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Towards a methodological framework for designing a KaaS system

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Abstract— The paper proposes a KaaS conceptual model by using the well-known definitions of knowledge vis-à-vis information. Based on this KaaS model, using the principles of business model and service science, the paper proposes a representative classification KaaS business model types as well as a preliminary macro-methodological framework for designing commercially viable KaaS. The *design emphasis* is on distinctive KaaS value proposition for a chosen market segment, simple revenue mechanism, low cost structure, and agile value network that positions the focal firm strategically on the ‘choke-point’ in the value net which ‘locks in’ its customers and value partners while ‘locking-out’ potential or real competitors.

Keywords-KaaS, business model, service science, design methodology

I. INTRODUCTION

Clouds technologies are enabling new types of on-demand service such as infrastructure, platform and software as a service. Clouds are a large pool of easily usable and accessible virtualized resources, through a *pay-per-use revenue method*, which can be *dynamically reconfigured* to allow optimum resources utilization [11]. The emerging next-generation networks are also allowing telecom service providers to offer “*application environment as a service*” to entrepreneurial third-party service providers to, in turn, create and offer new innovative services to the market, under a variety of *negotiated* business models and associated service agreements [3]. These dual trends are offering entrepreneurs opportunities to extend the on-demand service models to the new “knowledge as a service” KaaS model. According to the principles of service science [12], we argue that the purpose of KaaS service is to allow clients ‘pay-per-use’ access to ‘specialized’ provider knowledge, *on-demand*, so as to *integrate it with their own specific internal knowledge to create value for themselves* (and hence the provider). This paper proposes a methodological framework for designing KaaS that co-creates value with customers. It is organized as follows. Section II reviews briefly the definitions of knowledge vis-à-vis information, and proposes a conceptual KaaS model and a typology of KaaS. Section III overviews the business model and service science principles and proposes a KaaS business model classification. From these the framework

for KaaS model design is also derived and proposed in Section IV. Section V concludes the paper with a preliminary ‘trailing’ of the proposed framework to a case example.

II. DEFINITIONS OF KNOWLEDGE & KAAS

Fahey and Prusak [5] argue knowledge is *information combined with experience, context, interpretation, reflection, intuition and creativity*. Information becomes knowledge once it is processed in the mind of an individual. This knowledge then becomes information again once it is articulated or communicated to others in the form of text, computer output, spoken, or written words or other means.

Grover and Davenport [7] claim knowledge processes lie somewhere between information and the firm’s source of revenue, its products and services. This process can be generically represented in three sub processes: *knowledge generation, knowledge codification, and knowledge transfer/realization*. We use the Grover-Davenport model to define the KaaS model (Figure 1) where the product or service is the codified knowledge generated by the knowledge service provider. Knowledge is commonly distinguished by explicit and tacit knowledge. *Explicit knowledge* is codified as information and can be readily transmitted between individuals both formally and systematically. *Tacit knowledge* is on the other hand highly personal and hard to formalize, making it difficult to communicate or share with others [7, 4:395].

From these definitions we observe that KaaS would either provide codified (explicit) knowledge transfer to the client via online interface, or tacit knowledge transfer via face-to-face interface (such as professional consulting), or via telephone interface (such as call center or help desk service by human agents). For the purposes of this paper, KaaS service model is analyzed in the context of grid-network-based services – i.e. codified knowledge provisioning.

The on-demand knowledge service types that could be offered by KaaS can be categorized representatively as:

- Explicit or codified knowledge which includes: (1) general information aggregation and retrieval open to public, (2) specialist *routine* knowledge retrieval on-demand, (3) specialized codified knowledge generated by trained service agents by performing pre-defined set of

activities or processes for the clients on behalf of the firm to whom the KaaS provider is contracted for the service provision, (4) Specialist knowledge codified into software and provisioned as software as a service (SaaS) to which a client firm may be subscribed so as to add its own codified knowledge for use by its own internal customers (staff members).

- Tacit knowledge which includes: (1) specialized tacit knowledge service provided by an expert and (2) Professional consulting service – ad hoc by contract assignment.

The degree of ‘work’ that a client has to perform to integrate the ‘knowledge’ acquired from KaaS with its own internal knowledge and competences to co-create value varies with the KaaS service type – e.g. the client has to do much more to create value (e.g. new knowledge) with the information aggregation (Google-like) service than in the case of hiring a professional consultant to create the same new knowledge for the firm. The degree of customer involvement in *value co-creation* and in some cases *KaaS knowledge co-production* is a central KaaS service design issue which directly impacts the pricing and revenue mechanisms. Client feedback in KaaS service is part of the client involvement design issue.

III. BUSINESS MODEL & SERVICE SCIENCE PRINCIPLES

A commercially viable KaaS must comply with business model and service science principles.

Business model defines the manner by which an enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit [10]. Business model design [2] must articulate the value proposition (benefits to customers), identify the chosen market segment, define the structure of the value chain and resources/assets required to deliver on the value proposition, define the revenue mechanisms and associated cost structure for the offering, and position the focal firm in the value network with a competitive strategy that give it advantage over its rivals sustainably. Thus KaaS design must include its business strategic choices for resources and competences, organizational structure, propositions for value delivery.

A service-centered view of KaaS is inherently customer-oriented and *relational* [12]. Service is a *process* of applying the provider’s competence (i.e. knowledge and skills) for the benefit of, and in conjunction with, the customer. A service offering is produced using the provider’s resources which include both tangible (such as computer systems) and intangible (such as knowledge, competence and relationship) assets. But the value characteristics of the service provisioned are *co-created* through the *interactions* of the client’s competences (knowledge and skills) with that of the service provider; thus, the client is (*pro-*)*active* in service interaction and it co-creates value for itself with the provider [6]. Value co-creation interactions between provider and client (service) systems are service interactions. Each interaction is made up of three main activities [8]: (1) proposal – proposing a value-

creation interaction to another service system (e.g. client); (2) agreement – agreeing to a proposal; and (3) realization – realizing the proposal. And value co-creation consists of three contiguous processes: the customer value-creating processes; the provider value-creating processes; and the encounter processes through which the customer interacts with the provider [9].

From the above business model constructs, service science principles and the KaaS model in Figure 1, we propose a classification scheme for classifying the various types of KaaS in terms of the business model constructs as shown in TABLE I.

IV. METHODOLOGICAL FRAMEWORK FOR KAAS DESIGN

Using the business model and service science principles, we propose a macro-framework for designing a commercially viable KaaS service methodically by going through the following steps iteratively while ensuring the criteria of each step are satisfied *integratively (congruently)* with the other steps:

- a. the KaaS service fulfills an un-served or under-served market segment;
- b. distinctive KaaS customer value proposition (benefits to the customers are superior to what’s available or expected in the marketplace) which resonates with the firm’s brand and corporate values;
- c. pricing and revenue mechanisms are simple and reinforce the customer’s sense of fairness in terms of KaaS value for money;
- d. agile KaaS value network design of partners, suppliers and customer that delivers maximum value and minimal costs and fulfills the KaaS customer value proposition distinctly, and that can be readily reconfigured to sustain its superior value proposition, in response to the dynamic environmental (market and technology) changes;
- e. continuous alignment and realignment of the customer, KaaS provider and encounter processes end-to-end to ensure *lean* production and *lean* consumption (which includes decision on the *customer involvement strategies* for knowledge co-production and value co-creation) of KaaS service so as to maximize customer experience in accordance with the rigorous service engineering principles [1];
- f. integrate the revenue mechanisms seamlessly with the KaaS service delivery process to enhance the value-for-money service integrity and experience for the customer;
- g. experiment with customers and quickly learn from feedback and redesign KaaS service model to match customers expectations;
- h. incorporate unique KaaS design themes (strategy) to ‘lock in’ customers and ‘lock out’ current or future competitors;
- i. sense and seize the opportunities to redesign/reconfigure and implement change to the KaaS business and service models in response to or in anticipation of external environmental (market, regulatory or technology) changes

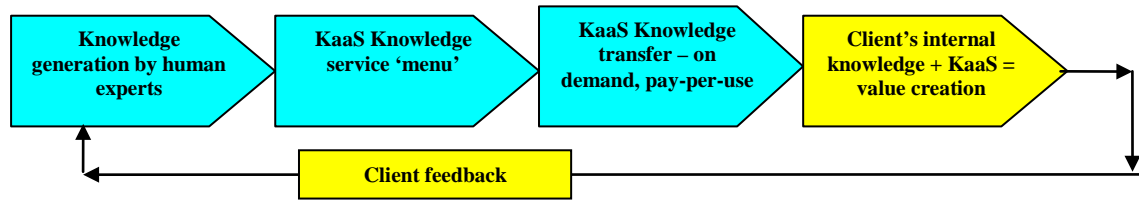


Figure 1. KaaS Service Model according to knowledge and service science theories

TABLE I. KAAS CLASSIFICATION SCHEME BASED ON BUSINESS MODEL PRINCIPLES

KaaS Type	Value propositions	Revenue model	Relationship with client	Network partners / organization structure	Resources / competences
Information (codified knowledge) retrieval e.g. Google ; Wikipedia	Information on demand – via rapid search using keywords – sub-second response time	Advertisement; sponsorship or subscription	Remote access via online interface	Worldwide hosts containing publicly accessible information; advertisers; wiki-editor volunteers;	specialty-designed computing hardware & software infrastructure
Routine knowledge (codified) retrieval e.g. stock markets intelligence	Advice on demand – via structured queries or semi-natural language	Subscription or pay-per-use	Remote access via online interface; plus help-desk ; account management for subscription customers	Company public relations; stock analysts; regulators; central banks;	knowledge management software, e.g. CRM software
Knowledge (codified or tacit) produced via predefined routine activities e.g. call centre Business Process Outsourcing; credit check agency	Business outcome on demand – via Contracted SLA	Task-based or outcome-based fixed term contract	Remote access via online or telephone interface; plus help-desk ; account management for subscription customers	Education institutions; labor recruitment agencies; computer and software vendors; telecom networks	Trade-trained human resources; computer, software infrastructure
Knowledge (tacit) produced via ad hoc queries e.g. online tax consultant or other professional services such as medical imaging diagnosis	Specialist task performance on demand – via menu-listed SLA per service item	Pay-per-use or fixed term contract	Remote access via online or telephone interface; plus help-desk ; account management for subscription customers	Other consultants; professional associations; medical imaging vendors	combination of expert systems and human experts
Professional services consulting invoked by ad hoc requests (tacit knowledge)	Advanced advisory services	Pay-per-use or fixed term contract per assignment	On-site working with clients; back-office analysis; account management	Complementary consultants; education institutions; professional associations; business councils	Specialist professionals with accredited qualifications
Software as a service – specialist knowledge embedded in the software, e.g. technique for managing customer relationship embedded in Salesforce's CRM SaaS, to which clients can add their own customer specific information	Specialist application customizable to client's unique requirements	Subscription	Online interface; help-desk; account management	Complementary software service providers; clients' information systems	Industry specialists and software designers and programmers

V. CONCLUSIONS

The paper proposes a KaaS conceptual model (Figure 1) by using the well-known theory and definitions of knowledge vis-à-vis information. Based on this KaaS model, using the principles of business model and service science, the paper proposes a representative classification KaaS business model types (TABLE I); as well as a preliminary macro-methodological framework for designing commercially viable KaaS. The *design emphasis* is on distinctive KaaS value proposition for a chosen market segment, simple revenue mechanism, low cost structure, and agile value network that position the focal firm strategically on the 'choke-point' in the value net which 'locks in' its customers and value partners while 'locking-out' potential or real competitors.

A cursory trial 'retrospective' application of the proposed methodology to a successful 'knowledge factory' service provider was performed. The firm provides a knowledge codification service (on a contract basis) by performing digitization of hand-written documents accurately, speedily and cost-effectively (to agreed Service Level Agreements) for its customers by using a combination of human- and technology-based service platform – a core competence the provider has been developing ('perfecting') over many years of experimentations (trial-and-error) with its customers and partners. It highlights the firm's competitive advantage transcends its service platform to include its network of customers and most importantly its channels to raw talents whom can be quickly trained, morphed and absorbed into the firm's core competency fabric of knowledge creation.

This is a preliminary macro-methodological framework for KaaS service design. More work still needs to be done to validate the framework comprehensively, and to refine it and to flesh it out with details by applying it systematically to a case study of real KaaS firm. This is being applied to the above-mentioned service provider.

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