning, and so on. E-learning is one of the most popular learning approaches which have been utilized by individuals and organizations in recent years. When information and communication technologies are involved in learning procedure, it is generally referred to E-learning [11]. E-learning precedes the traditional classroom learning in many aspects. Two major advantages of utilizing E-learning for workplace learning might be cost-effective and flexible. However, whether there would be fine Return on Investment (ROI) when E-learning is employed in training is a highly reservation question. Some claims that E-learning is no more than bells and whistles, and the idea of relying on E-learning alone to obtain effective workplace learning is quite naive. To individuals, although knowledge can be learned by participating E-learning programs, more often than not, individuals do not think it is helpful since knowledge learned cannot help improve their work performance. To organizations, E-learning is generally designed without meeting organizational mission. E-learning is performed poorly in motivating employees to learn in the workplace context.

This study aims to solve the problem by investigating the mechanism of developing an effective workplace E-learning environment that can engage learners in the e-learning environment. To achieve this, we examine what workplace learning is, what workplace learning requires, and how a workplace E-learning system can be developed in line with these requirements as follows.

III. REQUIREMENT ANALYSIS ON WORKPLACE LEARNING

Different learning theories provide guidance to workplace learning from different perspectives. Adult Learning theory has concentrated on individual perspective, illustrating distinctive characteristics of learners in workplace context. Situated Learning and Community of Practice theory both have stressed the social perspective of workplace learning. Situated Learning stress the learning content determined by social context. Community of Practice has emphasized the interaction between the learner and the learning environment, and the impact of workplace settings on individual learners. Organizational Learning considers workplace learning on macro scope by examining good learning operations on organizational level.

In order to have a better understanding of workplace learning, we refer to four fundamental elements of learning environment addressed in [4]. The foremost is the learner, which is the chief actor in both of two processes; the other three elements belong to the learning surroundings: the learning content, the learning social context and other learning stakeholders such as parents or society. In workplace settings, the learners are employees in an organization; the learning content is the expertise and knowledge required in working practice; the learning social context is the workplace; and other learning stakeholder is the organization. An effective workplace learning environment should take the four aspects into consideration. Based on this, we establish a systematic understanding of workplace learning from the following perspectives, which lays a foundation for us to investigate the requirement on workplace learning applications.

A. Understanding Workplace Learning

From the perspective of learner, employees are adults with distinctive learning characteristics. Employees in an organization have distinct job responsibilities which require different types and levels of expertise. Each employee would have his/her own learning needs and expectancies. Even assigned with an identical task, with different educational background and working history, different employees would have different performance. Employees would learn if learning can satisfy their learning needs which are dependent upon their experiences and relevant to their work situations and expectations of development possibilities.

From the perspective of learning content, workplace knowledge is defined under a specific setting or context and determined by cultural standards and social practices, which is stated in Situated Learning theory [10]. The learning content is contextual in that knowledge in workplace is disseminated within an organization and arises from employees’ daily activities and interaction with the working environment [9]. Meanwhile, learning content is dynamic. Employees have to think new ideas, adjust learning process in the aim of improving inter-organizational performance. Also, organizations have to continuously acquire for new knowledge, new products, new skills, and remain openness to the outside world. To facilitate learning practice, knowledge assets accumulated through workplace learning processes needs to be well organized, updated and maintained for staff to access and learn.

From the perspective of learning social context, workplace learning environment is a knowledge society that builds upon community of practice [1]. According to Nonaka’s knowledge creation theory, knowledge created by individuals are amplified and crystallized during the process of informal communities of social interaction within the organization, interaction between the
organization and its surroundings. Usually, in working context, a team of members with different skills and experiences analyze the problem, find directions and devise a solution. They obtain new knowledge by reflecting on problem-solving process, and utilize their new knowledge by going through the action-reflection-action cycle [7].

From the perspective of the extra stakeholder (organization), organizational structure, strategy and practice would exert great influence on workplace learning. Referring to Organizational Learning theory, organizations have expectancies relevant to learning activities derived from their mission and vision. They wish individual learning can be transferred back to job and utilization of new skills to enhance organizational performance. Moreover, workplace learning is a dynamic process which both influences and is influenced by the dynamic changes in organizational structures and practices. An organization’s mission and vision need to embrace different meaning in different periods of the outer changing world. This would lead to the adjustment of business strategy, job design, and reward system. Therefore, workplace learning should not be a one-fit-for-all process, but a continuously adaptive procedure.

B. System Requirement

According to the above understanding of workplace learning, we identify the requirements on workplace E-learning systems as follows. From the perspective of the workplace learner, the system should be able to support learners’ self-directed learning by guiding their knowledge acquisition process. The learners should be able to determine their learning needs and objectives based on personal and organizational development request. It could be achieved by identifying key expertise required for each individual, and providing appropriate learning content which is believed or actually helpful to develop specific workplace skill. From the perspective of the learning content, the system should be able to manage (capture, organize, store, retrieve, update) learning materials and knowledge assets accumulated from daily working activities. The link between the learning resource and specific workplace expertise should be established. In particular, the learning resource should be continuously renovated with changes in learning content and from learning needs in an organization’s internal and external environments. From the perspective of the learning social context, the system should be able to provide an environment that facilitates social interactions. It could be achieved by linking individuals with relevant capability building in the work context to guide their knowledge acquisition and utilization process, and linking individuals with relevant work context to guide their knowledge sharing and transfer process. From the perspective of the organization, the system should be able to reflect the organization’ needs on learning, which is aligned with organizational mission and vision, job design, and reward system. When the organization rebuilds its organizational structures or redefines job responsibilities, the systems should allow the corresponding changes in organizational learning.

In brief, a workplace E-learning system should be able to: 1) help individuals identify the key expertise needs to be developed in his/her work context, which is derived from the organization’s mission and vision; 2) guide and manage learning resources in a way that the relationship between a specific expertise and relevant learning resource is clearly established; and 3) guide and direct knowledge acquisition, utilization and sharing process within relevant expertise or work context.

IV. PROPOSED KPI-BASED WORKPLACE LEARNING DEVELOPMENT

We propose a solution to workplace E-learning development based on Key Performance Indicators (KPI). Organizations use performance measurement procedure to improve performance by setting performance objectives, assessing performance, collecting and analyzing performance data, and utilizing performance results to drive performance development [12]. Performance measurement is crucial for organization development and it is a main drive for employees’ learning activities. Key Performance Indicators (KPI) is a flexible and popular approach to conducting performance measurement in organizations. KPI can be used to assess almost any aspect of work performance, whatever financial or non-financial, depending on individual organization’s design. It shows a clear picture for each individual in organization what is important and what they need to do [12]. In a KPI performance measurement system, organizational vision and mission are interpreted into clear defined department goals and objectives. These goals and objectives are then broke down into performance targets related to each job category reflecting specific organization strategy, official capability requirements for individual employees.

A. Why KPI for Workplace Learning

As a special meaning to workplace learning practices, KPI is a practice which involves organizational elements such as business objective, competency development, performance, organizational structure, and job system. From the perspective of the workplace learner, KPI defines skills, expertise and performance indicator for each job position. It may reflect employees’ learning objectives and work performance. From the perspective of the learning content, KPI can be used as an index system to organize and manage corporate learning content in a way that is consistent with organizational job system. From the social perspective, KPI sets up a linkage between an employee and his/her work context about what key expertise he/she needs for the job, what he/she needs to learn to build the expertise, and how well he/she performs at work. KPI also sets up linkages between employees about who do the similar work with similar things to learn. Thus, KPI can be used a systemized scheme to direct knowledge acquisition, utilization and sharing process. From the perspective of the organization, KPI is the concrete and practical form of the lofty and abstract organizational mission and vision. It bridges the gap between an organization’s objectives and its employees’ targets, making organizational goals accomplishable. Moreover, KPI can be dynamically adjusted according to organizational strategies. Therefore KPI can reflect state-of-the-art organizational goals.

In brief, KPI is able to help employees identify key capabilities with performance required by the organization. It aligns learning with organizational mission and vision as well as employees’ development possibilities. It can be used as a systemic scheme to

organize and manage learning contents in line with key capability to be built. It can facilitate effective knowledge acquisition, application and sharing by linking these activities with relevant work context. Therefore, KPI is directly applicable to workplace learning development.

B. Workplace E-learning Model Based on KPI

KPI is utilized to measure work performance in an organization from different perspectives. As shown in Fig.1, a KPI system is designed based on an organization’s job system. It consists of three components, KPI item, rating criteria and KPI value. Each job position is assigned a set of specific KPI items, in line with a set of capabilities required by the job position. For example, oral and written communication skills might be two KPI items defined for a sales job position. Performance is measured using a rating method. For each KPI item, rating criterion is set up to measure related performance perspective. For example, the KPI system in an organization might be rated on a 3 level scale; criteria for each level should be separately defined. During performance assessment, an employee’s performance is measured based on KPI items corresponding to his/her job position. For each KPI item, the employee will be given a mark according to corresponding rating criterion. We call this mark as a KPI value. As a result, an employee’s performance measurement result is a set of KPI values.

This measurement activity can be conducted by one or more persons. For impartiality and objectivity reasons, most organizations use 360 degree feedback to assess employees’ performance. It means the employee’s performance would be assessed by the employee himself/herself, his/her supervisor, his/her subordinate, and his/her peers. Each appraiser given the employee a set of KPI values, and each appraisal is given a certain weight. As a result, a set of general KPI values will be calculated to evaluate the employee’s work performance.

The essential of this model is that KPI system is used to describe learning objectives, manage learning content, assess learning result, and facilitate learning procedure.

Describe learning objectives. Learning objectives in this model are separated into three levels. On the top level is job position. Practical workplace learners pursue higher positions with more salary or positions that they are interested in. This is a main motivation for employees to learn at work. The medium level is KPI items – capabilities defined for each job position. This level has more practical meaning. An employee can get the job position he/she wants only if he/she obtains capabilities required. The bottom level is KPI values – ratings reveal performance. Since work performance is habitually used to make reward decisions, practical workplace learners learn in order to obtain high performance. In another word, high KPI value is one of the most important learning objectives for workplace learners.

Manage learning content. Learning contents are stored in the system in the form of digital files. Each digital file is similar to a learning object in a typical E-learning system. It is called as a learning case in this model. Learning cases are organized under a KPI system (referring to Fig. 2). For each KPI item of a certain job position, there is a group of learning cases. They are learning materials which can help improve the capability defined in the KPI Item. Different learning cases may contain different materials. A case can be a piece of course material, a paragraph of programming code, a recommended booklist or an article about a project experience. In this model, we divide them into four types, i.e., Study Plan, Course Material, Recommendation, and Experience. Besides, each case is tagged with two pieces of information, quality level and contributor’s performance information. Quality level stands for the quality of the learning case. It can come from the contributor’s or other learners’ evaluation. Contributor’s performance information includes contributor’s position information and KPI value of the contributor obtained at the time of contribution. We provide the two pieces of information to help learners in choosing learning cases.

Assess learning result. Learning result is assessed using rating criterion in this model. It is similar to the performance measurement procedure in real organizational operation. Since ratings in performance measurement indicate an employee’s working knowledge and proficiency, assessment result using this approach can signify how much knowledge learned is transferred into work.

Facilitate learning procedure. Learning contents are contributed by employees or collected by training officers. Learning content delivery is triggered when an employee wants to retrieve a tailored learning solution. The learner may select a job position and relevant KPI items to specify his/her learning objectives. Moreover, the learner can select learning case type and quality level to restrict learning cases he/she needs. The system will deliver a learning solution containing cases matching the employee’s input. Each learning solution belongs to an employee and has its own lifetime, which starts when it is delivered and ends when its owner closes it. Employees control learning paces by themselves and can evaluate, revise and contribute learning cases during the learning process. Learning cases with too much negative comments or too low access rate will be eliminated from the learning content base.

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<th>Position</th>
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<th>Assessment Objectives</th>
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<td>Level 1:</td>
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<td>Level 2:</td>
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<td>Peer B Rating (Weight 1/3): Level 1</td>
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Figure 1. A KPI System
C. An Example

We use an example to present a workplace E-learning model design based on KPI system. ComA is a medium size company that develops software. As outlined in Fig. 3, the company’s organizational structure consists of four functional departments -- Back Office (HR, IT, Legal Affairs), Consulting, Research & Development, and Customer Service. Each functional department has one or more job categories, and each category has one or more positions. For example, in Consulting department, there are job categories such as pre-sales, sales and consultant; in the consultant job category, there are three positions: assistant consultant, associate consultant and chair consultant.

ComA uses a KPI system to conduct performance measurement. Each KPI Item is rated on a 5 level scale. Performance measurement event is conducted in ComA twice a year. Mark and Lizzie work in Research & Development department. Mark is an intermediate testing engineer who has 2 years’ testing experience. Lizzie is a junior testing engineer who joined ComA 2 months ago. Both of Mark and Lizzie are using the workplace E-learning system to improve their work performance. The last performance measurement event of ComA has just finished. Mark is content with his performance result and plans to pursue a higher level position – senior testing engineer. He wants to learn something relevant to project review and project management, the skills required for Senior Testing Engineer but not required for his current position. Lizzie didn’t take part in the last performance measurement event. However she used the self-assessment function of the system and obtained a simulative performance result. Lizzie is not content with her current performance and wants to learn more to enhance her proficiency. She aims to strengthen her domain knowledge and test planning skill required for her position. Fig. 4 shows their current performance measurement result and learning objectives.

For Mark, he would select the following items in order to retrieve a tailored learning solution: Job Position – Senior Testing Engineer; KPI Items – Project Management Skill and Project Review Skill. He also can use learning case type and quality level to select learning cases. Based on the selection, the system will deliver a set of personalized learning cases to Mark. He may check the contributor information for further selection of learning cases. After Mark finishes his learning, he can use self-assessment function to evaluate his learning outcomes.

For Lizzie, she would do the similar operations as Mark to retrieve an adapted learning solution according to her own objective or preference. Meanwhile, the learners can evaluate or make comments on the learning cases as well as contribute new learning cases for knowledge accumulation and sharing.

D. System Architecture

Based on the above model, we propose the architecture of a KPI-based workplace E-learning system in a three-layer structure (see Fig. 5). Interface Layer is responsible for human-computer interaction. Application Layer contains four function modules – Learning Case Creation Manager, Case Retrieval Manager, Case Adjustment Manager, and Learning Solution Manager. Learning Case Creation Manager is used to store learning cases when a learner has knowledge to contribute. Case Retrieval Manager is used to search learning cases when a learner requires a learning solution. Case Adjustment Manager is used to refine learning cases when any update is reported regarding correction, comment or evaluation. Learning Solution Manager deals with basic events happened in a learning solution’s lifetime, such as initiation, update and close of a learning case. It also acts as a platform to use other modules when necessary. The Repository Layer stores a KPI system, learning cases, learning solutions, and employee information. Learning cases form the learning content base, including all learning cases as well as accessorial information of learning cases that supports effective learning content management, such as job position, material type, quality and contributor of
a learning case. A learning solution is an individual content base, which consists of learning cases for an individual.

V. CONCLUSIONS

In this paper we address the problem of developing a workplace E-learning environment that can engage learners in the e-learning in a more effective way. The main questions, arising from this motivation, are what workplace learning requires and how a workplace E-learning system can be developed in line with these requirements. We investigate workplace learning requirements from a variety of aspects, and find that a workplace E-learning system should be able to align learning with the learning needs derived from organizational mission and personal development request. Based on these requirements, we design a workplace E-learning model based on Key Performance Indicators (KPI). KPI can help achieve our objectives by: 1) aligning learning with organizational mission and vision as well as employees’ development possibilities, 2) organizing and managing learning contents in a systemic scheme in line with key capability building, and 3) facilitating knowledge acquisition, application and sharing by linking these activities with relevant work context. Based on this model, we propose an architecture of a KPI-based workplace E-learning system. The detailed system design, prototype construction and the justification of the effectiveness of this system will be discussed in the future work.

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