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(54) Title: KNOWLEDGE MANAGEMENT SYSTEM
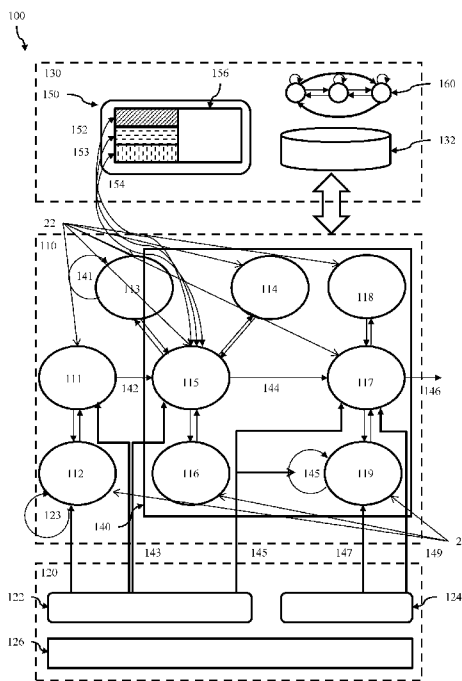
(57) Abstract: A computer implemented knowledge management system for performing enterprise scale architectural reviews of IT architecture or IT project proposals uses topic analysis and machine learning methods applied to unstructured data regarding IT strategy, standards and other guidelines to allow generation of technical and business domain specific collections. This enables efficient review by domain experts. This is further enabled through the use of a cloud based digital portal and social networking services that implement a social collaboration model to capture and allow review and exchange of intermediary knowledge during review and evaluation process. This allows wider members of the organisation to comment on a published expert review prior to formal endorsement, thereby speeding up the architecture review process.

Figure 3B

KNOWLEDGE MANAGEMENT SYSTEM

PRIORITY DOCUMENTS

[0001]   The present application claims priority from Japanese Provisional Patent Application No. 2018-39168 titled "Knowledge management system, method and program" and filed on 5 March 2018, the content of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002]   The present disclosure relates to knowledge management systems.

BACKGROUND

[0003]   The progress of new technologies, globalization, shifts in customer needs, and new business models has presented a number of challenges to global corporations. In particular significant changes have occurred in the field of information technology (IT), such as the emergence of Cloud Computing, Mobile IT, and big data. The major advances in the abovementioned technologies and processes have created a "Digital IT economy," causing both business opportunities and business risks, forcing enterprises to innovate or face the consequences.

[0004]   This can represent significant challenges for global corporations and other large entities. One approach that has been used to manage IT systems in large and global corporations has been Enterprise Architecture. Enterprise Architecture (EA) is the practice of performing enterprise analysis, design, planning, and implementation, using a comprehensive approach at all times, for the successful development and execution of IT strategy. ISO/IEC/IEEE42010:2011 is an architecture framework defined as "conventions, principles, and practices for the description of architecture established within a specific domain of application and/or community of stakeholders." In addition, EA visualizes the current corporate IT environment and business landscape to promote a desirable future IT model, and EA is considered an essential element of corporate IT planning as it offers benefits to companies, such as coordination between business and IT, enhancement in organizational communication, and reduction in the complexity of IT.

[0005]   Enterprise architecture (EA) is effective because it contributes to the design of large integrated systems, which face a major technical challenge toward the era of Cloud/Mobile IT/Digital IT. From a comprehensive perspective, EA encompasses all enterprise domains, such as business, organization, applications, data, and infrastructure, for establishing current architecture visibility and future architecture/roadmap. However existing EA frameworks, such as The Open Group Architecture

Framework (TOGAF) and the Adaptive EA framework (known as the Gill framework) have been criticised for the size, lack of agility, and complexity, and have been found to be inappropriate to achieve digital transformation. In particular EA frameworks need to accept change in the methods that adequately consider the emerging new paradigms and requirements that affect EA such as enterprise Mobile IT and Cloud computing.

[0006] There is thus a need to develop improved knowledge management systems, methods, and platforms and systems for implementing EA frameworks or to at least provide a useful alternative to existing systems.

SUMMARY

[0007] According to a first aspect, there is provided a computer implemented knowledge management method for managing a review of a proposal using a digital portal, the method comprising:

preparing and submitting a proposal document by one or more proposers using a digital portal system comprising a knowledge management system, the proposal document comprising data relating to a plurality of technical and business domains associated with a proposed project and compliance and conformance with a plurality of guidelines, each guideline associated with one of the plurality of technical and business domains;

performing topic modelling on a corpus of documents to obtain a plurality of topics, and storing each topic and associated topic metadata in a NoSQL database of a knowledge management system, wherein the corpus of documents comprises one or more documents comprising unstructured data, and the corpus of documents comprises documents relating to a guideline associated with one of the plurality of technical and business domain;

generating a plurality of technical and business domain specific collection of documents by applying one or more machine learning modules to the plurality of topics, and storing the collection in the knowledge management system;

performing a review of the proposal document using the digital portal system comprising:

reviewing the proposal document by a plurality of technical and business domain expert reviewers, wherein each expert reviewer uses a user interface provided by the digital portal to access the technical and business domain specific collection related to their domain expertise, and assesses compliance and conformance and associated risks of the proposal document with one or more guidelines, and provides assessment information to the review board users as either intermediate knowledge documents captured and stored in the knowledge management system or as explicit knowledge documents published in the knowledge management system via the digital portal system;

updating the proposal document based on the review step,

wherein a project evaluation database of the knowledge management system stores a process status, transmit status and a knowledge form for each of the technical and business domains during the review process; and

publishing a review result of the proposal document on the digital portal;

receiving comments via a social networking service from general members of the digital portal; and

evaluating the proposal document, by one or more review board users and updating the proposal document based on the received comments, by one or more proposers, and publishing an evaluation report on the proposal document using the digital portal, wherein the evaluation report comprises an approval, conditional approval or disapproval.

[0008] In one form, the knowledge management system comprises one or more SQL databases, and the one or more SQL databases store domain specific data extracted from one or more documents comprising structured data.

[0009] In one form, assessing the compliance and conformance and associated risks of the proposal document with one or more guideline comprises assessing enterprise level conformance, functional aspects, operational aspects and/or viability of the proposal document. The technical domains comprise business analytics, big data, AI, research analytics, security, cloud platform, cloud interface, digital platforms, mobile IT applications, Internet of Things (IoT), middleware, master data management, database, and business process management. The business domains include finance, procurement, supply chain, manufacturing, sales, marketing, research, development.

[0010] In one form, preparing and submitting a proposal document comprises using the plurality of technical and business domain specific collections to assess compliance and conformance with one or more guidelines.

[0011] In one form, the digital portal provides a social networking service and the intermediary knowledge documents comprise one or more of Architecture Board minutes, emails, or social networking posts, and the preparation step and review step comprise exchanging one or more intermediary knowledge documents to facilitate knowledge sharing.

[0012] In a further form, the knowledge form records the knowledge conversion stage of a review document from one or more intermediary knowledge documents to one or more explicit published documents, or in some embodiments, to tacit documents.

[0013] In one form, the topic modelling uses latent Dirichlet allocation (LDA)

[0014] In one form, the one or more machine learning modules are a plurality of machine learning classifier, each classifier configured to classify a topic into one of the plurality of technical and business domains.

[0015] In one form, the one or more machine learning modules are one or more unsupervised machine learning modules that allocate a topic into a plurality of groups, and each group is mapped to one of the plurality of technical and business domains or a null group.

[0016] In one form, the proposal document is an IT architecture proposal document and the review board is an Architecture Board, or the proposal document is a new IT project proposal and the review board is an Architecture Board including members from a project or program management office. In a further form the technical and business domains are IT architecture technical and business domains.

[0017] According to a second aspect, there is provided a computer implemented knowledge management system for managing a review of a proposal document, the system comprising:

a cloud based computing platform;

a digital portal hosted on the cloud based computing platform;

a social networking service hosted on the cloud based computing platform;

a knowledge management system hosted on the cloud based computing platform comprising:

one or more NoSQL databases storing plurality of topics and associated metadata obtained by performing topic modelling on a corpus of documents, the corpus of documents comprising one or more documents comprising unstructured data, and the corpus of documents comprises documents relating to a guideline associated with one of the plurality of technical and business domain; and a plurality of technical and business domain specific collection of documents obtained applying one or more machine learning modules to the plurality of topics;

one or more relational databases comprising:

a project proposal database storing a proposal document;

a project evaluation database that stores a process status, a transmit status, and a knowledge form for each of a plurality of technical and business domains in all review steps with all related documents;

an evaluation status database that stores evaluation information associated with a proposal document;

a document proposal interface that allows a user to prepare, submit and update the proposal document, wherein the proposal document comprises data relating to a plurality of technical and business domains associated with a proposed project and compliance and conformance with a plurality of guidelines, each guideline associated with one of the plurality of technical and business domains;

a review interface configured to allow a plurality of technical and business domain expert reviewers to each access the technical and business domain specific collection related to their domain expertise, and assesses compliance and conformance and associated risks of the proposal document with one or more guidelines, and the review interface is further configured to capture and allow viewing of one or more intermediate knowledge documents, and to generate and publish one or more explicit knowledge documents relating to the review of the proposal document, and to publish a review results; and

a user interface configured to allow general users to view the published review and provide comments via the social networking service and to publish an evaluation report on the proposal document using the evaluation status database, wherein the evaluation report comprises an approval, conditionally approval or disapproval.

[0018] In one form, the knowledge management system comprises one or more SQL databases, and the one or more SQL databases store domain specific data extracted from one or more documents comprising structured data, and the review interface is configured to access both the technical and business domain specific collection and the one or more SQL databases.

[0019] In one form, assessing the compliance and conformance and associated risks of the proposal document with one or more guidelines comprises assessing enterprise level conformance, functional aspects, operational aspects and/or viability of the proposal document.

[0020] In one form, document proposal interface provides access to the plurality of technical and business domain specific collections.

[0021] In one form, the intermediary knowledge documents comprise one or more of Architecture Board minutes, emails, or social networking posts.

[0022] In a further form, the knowledge form records the knowledge conversion stage of a review document from one or more intermediary knowledge documents to one or more explicit published documents.

[0023] In one form, the topic modelling uses latent Dirichlet allocation (LDA).

[0024] In one form, the one or more machine learning modules are a plurality of machine learning classifier, each classifier configured to classify a topic into one of the plurality of technical and business domains.

[0025]   In one form, the one or more machine learning modules are one or more unsupervised machine learning modules that allocate a topic into a plurality of groups, and each group is mapped to one of the plurality of technical and business domains or a null group.

[0026]   In one form, the proposal document is an IT architecture proposal document and the review board is an Architecture Board, or the proposal document is a new IT project proposal and the review board is an Architecture Board including members from a project or program management office. In a further form the technical and business domains are IT architecture technical and business domains.

BRIEF DESCRIPTION OF DRAWINGS

[0027]   Embodiments of the present disclosure will be discussed with reference to the accompanying drawings wherein:

[0028]   Figure 1 is a schematic diagram of a knowledge management platform according to an embodiment;

[0029]   Figure 2 is a block diagram of the knowledge management system according to an embodiment;

[0030]   Figure 3A is schematic diagram of an assessment meta-model used by an Architecture Board according to an embodiment;

[0031]   Figure 3B is schematic diagram of a social collaboration model (SCM) according to an embodiment;

[0032]   Figure 3C is a schematic diagram of a Global Digital Transformation Communication (GDTC) model according to an embodiment;

[0033]   Figure 4A is a schematic diagram of machine learning system for a knowledge management system according to an embodiment;

[0034]   Figure 4B is a schematic diagram of a software architecture for a knowledge management system according to an embodiment; and

[0035]   Figure 5 is a schematic diagram of a cloud software architecture for a knowledge management system according to an embodiment.

[0036]   In the following description, like reference characters designate like or corresponding parts throughout the figures.

DESCRIPTION OF EMBODIMENTS

[0037] With reference to Figure 1, the knowledge management system 1 is a cloud based 10 computing platform which hosts a digital portal 122, which may be a global enterprise portal. Project managers 21, review board members 22, including technical and business domain expert reviewers, other general users 23 use the enterprise portal to assess new proposals and issue review reports which may include approval, conditional approval (and any associated conditions or actions) or rejection. In some embodiments the system can be accessed from anywhere in the world using a computing device. The knowledge management system uses a social collaboration model (SCM) including a social networking service (or tools) that allows general users 23 to view and comment on a published review. This may allow further updating of the proposal, or even further evaluation, before the project before it is endorsed or rejected by senior management (or similar decision maker).

[0038] To illustrate the knowledge management system 1 embodiments relating to IT architectural proposals and review by an Architecture Board will be described. A similar process is used for new IT project proposals and review by an Architecture Board including members from a project or program management office. The review process uses an adaptive integrated Digital Architecture Framework (AIDAF) which will now be described. In one embodiment the AIDAF model is an Enterprise Architecture (EA) framework model integrating between an adaptive EA cycle and a TOGAF or simple EA framework implemented by various business division units. The Architecture Board performs architecture reviews and enables the alignment between IT architecture strategy and each solution architecture in IS or IT projects including digital IT solutions. The role of the Architecture Board is to evaluate the operational/functional aspects and/or viability of solution architectures with Enterprise level standard conformance, and that architecture related risks are coped with. Additionally the Architecture Board must assess, review and resolve architecture integration issues across IS/IT organization. Further EA risks must be assessed and mitigated timely and consistently. The tasks of the Architecture Board include reviewing architecture/standard/common platform of new IS/IT projects, involving new technologies; to endorse signed architecture of new IS/IT projects for the month (or fortnight, or week), and share architecture strategy in each departments, initiatives, and their status. The system may also be used for other similar system such as project management office (PMO) review of new project proposals. Note that in some embodiments a PMO review may fall within the scope of an Architecture Board review (eg as a relevant technical and business domain). It will be understood that the knowledge management system and method described herein may be used for applications where a review board is required to assess technical and business related compliance and conformance with guidelines, and identify risks and in collaboration with project managers to generate solutions to address any risks.

[0039] This AIDAF begins with a context phase in which project plan documents (including architecture designs) for new Digital IT projects are made on a short-term basis. This begins with the Context Phase

where project managers 21 develop IT architecture proposal documents (or new IT project proposals) 46 by referring to materials of the Defining Phase (e.g., architectural guidelines for Security/Digital IT, aligned with IT strategy). During the Assessment/Architecture Review Phase, the Architecture Board members 22 including domain experts review the architecture in the initiation documents for the IT project. The review documents are published, and a social networking service allows general users 23 (ie members of the organisation) to comment and negotiate using social networking tools. This assists in the final review/results/confirm stage leading to endorsement of a project. In the Rationalization Phase, the stakeholders and Architecture Board decide upon replaced or decommissioned systems by the proposed new information systems. In the Realization Phase, the project team begins detailed design and implementation of the new IT project after deliberating on issues and action items (including addressing action items). This process is continuously repeated to create an adaptive EA cycle in which new projects can be rapidly proposed, reviewed and evaluated.

[0040] Embodiments of the knowledge management system described herein implement a social collaboration model (SCM) and a Global Digital Transformation Communication (GDTC) model that underpins the knowledge conversion process used in the social collaboration model (SCM) to enable Architecture Board to rapidly receive new project submissions and evaluate them.

[0041] Figure 2 is a block diagram 30 of the knowledge management system according to an embodiment. A storage module 30 comprises multiple databases, including a project proposal or database 42 that stores a project ID 44, and project information 44 such as IT architecture proposal document. A user interface 40 allows project managers, the Architecture Board members 22, and domain expert reviewers to prepare, submit, review and update the IT architecture proposal document 22. The proposal document 22 comprises data relating to a plurality of IT architectural domains associated with a proposed IT project and compliance and conformance with a plurality of guidelines each associated with one of the plurality of IT architectural domains. The guidelines comprise information relating to business and IT strategy and goals, best practice, regulatory requirements, logistical requirements, technical requirements, security requirements, etc covering a range of business and technical domains. The term guideline will be used to generally cover this information/requirements/standards. The expert reviewers assess the compliance and conformance and associated risks of a proposal document by assessing enterprise level conformance, functional aspects, operational aspects and/or viability of the proposal document with the one or more guidelines. They can then issue questions or action items to project managers to seek clarification or improve the compliance and conformance with guidelines, and the project managers can complete action items and update the proposals in response. In the context of this specification, we will consider compliance and conformance as broadly equivalent terms (and can be used more or less interchangeably). The evaluation is performed across a range of technical and business domains (by experts in each domain). Technical domains include business analytics, big data, AI, research analytics,

security, cloud platform, cloud interface, digital platforms, mobile IT applications, Internet of Things (IoT), middleware, master data management, database, and business process management. The business domains include finance, procurement, supply chain, manufacturing, sales, marketing, research, development.

[0042] This is supported by a machine learning system 50. As outlined below and illustrated in Figures 4A and 4B, the machine learning is configured to process a corpus 502 of unstructured documents 412. The corpus of documents 502 relate to guidelines associated with one of the plurality of IT architectural domain. A topic modelling module 420 obtains or generates a plurality of topics 422, and a NoSQL database 52 stores each topic and associated topic metadata 56 such as the documents relating to the topic. A machine learning process 430 applies one or more machine learning modules 431, 432, 433 to the plurality of topics to generate a plurality of IT architectural domain specific collection of documents 440. A database, such as the NoSQL database 52, store an architectural domain 54 and the associated documents 56. In one embodiment, structured documents 504, such as Excel, XML, or other structured database containing data relating to guidelines associated with the plurality of IT architectural domain is mapped to a relational database 482 using a mapping schema. In some embodiments, this structured data is also added to the machine learning process 430 (designated by dotted arrows 426) so that the collections generated are based on a combination of information from structured and unstructured data sources. In another embodiment the structured data is passed to a separate machine learning process 434 (separate from the system processing the unstructured data) and used to add to the IT architectural domain specific collection of documents (either added to existing collections or as separate collections). Additionally the relational database 482 may be directly accessed via a user interface 450 during the review process. The machine learning algorithms may be updated and regenerated as additional data is generated. For example as review processes are performed and additional data or documents identifying best practice and action items to address risks are generated, then this data can be integrated into the machine learning systems.

[0043] Expert domain reviewers can then access a collection of documents 441 specific to the expertise using a user interface 450 illustrated in Figure 4B. A user interface layer 450 such as a python based user interface provide data visualisation 452, editing 454 and scripting access 456 to the IT architectural domain specific collection of documents 440 (ie the machine learning results) and other data via service layer 460. The service layer provides a plot generate 462, edit functions 464 and script recorder 466 which access a data access layer 470 that comprises a relational or SQL database 482 and a NoSQL database 484 such an object based database that stores Object Data Management (ODM) objects. The SQL database 482 may store structured data (eg guidelines) mapped from Excel of other structured data sources, as well as the project proposal database 42, project evaluation database 62. Information extracted from the unstructured data via the machine learning system 50 is stored in the NoSQL database 484. In

one embodiment the data access layer uses SQL Alchemy to support python scripts used to access and extract data. In one embodiment the relational/SQL database 482 is an SQL Lite database.

[0044] Figure 5 is a schematic diagram of a cloud software architecture for implementation of the knowledge management system according to an embodiment. Structured data 502 such as excel, XML or SQL database data relating to architecture guidelines, as well as unstructured data 504 such as Word, Powerpoint, text files and other similar documents is provided to a cloud based virtual private cloud 510, via an elastic load balancing interface 512. This passes data to a proxy server 515 in a security group 514 that executes the python scripts 516 via user interface layer 450. The results report 530 from a query are provided via an elastic search service 520.

[0045] Thus as outlined above the knowledge management system comprises one or more SQL databases, and the one or more SQL databases store domain specific data extracted from one or more documents comprising structured data. Unstructured data is also processed using topic analysis (or semantic analysis) and machine learning methods which store and group identified topics in a NoSQL database. The topic modelling may be performed using latent Dirichlet allocation (LDA) or similar topic modelling methods.

[0046] The one or more machine learning modules 430 may be a plurality of machine learning classifiers (eg 431, 432, and 433) where each classifier configured to classify a topic into one of the plurality of IT architectural domains. A supervised learning method may be used to build each classifier using reference data sets including test and training sets, including deep learning methods using multiple layered classifiers and/or multiple neural nets. Various algorithms may be used including linear classifiers, regression algorithms, support vector machines, neural networks, Bayesian networks, etc. In another embodiment, the one or more machine learning modules 430 are one or more unsupervised machine learning modules that allocate a topic into a plurality of groups, and each group is mapped to one of the plurality of IT architectural domains or a null group. For example the unsupervised methods may be clustering (k-means, Hierarchical clustering), neural networks (including self-organising maps, generative adversarial networks, etc) or deep learning (ie multiple layers of neural networks). The machine learning modules may be implemented using machine learning software libraries such as Tensorflow, Numpy, Keras, Theano, MATLAB, AWS, etc.

[0047] As illustrated in Figure 3B machine learning methods are used to generate IT architectural domain specific collections 152, 153, 154 to allow reviewers 22 and project managers 21 to separately assess compliance and conformance and associated risks of a project proposal against each specific technical domain (via user interface on digital portal 152, 153, 154). Additionally reviewers 22 can access guideline information obtained from structured data and stored in SQL database. This facilitates separate

review of each technical and business domain to evaluate the compliance and conformance or goodness of fit to the guidelines.

[0048] A project evaluation database 62 logs details of the knowledge conversion status for the Architecture Board review of the IT architecture proposal document. This allows tracking and visibility of where a proposal is within the review and evaluation process. In one embodiment the project evaluation database 62 stores (or chronologically logs) a process status 64, a transmit status 66, and a knowledge form 68 for each of a plurality of IT architectural domains in the IT architecture proposal document. The process status 64 refers to the knowledge conversion stage (for example in the GDTC model – see Figure 3C), the transmit status 66 is used to log the user now handling the IT architecture proposal document, such as project manager 21, an Architecture board member 22 or a domain expert (for example who the document has been transmitted to), and the knowledge form 68 such as tacit knowledge, implicit knowledge, or explicit knowledge (discussed below).

[0049] The digital portal thus provides a review interface configured to allow a plurality of IT architectural domain expert reviewers to each access the IT architectural domain specific collection related to their domain expertise. They can assess compliance and conformance and associated risks of the IT architecture proposal document with one or more guidelines. The review interface is further configured to capture and allow viewing of one or more intermediate knowledge documents, and to generate and publish one or more explicit knowledge documents relating to the review of the IT architecture proposal document. A review report can be issued and may include an approval, conditional approval (including any required actions) or disapproval/rejection. These may be included as recommendations for endorsement or a final decision by senior manager or other decision maker following a review/result/confirmation stage 117, which we will also refer to as an evaluation stage or process (for convenience).

[0050] A project status database 72 stores the project identification 74 and evaluation results 76 by the Architecture Board. The evaluation results 76 are used to store information on the approval, conditional approval and disapproval of the IT architecture proposal, along with any associated action items and progress towards completion of action time. Approval shows that the project has been accepted across the Board. Conditional approval projects have been accepted, but that subsequent follow-up (ie actions) is required (either now or during implementation), or indicate that some further modification of the architecture document is required. Disapproval or rejection indicates the project was not accepted. Information about fixes or further comments to address conditional support is also stored. An IT architecture proposal evaluation report 70 can be generated from the project evaluation database 72.

[0051] The user interface thus allows users to view and generate intermediate knowledge documents and view and publish explicit knowledge documents, as well as publication of an evaluation report on the IT

architecture proposal document using the evaluation status database. This allows managers to view the progress or status of a proposal, including progress on any action items during later stages such as detailed design and implementation.

[0052] This Architecture Board performs Architecture Reviews regarding proposed architectures on the basis of the following evaluation criteria, and issues actions items based on those reviews:

[1] Enterprise level conformance—align with architecture roadmap, standard, each architecture principle;

[2] Functional aspect—clarifies solutions/architecture specs, integration points, with standard master data;

[3]Operational aspect—alignment with the service level, security design and privacy, system availability; and

[4]Viability—application rationalization, risks/countermeasures, data migration/testing strategy. That is, the guidelines define requirements for each of the technical and business domains, and the review process uses the above criteria to assess how a proposal meets the guideline requirements or suggestions. Any identified gaps or deficiencies lead to further questions or action items for the project managers to address.

[0053] An embodiment of an assessment meta-model used by an Architecture Board is illustrated in Figure 3A. Figure 3B is schematic diagram of an architecture model and an implementation of a social collaboration model (SCM) 100 that uses the assessment meta model of Figure 3A according to an embodiment. Figure 3B is a schematic diagram of the review and evaluation process of the SCM according to an embodiment, and Figure 3C is a schematic diagram of a Global Digital Transformation Communication (GDTC) model according to an embodiment.

[0054] The SCM model 100 comprises business architecture (BA) 110 that sits on top of an Application Architecture/Technology Architecture (AA/TA) 120 which comprises an digital or enterprise portal 122 and social networking service or social tool application 124 which are built on Cloud-based technology platforms 126, such as Private Cloud, Infrastructure as a Service (IaaS), and Software as a Service (SaaS) (the Technology Architecture 120). The review process implemented by the BA is further illustrated in Figure 3B. Data Architecture 130 such as relational (SQL) databases 132 store the knowledge conversion status (and review and evaluation status) of IT architecture proposals according to the GDTC model 160 shown in Figure 3C. The digital portal may be a Global Architecture Board Collaboration Portal (GABCP) and the users are proposers 21 as well as members of the Architecture Board 22 and domain expert reviewers 23.

[0055] The GABCP can be used to show and distribute announcements, view and download Architecture Board results, architecture guidelines, and recent research information, as well as link to architecture

department web pages, and a menu format. Furthermore, messages can be sent among Architecture Board members through the enterprise social networking service (SNS). The global Architecture Board review activities were performed by leveraging the ability to show and distribute announcements, and view and download the Architecture Board results. With the abovementioned abilities provided on GABCP, users can collaborate while conducting architecture review activities and creating and distributing review result documents. Global Architecture Board members are registered on the collaboration portal site. They can then exchange messages via the enterprise SNS or e-mail, while storing and sharing various architecture guideline documents in a portal folder. Therefore, the architecture guidelines can be used by the Architecture Board review managers and reviewers 22 as a review criteria guide, and by the architect (project manager 21) of the new project proposal as a procedure for designing the solution architecture. After a meeting of the Architecture Board, a document summarizing the architecture review results is stored in the review results shared folder and published on the GABCP as an announcement letter; it is also sent to each member of the Global Architecture Board via e-mail. The review process is an internal process between project managers 21 and Architectural Board members 22 (including domain expert reviewers). However once the review results are published 144, the social networking tools (or service) 124 allow general users (ie members of the global organisation) to view 145 the published results and provide comments 149. The project managers 21 and Architectural Board members 22 can view these comments or posts, leading to further questioning and updating of the proposal document.

[0056] As illustrated in Figure 3B, the Architecture Board 22 issues a request for submissions 111 of new architecture documents for new project and Project managers 21 respond by drafting/creating new architecture document for new projects 112 which are submitted using the digital portal. A review and evaluation process 115 is performed by the Architecture Board 22 including domain experts 23 who may perform informal pre-reviews 113 and formal reviews 114, and project managers 21 may negotiate 116 with reviews to refine the proposal or address risks. The review results are published 144 including whether the Architecture Board provides its approval, conditional approval or rejection. The review evaluation status is recorded in a database and records the approval status and any associated conditions or actions, and time frame for completion. When conditional approval is provided, this may include immediate conditions (ie to be complied with before formal approval/endorsement) as well as actions to be performed at later times, such as during implementation (and whose status will need to be recorded and managed). The published review is provided to senior management (eg CIO, CFO, CEO) who will ultimately make a decision on whether to approve (or endorse) a project. Thus the Architecture Board approval is effectively an endorsement for approval, with ultimate approval provided by the senior management. A further feature of the knowledge management system is that the digital platform allows global general users 23 to view the published review 145 and allows a further review/result/confirmation stage, which we will also refer to as an evaluation stage or process 117, to occur using social networking service and tools 124. In this process, general users 23, as well as the project managers 21 and

Architecture Board members 22, can confirm the review and their understanding, pose questions or comments, and respond. In particular general users 23 can respond, comment or pose questions 149 via the social networking service 124. Architecture Board members 22 may pose questions 118 and receive answers from project managers 21, and project managers will confirm their understanding 119 of the review and provide further information, questions or update the proposal before an evaluation status and report is issued (indicating approval, conditional approval and associated conditions, or rejection). The project evaluation database stores the evaluation status which may change over time as the questioning 118 and understanding 119 stages occur, and action items addressed. For example after comments and questions from general users (via the social networking service), or further assessment of the published review, an ultimate approval (or formal endorsement) is provided by senior management (or similar group or person) including the CEO, CFO and CIO. They may then approve or endorse the approval in the Architecture review, and may place additional conditions or actions in light of the comments, questions and responses in the evaluation stage 117. The project evaluation status database records the status as well as the status of each action item (in progress/completed). If the project is endorsed 146 it is then formally adopted and implemented.

[0057] These activities are supported by the digital portal 122 and SNS 124 which implement a Global Digital Transformation Communication (GDTC) which is illustrated in Figure 3C and further outlined in Table 1. The GDTC that underpins the knowledge conversion process used in the social collaboration model (SCM). The GDTC model consists of three layers: the tacit knowledge group (TKG), intermediary knowledge group (IKG), and explicit knowledge group (EKG), as shown in Table 1. TKG contains roles for exchanging tacit knowledge, and its group node is human. TKG is related to organizational structures, member roles, and decision-making process, among others, and is generated in telephone or web conference communications. TKG does not generate any documentation for global communication, and we assume that it does not create any formal documents. The deliverables of TKG are discussions and meetings, and as such it does not always produce tangible deliverables that can be observed.

[0058] IKG performs the role of exchanging intermediary knowledge, and its group node is portal contents, which is related to the portal 122, SNS 124 and e-mail within the global community. IKG provides just-in-time documentation to global community members, and computer mediated communication (CMC) tools can be used if one member needs to coordinate with others. Just-in-time documentation refers to necessary knowledge becoming documents when global community members communicate with each other using CMC tools. The deliverables of IKG are Architecture Board minutes (or logs), SNS, and email logs. These are captured and stored in relational (eg SQL) database 132 (located in cloud platform 126).

[0059] The role of EKG is the exchange of explicit knowledge. The group node of EKG is document, and the document group results from document management services, whose functions are historical

management, enterprise document searching, and document file sharing. EKG provides full documentation to global community members, and its deliverables are documents such as Architecture Board review results/conference results and guidelines.

[0060] As a whole, the TKG group undergoes human communication during discussions and meetings. Communication between TKG and IKG involves the processes of intermediary knowledge provisions and acquisitions in the portal, SNS, and e-mail, while communication between IKG and EKG consists of the processes of quotations and documentations of explicit knowledge in the portal, SNS, and e-mail.

TABLE 1

Elements of layers in GDTC model

Knowledge Group	Group Node	Media	Documentation	Examples of deliverables
Tacit Knowledge Group 162	Human	Telephone, Web conference	No documentation	Discussions, web meetings
Intermediary Knowledge Group 164	Portal content	Portal, SNS, email	Just in Time Documentation	Architecture Board logs, SNS logs, email logs
Explicit Knowledge Group 166	Document	Document Management Services	Full Documentation	Architecture Board results, Architecture guidelines

[0061] Traditional global communications employ TKG 162 and EKG 166 in the knowledge process; however, a great deal of communication in meetings is necessary among the stakeholders in the case of covering many regions, such as Europe, Asia, the United States, South America, the Middle East, and Africa. Socialisation 163 include discussion in web conferences and meetings occurs as part of TKG. Externalisation 168 including the development of architecture guidelines leads to EKG 166. Combining 167 of EKG 166 includes document management of guidelines and issuing or review results. There is internalisation 169 of knowledge by performing architecture reviews.

[0062] Figure 3C shows the GDTC model, which adds IKG 164 to the traditional knowledge process in global communications, and illustrates additional knowledge conversion modes provided by the model. The knowledge processes in IKG consist of open and agile communication in the portal, SNS, and e-mail, and these CMC tools facilitate the communication within global communities and organizations. IKG records Architecture Board minutes (or meeting logs), SNS, and e-mail logs, which are not formal

documents, but still very effective knowledge for global communication. Global community members can read each other's knowledge processes in these logs. Collaboration 165 occurs using CMC tools, such as the portal and SNS, which support IKG 164. The interaction of TKG 162 and IKG 164 leads to resonant formation 172 such as appreciation of conforming to project planning documents and agreements to board members knowledge, or rejection of proposal, and then publication 171 including submission, explanation and request for project planning documents. The interaction of IKG 164 and EKG 166 leads to sophistication 173 including identification of evaluation points, making of review results and updating or project planning documents. The interaction also leads to fragmentation 174 such as showing action items from review results and guidelines in negotiation (ie fragmentation of documents).

[0063] Thus with reference back to Figure 3B, the Architecture Board leaders 22 request the architecture document for a new project. At that time and during the drafting of architecture documents and is not registered on the platform. The project manager 21 (or initiator) creates an architecture document for a new project and may consult guidelines. At this time, registration to the platform architecture document is not done yet. At this time, the architecture document for a new project is created through various collaborative processes. The GDTC models cooperative (Socialization) and knowledge translation stages. Knowledge of this architecture document is tacit condition. As the architecture document is uploaded to the digital home (received) 142, the document is exposed for review and thus the knowledge translation stages to publication (Publication) 171 as intermediary knowledge available to the Architectural Board members 22.

[0064] This architecture document is available on the digital platform 122, and thus we transition to a collaboration stage. This includes informal review 113 and collaboration between domain reviews and project managers. This may include the domain reviewers, receiving requests from project managers, referring guidelines 141 and performing informal reviews. This may be supported by the SNS 124. A formal review 114 may also occur in which a committee meeting is held to perform a formal review. Reviewers 23 may request briefings which are provided by project managers 21 to negotiate changes to the proposal 116. At the completion of the review evaluation process 115 the review is published 144 to the global digital portal 122. This will also be provided to the senior management (eg CEO, CFO, CIO) and/or other responsible for final or ultimate approval (or for endorsement of the review).

[0065] During a review/result/confirmation stage, which we have referred to as an evaluation stage 117, evaluation results will be presented to the project managers 21 (initiators). This informs the project managers who understand and confirm their understanding of the review and can raise further questions. The Architecture Board may issues requests to answer their questions and then receive the answers. These may come from either project managers 21 or global users 23 via the social networking portal 124. Similarly global users can provide comments on the review and raise questions, and these comments will be available for the senior management to take into account when endorsing a project. Any disapproval is

evaluated and modifications required in the architecture document along with action items (corrections) can be made 119. The knowledge translation stage corresponds to resonance (Resonant Formation) 172, and through the resonance of the mediation this is converted to the tacit knowledge form 162. Conditional, or conditional support of the architecture document corresponds to a knowledge translation stage of refinement (Sophistication). Project managers 21 need to need to understand the approval conditions 119 which corresponds to consolidation (Combination 167) knowledge translation stage. If the architecture documentation is supported and the architecture document becomes an official document, then the knowledge translation stage corresponds to refinement (Sophistication) stage.

[0066] The Architecture Board's review is thus carried out through the exchange of explanations and opinions between the leader/Architecture Board members 22 and each new project leader 21 on the digital enterprise portal 122. Once published global users 23 can view and use social networking tools 124 to comment, pose questions, or answer questions. This additional information can be used to increase the speed and effectiveness of the review process leading to endorsement 146. In this process, we observed that the review results, problems, and solutions are formed into explicit knowledge and published as the final project proposals are created through collaboration and sophistication. The digital portal provides a social networking service and the intermediary knowledge documents comprise one or more of Architecture Board minutes (or meeting logs), emails, or social networking posts, and the preparation step and review step comprises exchanging one or more intermediary knowledge documents to facilitate knowledge sharing. The project evaluation database 62 logs details of the knowledge conversion status for the Architecture Board review of the IT architecture proposal document. In a further form, the knowledge form records the knowledge conversion stage of a review document from one or more intermediary knowledge documents to one or more explicit published documents (or in some cases to tacit documents). Thus to summarise evaluating the IT architecture proposal document comprises architecture board users reviewing published explicit knowledge documents and generate an evaluation report comprising one or more questions to the one or more proposers, and the one or more proposers respond and update the IT architecture proposal. Table 2 illustrates the actions of a Global Architecture Review Board.

TABLE 2

Actions of a Global Architecture Review Board

Action	Person In Charge	Global communication process (BA -	Application Platform (AA)	Cloud Platform (TA)	Action details (The status of conforming to Assessment meta-model in bold.)

		No. of step)			
1	L	Submission request (111)	e-mail/ Portal	Private Cloud, Private Cloud -> SaaS	(Distributed below) We will hold a meeting of the Global Architecture Board on the date (month) (day). Please submit the new project proposal by date (month) (day).
2	P	Reference (123)	Portal	Private Cloud -> SaaS	Architecture Guidelines on enterprise portal - GABCP are referred to, and new project proposals are created.
3	P->L	Submission→ Consolidation (112)→(111)	e-mail/ Portal	Private Cloud, Private Cloud -> SaaS	New project proposals are uploaded on enterprise portal - GABCP.
4	L	Confirmation (thanks) (111)	e-Mail/ SNS	Private Cloud, SaaS	New project proposals are checked, and appreciation is expressed via e-mail, SNS.
5	M	Evaluation (115)→(113)	Portal	Private Cloud -> SaaS	Members of the Architecture Board confirm proposals for each project, and **evaluate them on the basis of criteria defined in Assessment Meta-model beforehand.**
6	M, L	Reference (113, 141)	Portal	Private Cloud -> SaaS	Members and the leader of the Architecture Board refer to (download) the **Architecture Guidelines defined in Defining phase in Assessment Meta-model** from GABCP while evaluating projects beforehand.
7	L	Evaluation (judgement of important point) (113)→(115)	Portal	Private Cloud -> SaaS	The leader reviews proposals for new projects **based on criteria defined in Assessment Meta-model** beforehand, judges important evaluation points, and extracts them on enterprise portal – GABCP.
8	P	Explanation-> evaluation request (116)	Portal (Web conference)	Private Cloud -> SaaS, SaaS	Architecture manager/new project manager explains the new project proposal on GABCP, and receives questions.
9	M, L	Understanding->	Portal (Web	Private	The members and the leader of the

		question(115)-> evaluation (114)	conference)	Cloud -> SaaS, SaaS	Architecture Board ask questions about the new project proposals on enterprise portal, and **create action items based on criteria defined in Assessment Meta-model** when the documents need to be refined or additional responses are needed.
10	L	Summary, official evaluation (115)	Portal	Private Cloud -> SaaS	After summarizing the review results of the Architecture Board and action items while accessing enterprise portal, the leader conducts an official **evaluation based on criteria defined in Assessment Meta-model**.
11	L	Consolidation (evaluation result) (117)	Portal	Private Cloud -> SaaS	An official evaluation results document of the review is created and uploaded on enterprise portal - GABCP.
12	L	Confirmation request (117)→(119)	Portal/ SNS/ (e-mail)	Private Cloud -> SaaS, SaaS, Private Cloud	The leader creates and publishes an announcement letter on enterprise portal - GABCP. Messages are also sent to members of the Architecture Board and Project Managers via SNS as well as e-mail.
13	M, P	Understanding (119)	Portal/ SNS (e-mail)	Private Cloud -> SaaS, SaaS, Private Cloud	Members of the Architecture Board and the project leader read and understand the review results document on enterprise portal - GABCP. The Architecture Board members show **action items for the project team to cope with as conditions, on enterprise portal via SNS, as shown in Assessment Meta-model**.
14	M, P	Question/ confirmation (117),(118)	Portal/ SNS (e-mail)	Private Cloud -> SaaS, SaaS, Private Cloud	Members of the Architecture Board and the managers of each project ask questions about the review results document on enterprise portal - GABCP, and send messages through the corporate SNS or e-mail.
15	L	Confirmation, reply (117)	SNS (e-mail)	SaaS, Private Cloud	The leader checks the corporate SNS and e-mail and replies.

16	P	Confirmation, response (119)	SNS (e-mail)	SaaS, Private Cloud	The manager for each project checks the corporate SNS and e-mails, refines and edits the proposals for each project, and responds to each action item **as shown in Assessment Meta-model** (if approved, the project begins).

[0067] Notes: L: Leader, M: Architecture Board member, P: New project manager.

[0068] Embodiments as described herein facilitate a more rapid Architectural review process that is flexible enough to meet the requirements of cloud, mobile IT, and digital IT evaluations. Topic analysis and machine learning methods applied to unstructured data allows generation of IT architectural domain specific collections, thereby enables efficient review by domain experts. This is further enabled through the use of a social collaboration model including the use of social media services to enable capture and exchanges intermediary knowledge during review and evaluation process to speed up review processes. In particular the inclusion of a social networking service 124 allows global users 23 to view, comment, pose and answer questions based on the published review. These can be viewed by both project managers 21 and architectural board members 22 leading to further modification of the proposal and endorsement. The use of social networking service 124 speeds up the final endorsement process.

[0069] The above system has been described in the context of an IT Architectural Board Review for IT Architecture projects in global organisation where there are a range of guidelines (or requirements) spanning multiple domains (cost, scheduling, HR, technical platform,) which may impact implementation risk. However it is to be understood that the system could be adapted to other similar applications where expert reviews across multiple technical and business domains are required to review a proposal affecting a large distributed organisation. More generally the architecture board is replaced with a review board who are tasked with reviewing and evaluating proposals.

[0070] Those of skill in the art would understand that information and signals may be represented using any of a variety of technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0071] Those of skill in the art would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software or instructions, middleware, platforms, or

combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

[0072] The steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two, including cloud based systems. For a hardware implementation, processing may be implemented within one or more application specific integrated circuits (ASICs), digital signal processors (DSPs), digital signal processing devices (DSPDs), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), processors, controllers, micro-controllers, microprocessors, or other electronic units designed to perform the functions described herein, or a combination thereof. Various middleware and computing platforms may be used.

[0073] In some embodiments the processor module comprises one or more Central Processing Units (CPUs) configured to perform some of the steps of the methods. Similarly a computing apparatus may be used to generate the orbital model to be supplied to the terminal apparatus, and the computing apparatus may comprise one or more CPUs. A CPU may comprise an Input/Output Interface, an Arithmetic and Logic Unit (ALU) and a Control Unit and Program Counter element which is in communication with input and output devices through the Input/Output Interface. The Input/Output Interface may comprise a network interface and/or communications module for communicating with an equivalent communications module in another device using a predefined communications protocol (e.g. Bluetooth, Zigbee, IEEE 802.15, IEEE 802.11, TCP/IP, UDP, etc). The computing or terminal apparatus may comprise a single CPU (core) or multiple CPU's (multiple core), or multiple processors. The computing or terminal apparatus may use a parallel processor, a vector processor, or be a distributed computing device, including cloud based computing devices and resources. Memory is operatively coupled to the processor(s) and may comprise RAM and ROM components, and may be provided within or external to the device or processor module. The memory may be used to store an operating system and additional software modules or instructions. The processor(s) may be configured to load and executed the software modules or instructions stored in the memory.

[0074] Software modules, also known as computer programs, computer codes, or instructions, may contain a number a number of source code or object code segments or instructions, and may reside in any computer readable medium such as a RAM memory, flash memory, ROM memory, EPROM memory, registers, hard disk, a removable disk, a CD-ROM, a DVD-ROM, a Blu-ray disc, or any other form of

computer readable medium. In some aspects the computer-readable media may comprise non-transitory computer-readable media (e.g., tangible media). In addition, for other aspects computer-readable media may comprise transitory computer- readable media (e.g., a signal). Combinations of the above should also be included within the scope of computer-readable media. In another aspect, the computer readable medium may be integral to the processor. The processor and the computer readable medium may reside in an ASIC or related device. The software codes may be stored in a memory unit and the processor may be configured to execute them. The memory unit may be implemented within the processor or external to the processor, in which case it can be communicatively coupled to the processor via various means as is known in the art.

[0075] Further, it should be appreciated that modules and/or other appropriate means for performing the methods and techniques described herein can be downloaded and/or otherwise obtained by computing device. For example, such a device can be coupled to a server to facilitate the transfer of means for performing the methods described herein. Alternatively, various methods described herein can be provided via storage means (e.g., RAM, ROM, a physical storage medium such as a compact disc (CD) or floppy disk, etc.), such that a computing device can obtain the various methods upon coupling or providing the storage means to the device. Moreover, any other suitable technique for providing the methods and techniques described herein to a device can be utilized.

[0076] The methods disclosed herein comprise one or more steps or actions for achieving the described method. The method steps and/or actions may be interchanged with one another without departing from the scope of the claims. In other words, unless a specific order of steps or actions is specified, the order and/or use of specific steps and/or actions may be modified without departing from the scope of the claims.

[0077] Throughout the specification and the claims that follow, unless the context requires otherwise, the words "comprise" and "include" and variations such as "comprising" and "including" will be understood to imply the inclusion of a stated integer or group of integers, but not the exclusion of any other integer or group of integers.

[0078] The reference to any prior art in this specification is not, and should not be taken as, an acknowledgement of any form of suggestion that such prior art forms part of the common general knowledge.

[0079] It will be appreciated by those skilled in the art that the disclosure is not restricted in its use to the particular application or applications described. Neither is the present disclosure restricted in its preferred embodiment with regard to the particular elements and/or features described or depicted herein. It will be appreciated that the disclosure is not limited to the embodiment or embodiments disclosed, but is capable

of numerous rearrangements, modifications and substitutions without departing from the scope as set forth and defined by the following claims.

CLAIMS

1.   A computer implemented knowledge management method for managing a review of a proposal using a digital portal, the method comprising:

preparing and submitting an proposal document by one or more proposers using a digital portal system comprising a knowledge management system, the proposal document comprising data relating to a plurality of technical and business domains associated with a proposed project and compliance and conformance with a plurality of guidelines, each guideline associated with one of the plurality of technical and business domains;

performing topic modelling on a corpus of documents to obtain a plurality of topics, and storing each topic and associated topic metadata in a NoSQL database of a knowledge management system, wherein the corpus of documents comprises one or more documents comprising unstructured data, and the corpus of documents comprises documents relating to a guideline associated with one of the plurality of technical and business domain;

generating a plurality of technical and business domain specific collection of documents by applying one or more machine learning modules to the plurality of topics, and storing the collection in the knowledge management system;

performing a review of the proposal document using the digital portal system comprising:

reviewing the proposal document by a plurality of technical and business domain expert reviewers, wherein each expert reviewer uses a user interface provided by the digital portal to access the technical and business domain specific collection related to their domain expertise, and assesses compliance and conformance and associated risks of the proposal document with one or more guidelines, and provides assessment information to the review board users as either intermediate knowledge documents captured and stored in the knowledge management system or as explicit knowledge documents published in the knowledge management system via the digital portal system;

updating the proposal document based on the review step,

wherein a project evaluation database of the knowledge management system stores a process status, transmit status and a knowledge form for each of the technical and business domains during the review process; and

publishing a review of the proposal document on the digital portal;

receiving comments via a social networking service from general members of the digital portal; and

evaluating the proposal document, by one or more review board users and updating the proposal document based on the received comments, by one or more proposers, and publishing an evaluation

report on the proposal document using the digital portal, wherein the evaluation report comprises an approval, conditional approval or disapproval.

2.   The method as claimed in claim 1, wherein the knowledge management system comprises one or more SQL databases, and the one or more SQL databases store domain specific data extracted from one or more documents comprising structured data.

3.   The method as claimed in claim 1, wherein the assessing the compliance and conformance and associated risks of the proposal document with one or more guidelines comprises assessing enterprise level conformance, functional aspects, operational aspects and/or viability of the proposal document.

4.   The method as claimed in claim 1, wherein preparing and submitting a proposal document comprises using the plurality of technical and business domain specific collections to assess compliance and conformance with one or more guidelines.

5.   The method as claimed in claim 1, wherein the digital portal provides a social networking service and the intermediary knowledge documents comprise one or more of Architecture Board minutes, emails, or social networking posts, and the preparation step and review step comprises exchanging one or more intermediary knowledge documents to facilitate knowledge sharing.

6.   The method as claimed in claim 5, wherein the knowledge form records the knowledge conversion stage of a review document from one or more intermediary knowledge documents to one or more explicit published documents.

7.   The method as claimed in claim 1, wherein the topic modelling uses latent Dirichlet allocation (LDA).

8.   The method as claimed in claim 1, wherein the one or more machine learning modules are a plurality of machine learning classifier, each classifier configured to classify a topic into one of the plurality of technical and business domains.

9.   The method as claimed in claim 1, wherein the one or more machine learning modules are one or more unsupervised machine learning modules that allocate a topic into a plurality of groups, and each group is mapped to one of the plurality of technical and business domains or a null group.

10.   The method as claimed in claim 1, wherein the proposal document is either an IT architecture proposal document and the review board is an Architecture Board, or the proposal document is a new IT

project proposal and the review board is an Architecture Board including members from a project or program management office.

11.   A computer implemented knowledge management system for managing a review of an proposal, the system comprising:

a cloud based computing platform;

a digital portal hosted on the cloud based computing platform;

a social networking service hosted on the cloud based computing platform;

a knowledge management system hosted on the cloud based computing platform comprising:

one or more NoSQL databases storing plurality of topics and associated metadata obtained by performing topic modelling on a corpus of documents, the corpus of documents comprising one or more documents comprising unstructured data, and the corpus of documents comprises documents relating to a guideline associated with one of the plurality of technical and business domain; and

a plurality of technical and business domain specific collection of documents obtained applying one or more machine learning modules to the plurality of topics;

one or more relational databases comprising:

a project proposal database storing a proposal document;

a project evaluation database that stores a process status, a transmit status, and a knowledge form for each of a plurality of technical and business domains in all review steps with all related documents;

an evaluation status database that stores evaluation information associated with a proposal document;

a document proposal interface that allows a user to prepare, submit and update the proposal document, wherein the proposal document comprises data relating to a plurality of technical and business domains associated with a proposed project and compliance and conformance with a plurality of guidelines, each guideline associated with one of the plurality of technical and business domains;

a review interface configured to allow a plurality of technical and business domain expert reviewers to each access the technical and business domain specific collection related to their domain expertise, and assesses compliance and conformance and associated risks of the proposal document with one or more guidelines, and the review interface is further configured to capture and allow viewing of one or more intermediate knowledge documents, and to generate and publish one or more explicit knowledge documents relating to the review of the proposal document, and to publish a review result; and

a user interface configured to allow general users to view the published review and provide comments via the social networking service and publish an evaluation report on the

proposal document using the evaluation status database, wherein the evaluation report comprises an approval, conditionally approval or disapproval.

12.   The system as claimed in claim 11, wherein the knowledge management system comprises one or more SQL databases, and the one or more SQL databases store domain specific data extracted from one or more documents comprising structured data, and the review interface is configured to access both the technical and business domain specific collection and the one or more SQL databases.

13.   The system as claimed in claim 11, wherein assessing the compliance and conformance and associated risks of the proposal document with one or more guidelines comprises assessing enterprise level conformance, functional aspects, operational aspects and/or viability of the proposal document.

14.   The system as claimed in claim 11, wherein document proposal interface provides access to the plurality of technical and business domain specific collections.

15.   The system as claimed in claim 11, wherein the intermediary knowledge documents comprise one or more of Architecture Board minutes, emails, or social networking posts.

16.   The system as claimed in claim 15, wherein the knowledge form records the knowledge conversion stage of a review document from one or more intermediary knowledge documents to one or more explicit published documents, or in some embodiments, to tacit documents.

17.   The system as claimed in claim 11, wherein the topic modelling uses latent Dirichlet allocation (LDA).

18.   The system as claimed in claim 11, wherein the one or more machine learning modules are a plurality of machine learning classifier, each classifier configured to classify a topic into one of the plurality of technical and business domains.

19.   The system as claimed in claim 11, wherein the one or more machine learning modules are one or more unsupervised machine learning modules that allocate a topic into a plurality of groups, and each group is mapped to one of the plurality of technical and business domains or a null group.

20.   The system as claimed in claim 11, wherein the proposal document is either an IT architecture proposal document and the review board is an Architecture Board, or the proposal document is a new IT project proposal and the review board is an Architecture Board including members from a project or program management office.
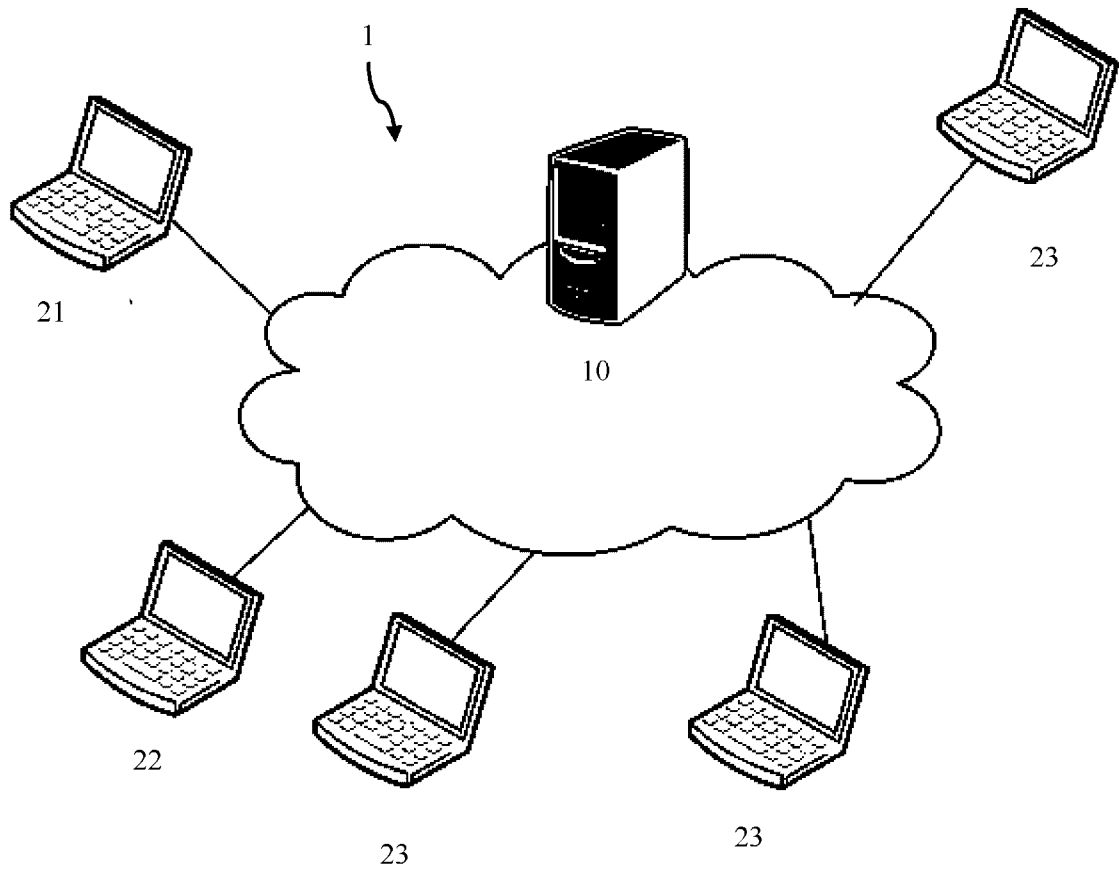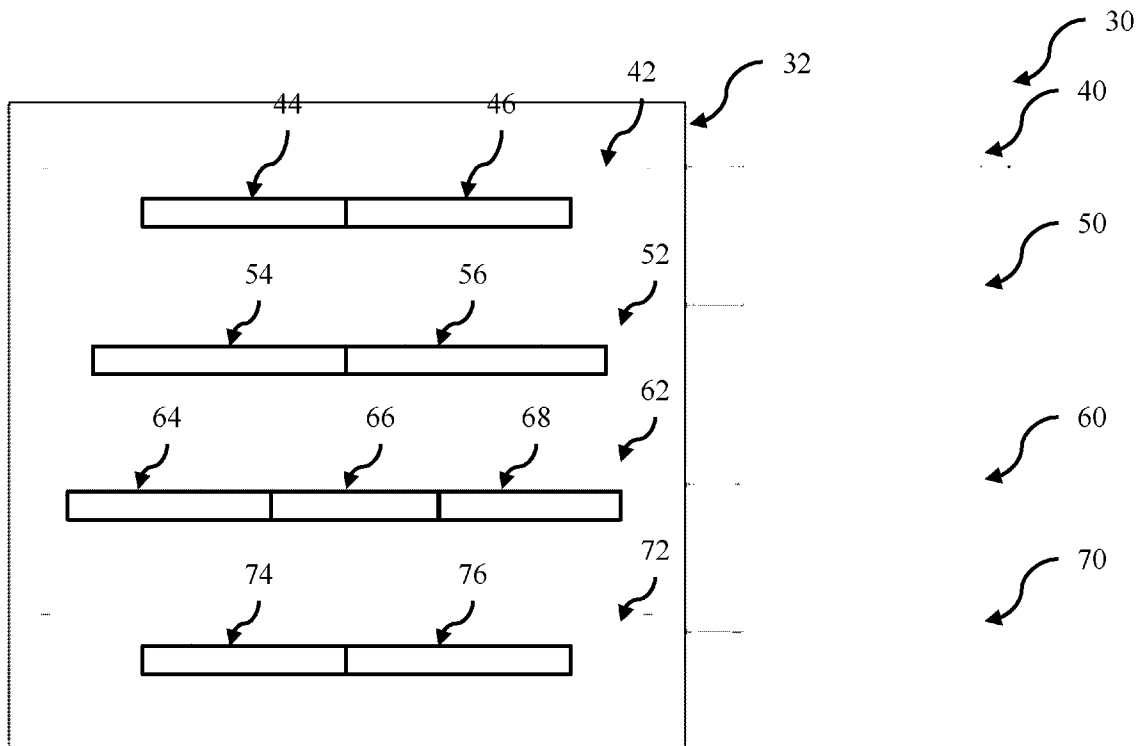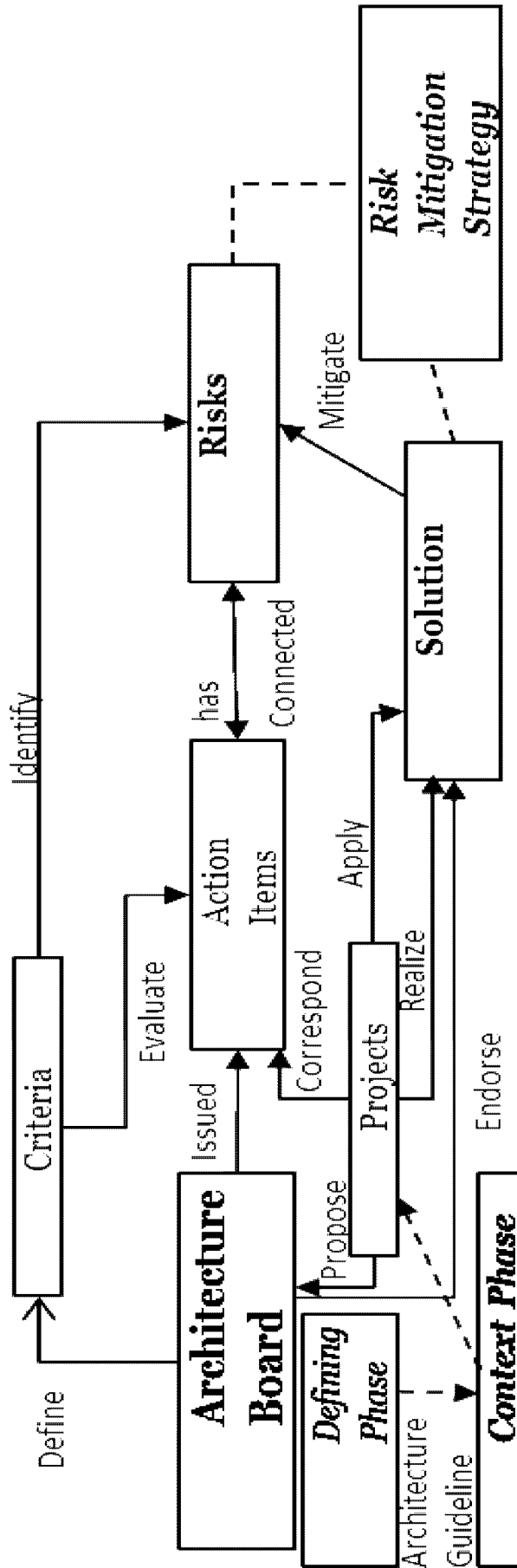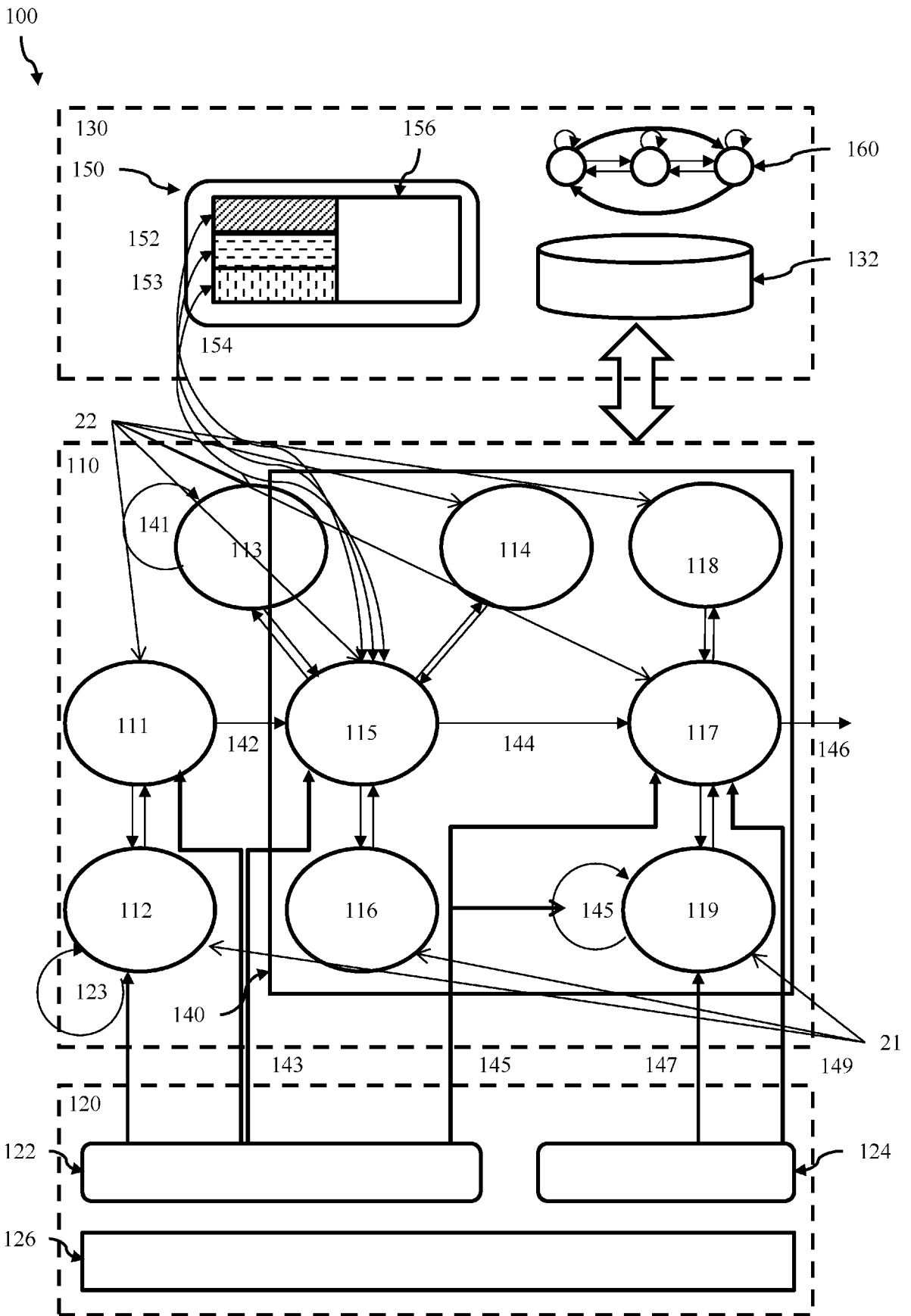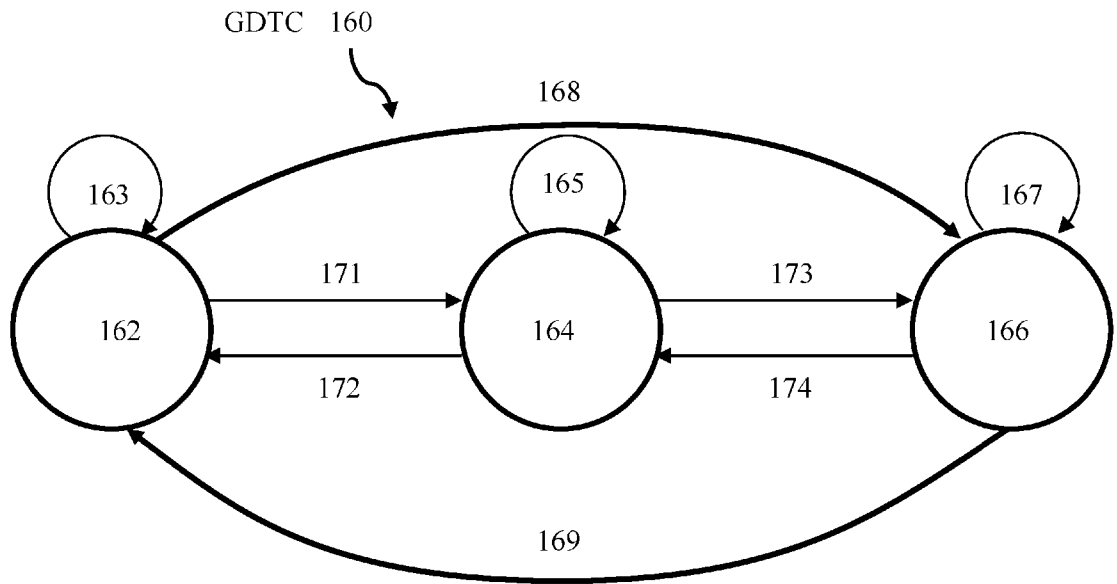
Figure 1

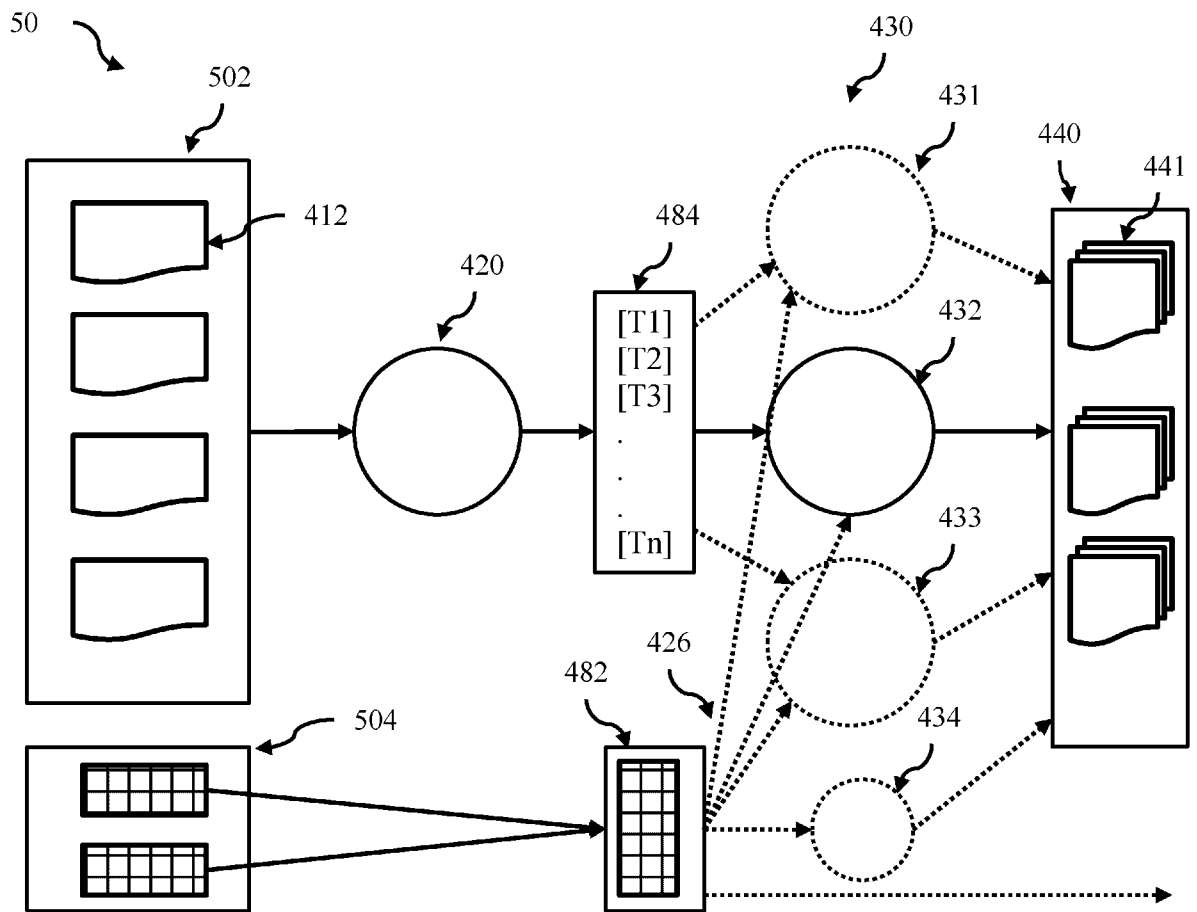Figure 2

Figure 3A

Figure 3B

Figure 3C

Figure 4A
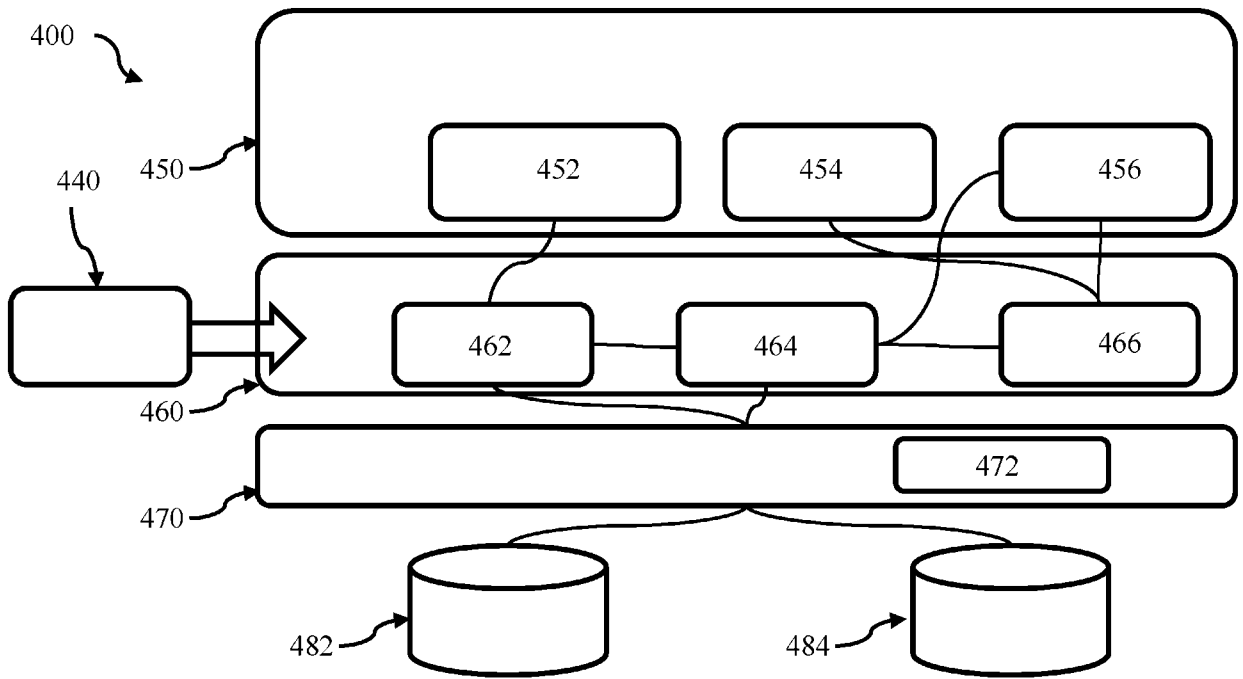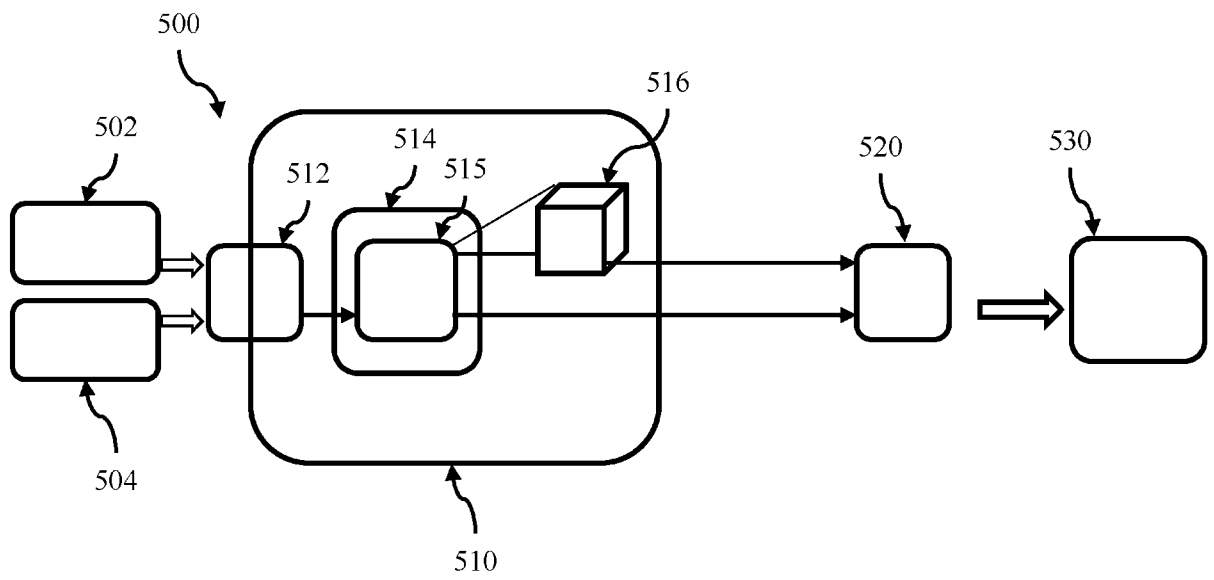
Figure 4B

Figure 5

A. CLASSIFICATION OF SUBJECT MATTER

G06Q 10/10 (2012.01)   G06Q 10/06 (2012.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PATENW and INSPEC: IPC: G06Q10/06-, G06Q10/10-   **CPC:** G06Q10/06-, G06Q10/10-, G06Q10/0635, G06Q10/0637-, G06Q10/101, G06Q10/103   **Keywords:** management, KMS, enterprise, level, architecture, collaborate, review, evaluate, proposal, compliance, technical, business, guideline, database, topic, "machine learning", expert, board, "social network" and similar terms.

Google and Google Patents Search: Keywords as above.   **Applicant(s) and/or Inventor(s) Name Search:** AUSPAT, Espacenet, and internal databases provided by IP Australia.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

☒ Further documents are listed in the continuation of Box C	☒ See patent family annex

*	Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
9 November 2018	09 November 2018

Name and mailing address of the ISA/AU	Authorised officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	Greg Maloney AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262256165

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US US2007/0074148 A1 (MORGAN) 29 March 2007 See the entire document, in particular the abstract, figures 1(a) - 1(c), 4 and 5, paragraphs 3, 47 - 67 and 78 - 111, and claim 1.	1 - 20
A	US 2003/0130993 A1 (MENDELEVITCH et al.) 10 July 2003 See the entire document.	1 - 20
A	US 7024408 B2 (DEHLINGER et al.) 04 April 2006 See the entire document.	1 - 20
A	KR 20150050674 A (YIM) 11 May 2015 See the entire document.	1 - 20
A	US 2008/0319812 A1 (SOUSA et al.) 25 December 2008 See the entire document.	1 - 20

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
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US 2003/0130993 A1	10 July 2003	US 2003130993 A1	10 Jul 2003
		EP 1421518 A1	26 May 2004
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End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.