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A Systematic Input Selection for Service Identification in SMEs

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Abstract: Service-oriented Architecture (SOA) as an ideal architecture to support today's business challenges such as agility and flexibility acts like a bridge between IT and business domains. There are intensified SOA applications at large enterprises. However, small and medium enterprises cannot obtain SOA benefits due to the lack of compatible solutions of SOA implementation challenges. Service identification is the first step in service modeling that extracts services as building blocks of SOA. Determining suitable inputs for SME service identification based on their conditions is a key factor for developing related identification method. This paper proposes SME based criteria to evaluate current inputs of service identification. To assess the inputs that are collected from variety of sources a mapping process between enterprise goals and collected inputs is presented.

Key words: Business process, service identification, SOA, service modeling, enterprise goals

INTRODUCTION

Service-oriented Architecture (SOA) aims to reorganize the enterprise architecture base on its business goals. It fills the gap between IT and business domain in order to keep up with the changing trend in today's business. The main SOA enhancements are flexibility and agility in processes that lead to the development of compatible information systems with business changing frequency. This will equip the enterprise with enough power to be competitive (Bieberstein *et al*., 2005; Erl, 2005).

By listing SOA's capabilities against SME's challenges, it will be clear that SOA could cover many of SMEs' challenges by its nature. The tendency to implement SOA within enterprises has intensified in the mid of last decade (Al-Aaidroos *et al*., 2011). For example increasing agility, decreasing complexity, possibility of reusing the legacy systems, possibility to service sharing and so on are number of SOA goals that at the same time considered as vital requirements in SME firms (Wang *et al*., 2007; Berbner *et al*., 2005). SMEs need to access the market with minimum investment and experts' knowledge (Michael Decker and Bulander, 2006; Castro-Leon *et al*., 2007). Moreover, SOA implementing is a costly process in terms of time, financial and resources, besides, it is not surprising that many SMEs do not involve themselves in implementing or restructuring their IT systems based on SOA because they do not believe on SOA benefits (Diao and Ma, 2008; Castro-Leon *et al*., 2007). As a result they cannot getting SOA benefits and compete with other companies. This will lead them to lose the competence and their businesses will be at risk.

In addition, situational method engineering in the last decade stated that a fixed method is not appropriate for all environments and conditions. Thus, methods should be reconfigured to be compatible with specific situations (Ralyte and Rolland, 2001). Therefore, in order to achieve SOA goals in SMEs one of the most important conditions that has been considered in previous studies is considering SMEs' lack of resources such as technical knowledge, time and budget (Boer and During, 2001; Zdravkovic *et al*., 2007). This initiative in proposing SME's specific service identification method will raise the motivation of the SMEs in implementing and developing their systems based on service solutions.

In order to migrate to SOA the first requirement is the service modeling (Arsanjani *et al*., 2008). The Importance of service modeling activities in the development of SOA is undeniable and mistakes at this can affect all SOA layers (Chaari *et al*., 2007). To make services compatible with SMEs' conditions this phase should consider SMEs conditions and constraints. Service modeling is a fundamental step that has responsibility to identifying, specifying and realizing of services (Arsanjani, 2004). This stage influences all of the other components in the service life cycle and any faults in this phase will be costly and most difficult to correct (Chaari *et al*., 2007; Dijkman *et al*., 2008).

Service identification as a first step of service modeling is a basic precondition for a detailed specification and implementation of services in a SOA (Klose *et al*., 2007). It is placed in service modeling to identifying the existing capabilities and also potential capabilities in both business level (business processes,

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goals and etc.) and technical level (existing applications, databases and etc.) (Kohlborn *et al*., 2009). An effective service identification method should support business and IT aspect of an enterprise (Schroth, 2007). This view is well matched with comprehensive definitions presented by researches such as an organization for the advancement of structured information standards (OASIS) (OASIS, 2006).To achieve the goals of such comprehensive definitions, selecting inputs that contain information in the multi dimensions of an enterprise is a key factor. Besides, there is no pervasive and comprehensive method for service identification and also no consensus has been identified to address the pain point's challenges within service identification (Kohlborn *et al*., 2009). The lack of a standard SIM especially for SMEs led to hindrance in identifying accurate and acceptable services and as result lack in successful SOA implementation in the enterprise (Klose *et al*., 2007; Kohlmann and Alt, 2007). Therefore, importance of achieving a comprehensive SIM that specifically discuss SMEs challenges became a necessity. Every service identification method could be categorized based on their inputs, method and outputs (Gu and Lago, 2010). A Service Identification Method (SIM) should be clear in its input, method and output services to achieve its goals.

Inputs play important role in quality of services and thus SOA governance success. Checking and evaluating all types of inputs that has been used in previous researches become a necessity. Therefore, selection of appropriate input is a challenging subject in engineering every SIM that could be seen within the variety of SIM's differences in input selection (Gu and Lago, 2010).

Determining appropriate inputs should depend on enterprise situation, available resources and their conditions and is not fix within all type of enterprises. Therefore, the set of criteria that demonstrate the proper inputs among variety of options are strongly required and also at the same time a clear method and guidelines that support this selection.

To achieve the suitable and fitted inputs for SIM in SMEs, possible inputs should be analyzed with considering SMEs capabilities and their lacks in order to make confidence in accuracy, availability and performance of inputs that will be involved in identifying services. Therefore, two essential questions arise:

- What are the fundamental inputs that have been used in the existing SIMs and the applicability of these inputs for service identification in SMEs?
- What is the systematic and suitable road map to be followed by SMEs in order to select appropriate inputs for identifying services and to develop it into a rigorous method?

The main goal of this paper is to systematically assess the variety of inputs that could be selected in SIMs process and determining the level of applicability of each input type for SMEs. To achieve this goal the current inputs of service identification are critically discussed. Next, we derive criteria and assess each input of extant methods considering into account SMEs' situation. Then, according to extracted criteria all fundamental identified inputs of SIMs have been analytically compared with each other. In order to evaluate variety of input types a mapping between enterprises goals and extracted data from selected inputs is proposed. The solution promises to address the lack of a comprehensive evaluating of input types of SIM based on previous studies in SIMs and also SMEs situations. Moreover, the evaluation of inputs based on SMEs will be of great assistance for service modellers in SMEs. In general, the solution promotes SMEs to enter the world of SOA and to get benefits from it.

SMALL MEDIUM ENTERPRISES (SMEs)

In the developing countries, SMEs is seen as the engine of economy growth and their significant value is accepted (Sahran and Zeinalnezhad, 2010). There is a distinction between large and SMEs because of the differences in the enterprise structure, employee knowledge and level of capabilities (Taylor and Kane, 2005; Sahran *et al*., 2010). Thus, there is a difference between methods and tools that should be apply to each mentioned firms. SME has many kinds of influences in business in both quantity and quality aspects. Okpara (2009) introduce them as an engine of growth for any economy. Nowadays, SME-IT alignment became a must and SMEs should evaluate their organizational culture and their available resources to adopt suitable IT tools for the firm.

SERVICE IDENTIFICATION METHODS' INPUTS

Inputs of SIMs could be categorized in different types according to selection frequency of each type by previous SIMs as well as amount of consensus within previous researches on specific input types. Thus, Business processes, use case, activity diagram, source code, user interface, database, enterprise goals and enterprise domain knowledge has selected and mentioned by Borner and Goeken (2009), Kohlborn *et al*. (2009) and Gu and Lago (2010) and according to a systematic literature review are presented in this section.

Business processes are so important since they convert input of enterprise to output which is the main cause of enterprise existence (Kirikova and Stasko, 2007). A business process is set of tasks that are placed and ordered based on the procedural rules (Kim and Doh, 2009; Mohammadi and Mukhtar, 2012). However, business processes are not algorithm based entities but these kinds of inputs have used in the majority of service design and modeling methods. There are significant number of recent studies in SIM that focused on business process as input (Arsanjani, 2004; Dehnert and van der Aalst, 2004; Wang *et al*., 2005; Recker *et al*., 2006; Amsden, 2007; Senthil *et al*., 2008; Azevedo *et al*., 2009; Bianchini *et al*., 2009; Gu and Lago, 2010). Furthermore, Gu and Lago (2010) indicates this fact that business process consists majority of inputs among SIM methods that have been studied. A process model could be in a graph based or in a rule based form Lu and Sadiq (2007). Besides it, may be even informal process model that does not follow any standards of business process management models (Baldi and Jaccheri, 1995).

Once the SIM focuses on capturing the task and its requirements from processes, the business process should be decomposed hierarchically up to achieving the atomic logical tasks that indicates one important capability in BPM (Erl, 2005). It seems that a clear relations could be considered between both hierarchically trees of enterprise' goals and its business processes. Implementing these relations could reveal additional tasks in a business process whenever a task has no relation with any goal as well as demonstrates the redundancy of tasks when each goal or sub goal is implemented more than one time.

From a wide range of business process models and standards Business Process Modeling Notation (BPMN) (White, 2004) is selected in this research because of its clarity, popularity and comprehensiveness (Dorn *et al*., 2007; Mohammadi and Mukhtar, 2012). In addition, C3 notation has designed and proposed from scratch as special method based on SMEs' situation (Nielen and Jeske, 2006). So these two models has selected as suitable methods for business process modeling that are applicable in SMEs based on reasons which are briefly discussed below.

BPMN has gained most popularity amongst process notations (Group, 2009). Although, it is not yet the official notation for process modeling, it has preferred widely by the majority of researchers Van Nuffel *et al*. (2009). Since, BPMN has a clear notation, it can be easily understood and use even by managers (Recker and Indulska, 2006). In addition, at the same time BPMN is considered as comprehensive model that supports most of work flow patterns such as data, control flow and resources in comparison with other BPM models (Wohed *et al*., 2006). It provides an easy understanding model for a business analyzer to create processes and for technical developer to implement, monitor and manage the business processes (Recker *et al*., 2006). Moreover, BPMN can use non graphical notation to be converted to BPEL (Business Process Execution Languages) (Kabilan, 2005).

Based on Nielen and Jeske (2006) in order to cover SMEs lacks, smaller scale approach to BPM is a necessity for SMEs. Besides, process modeling is a time consuming task that is often ignored by SMEs (Nielen and Jeske, 2006). Thus, it proposes C3 notation model as a light notation model and suitable notation for SMEs. Simplicity of SMEs' structure in designing and analyzing the business processes for SMEs basically makes the SME have not been required high expertise such as external consultant or even can do portion of BPM tasks by their own. In addition, nowadays most medium size enterprises have IT department that is proportional to their size and thus has ability to do some BPM operations (Gramignoli *et al*., 1999).

Consequently, C3 notation has potentials to be applied in SMEs without high expertise and technical employees. C3 contains a limited number of graphical elements that lead to easy managing by SME's employee or stakeholders (Nielen and Jeske, 2006). Furthermore, the C3 elements have been originated from UML thus there is similarity between them (Nielen *et al*., 2011). C3 tries to maintain its capability to cover main elements such as iteration and synchronous collaborations and increase the similarity of its graphical elements with other BPM models such as EPC and BPMN (Nielen *et al*., 2011).

In addition, OMG as owner of UML has been contributed the BPMN thus it become more similar to UML and as OMG's product (Dorn *et al*., 2007). Table 1

Table 1: Advantages and disadvantages of C3 and BPMN

Model	Advantages	Disadvantages
C3	• Easy to learn for low knowledge employees • Limitation of graphical elements • Elements are similar to UML	• Not pervasive • Has not relationship with business execution language • Has not support service oriented explicitly
BPMN	• Pervasive • Similar to UML • Graphical in nature • Comprehensiveness elements • Ability to Map to process execution language • Comprehensively documented • Fully workflow specifications support • Its graphical elements can be extended based on the situation (Kabilan, 2005)	• Required expertise and knowledge • High number of notation elements

has listed the advantages and disadvantages of these two notations. The advantage or disadvantage attributes has assigned based on the above discussion and also SMEs' requirements and their situation according to studies published by Gramignoli *et al*. (1999) Jansen (2008) and Ganesh and Mehta (2011) has been considered.

Consequently, BPMN and C3 models could be two appropriate selections in SMEs based on their capabilities in resources specially experts' human resources.

Enterprise domain knowledge could be defined as the relationships among information that gives the people involved in an enterprise ability to do tasks that add value to the enterprise (Le Dinh and Moreau, 2011; Lavery and Boldyreff, 2002). Those people have the tacit knowledge about the enterprise or special process that contains previous experience and domain knowledge of enterprise experts (Grangel *et al*., 2007). The knowledge is in an informal language that is structured without any standard. This type of knowledge could be extracted from experts and documents in natural language (Christl *et al*., 2008). Often the lack of documentation in SMEs (Tosun *et al*., 2009) force the domain analyzers to use informal documents in the enterprise.

In addition, there are some tools such as plugin for Protg OWL (McGuinness and van Harmelen, 2004) that can be used to extract knowledge from text-documents. The risk of using such input type is false interpretation of definitions that are used by employees in documents (Christl *et al*., 2008).

This type of inputs is easier to achieve in enterprises since most of the SMEs has lack in documentation that has produced by standards such BPM or enterprise architecture techniques (Jansen, 2008; Tosun *et al*., 2009).

Enterprise domain knowledge has considered as one of easy to achieve resources. Therefore, it was selected by significant number of methods (Flaxer and Nigam, 2004; Jain *et al*., 2004; Jones, 2006; Chaari *et al*., 2007; Klose *et al*., 2007; Kohlmann and Alt, 2007; Kohlborn *et al*., 2009).

Use case has selected by number of SIMs as input for their identification method see (Kim and Doh, 2007; Knauss and Lubke, 2008; Si *et al*., 2009). Use case diagrams provide an overview of a system that have considered as a standard method to capture the requirements and interactions of the system under developing by depicting a sequence of actions and functional requirements clearly (Regnell *et al*., 1996; Vemulapalli and Subramanian, 2009). UML is close to computer logics and also their affinity to business processes models has made them applicable and popular (Fatolahi and Shams, 2006). Based on the UML capabilities, we propose a method for transforming UML in a form of PIM (platform independent model) to PSM (platform specific model) that is based on SOA profiles in UML (Zade *et al*., 2008). In addition, UML has developed based on O.O (object oriented) methodology and thus, become easy to computerize also majority of SMEs' applications has developed based on O.O and thus this factor would be encourage SMEs to select UML according to their experience and their affinity with O.O applications (Nikula and Sajaniemi, 2000; Anton *et al*., 2001; Arsanjani *et al*., 2008). Moreover, UML documents are achievable in SMEs that include IT department because, most of their applications have modelled based on UML and these documents could be found as attached documents to existing systems.

Activity diagrams are effective tools to show the system interactions roles and also steps that are involved in doing a special task. These diagrams have commonly used in the UML and BPM modelings of existing/legacy systems as a part of UML diagrams (White, 2004). Activity diagrams have proposed as input by Alahmari *et al*. (2010) that transform them to BPMN that is transformable to BPEL as a executable language. In addition, Mantell in (Mantell, 2003) develop an automated tool that get UML activity diagrams as input and transform it to BPEL. He focused on UML stereotypes that are flexible and could be assigned to any element of UML then a mapping table act as a reference between UML and BPEL elements by the automated application. Zhang *et al*. (2008) propose an MDA based approach and supporting tools to transforms the business requirements in UML to BPEL based on mapping rules repository (Zhang and Duan, 2008). Moreover, Vemulapalli et al explore an approach that rely on UML activity diagram and sequence diagrams as input and transform them to BPEL based on XMI (XML Metadata Interchange) that has mapped UML diagrams to BPEL and also produce WSDL (Web Service Definition Language) files (Vemulapalli and Subramanian, 2009).

Source code analysing legacy source code is considered in methods that define keeping legacy systems as one of their goals (Alahmari *et al*., 2010). It is used as input for SIMs that has bottom-up method to identify existing systems' capabilities as a service. Hence, service identifying based on legacy or existing systems' functions is main idea in these methods. Moreover, it could be a good option for SMEs that does not have enough standard documents relating to the domain knowledge and lack in enough resources to prepare other kinds of inputs.

Generally, source code analysis are considered in considerable number of methods that uses reverse engineering, wrapping legacy applications or transforming techniques by bottom-up or meet-in-middle approaches as

Table 2: Types of inputs used by SIM's

Input type	Approaches	Total
Business process	OASIS (2005), SAP (2009) Yousef *et al.* (2009), Arsanjani (2004), Zhang and Yang, (2004), Wang *et al.* (2005), Amsden (2007) and Inaganti and Behara (2007) Dwivedi and Kulkarni (2008), Fareghzadeh (2008), Jamshidi *et al.* (2008), Mani *et al.* (2008), Senthil *et al.* (2008), Azevedo *et al.* (2009), Bianchini *et al.* (2009), Kim and Doh (2009), Gu and Lago (2010) Chaari *et al.* (2007) and Ricca and Marchetto (2009)	20
Enterprise domain knowledge	Jain *et al.* (2004), Chaari *et al.* (2007), Klose *et al.* (2007), Kohlmann and Alt (2007), Flaxer and Nigam (2004), Jones (2006), Lee *et al.* (2008), Kohlborn *et al.* (2009), Papazoglou and Georgakopoulos (2003) and Jamshidi *et al.* (2009)	10
Use case	Mantell (2003), Kim and Doh (2007), Fareghzadeh (2008), Vemulapalli and Subramanian (2009), Si *et al.* (2009), Sewing *et al.* (2006), Bell (2008) and Adamopoulos *et al.* (2002)	8
Source code analysis	Chen *et al.* (2005), Zhang *et al.* (2005), Aversano *et al.* (2008), Feng *et al.* (2009), Alahmari *et al.* (2010) and Ricca and Marchetto (2009)	6
Activity diagram	Mantell (2003), Nadham (2004) and Vemulapalli and Subramanian (2009)	3
Database	Baghdadi (2006)	1
Enterprise goal	Sehmi and Schwegler (2006), Andersson *et al.* (2009), Chaari *et al.* (2007) and Kim *et al.* (2008)	4
User Interface	Senthil *et al.* (2008)	1
Mix	Zhang and Yang (2004), Senthil *et al.* (2008), Ricca and Marchetto (2009), Jamshidi *et al.* (2009), Chaari *et al.* (2007), Arsanjani *et al.* (2008), Cho *et al.* (2008), Fareghzadeh (2008) and Andersson *et al.* (2009)	9

the delivery strategy see (Chen *et al.*, 2005; Zhang *et al.*, 2005; Aversano *et al.*, 2008; Chen *et al.*, 2009; Alahmari *et al.*, 2010). Linthicum proposes an architecture that integrates data, processes and existing applications into a new form as web services (Linthicum, 2004). In addition, Delaitre *et al.* (2005) also uses source code analysis to create legacy code interface description file illustrating the source code's parameters to find out legacy code structure. Moreover, recent studies demonstrate the importance of legacy systems in two main dimensions in SME environment (a) the role of stable and successful legacy systems as the infrastructure to develop new technology and (b) the effectiveness state of legacy systems in SMEs (Nah *et al.*, 2001; Ahmed, 2009; Ganesh and Mehta, 2011).

User interface depicts workflow and data requirements inside the applications in an enterprise. In addition, relationships between users, data and stakeholders could be extracted from application's interfaces. This type of inputs is especially appropriate when there is no existing standard business process explanations in the enterprise and when the application has changed and customized based on the new enterprise situation. Thus, applications' user interfaces would be as resource of enterprise knowledge all along the years of enterprise applications updating. Senthil *et al.* (2008) proposed a method to gaining required data and navigation flow of information for web services by automated extraction method of those required information from legacy systems' interfaces.

Databases are standard and common tools for processing, storing and managing the data and information of the enterprise. Moreover, databases states as the core of information systems and should be considered in any information system' transformation. Extracting the current situation of systems based on table's data and their relations is effective and could show low level tasks out of relational databases to be used as documentation for under construction systems. Baghdadi (2006) has used reverse engineering techniques to develop a method to extract web services from database' tables. He has obtained exactly, one service per table that could guarantee the output web services with acceptable, coherence and precise information that were used and confirmed by employees within daily working with existing systems.

Enterprise Goals were commonly used in enterprise modeling (Rolland *et al.*, 1998). The goals could be divided into high level and low level goals where high level goals are related to high abstraction goals in top management strategies such as increasing the production amount of enterprise by 10% and low level goals that relate to conducting fine grained tasks in some processes or even inside a process. Goals has widely used in number of SIMs specially when the deliver strategy of web services had determined as top-down or meet-in-middle strategy (Sehmi and Schwegler, 2006; Chaari *et al.*, 2007; Arsanjani *et al.*, 2008; Kim *et al.*, 2008; Andersson *et al.*, 2009).

Reviewing literatures that present service identification methods revealed differences between approaches in selecting their inputs. However, majority of them has not illustrated details about how the specific type of input has selected.

Table 2 reflects the 48 papers in service identification area that classify the methods in categories based on selected input of theirs. The results of the classification were emphasized on two major points. Firstly, popularity of business process models to be use as input as well as tendency to using them in existing SIMs. Consequently,

about 40% of approaches have used business process models as inputs in their researches. Secondly, tendency of methods to use more than one resource as input of their methods in recent researches whereby increase the comprehensiveness and support the multi dimensions view of enterprise or any firm instead of narrowly view of them such as only technical or business view. In addition, this comprehensive review of previous studies revealed that there is a clear lacks in discussing about appropriate SMEs inputs in SIMs.

SME BASED CRITERIA

According to SMEs situation that can be described by their challenges and abilities (existence or potential) and besides, the available inputs for SIMs that discussed above, we can propose set of criteria to guarantee the compatibility of inputs in SMEs. These set of criteria aim to increase the quality of SIM that was rarely mentioned (Qian and Nianjun, 2009). The rationale of proposing criteria that have illustrated below is built on based on studies published by Nielen and Jeske (2006), Arsanjani *et al.* (2008) and Kohlborn *et al.* (2009).

Machine readability: This criterion refers to the compatibility of input type to store and processed with computer based systems. Shortage in this criteria increase the cost and time required to transform the input to a set of services that are executable and specifically related to XML standards family such as BPEL.

Interaction details: Means the level of details about interactions between processes, end users and stakeholders. This property by exposing events, preconditions and post conditions of enterprise activities, provides the background for determining service specification (ownership, dependencies, relations) and granularity level of candidate services.

High level abstraction: It means that analysing the enterprise from top management point of view based on documents such as business goals, enterprise architecture documents, road map documents and etc. This requires a notation that hides all implementation and technical detail from the viewer.

Low level abstraction: Supporting detail relationships between data, end users, systems and stakeholders are so important especially when implementation details within a graphical model is discussed. This feature is sensitive because it acts as connection between high level abstraction and executable version of the system.

Goals coverage: Major aims of SOA is to achieve business goals and agility (Kim *et al.*, 2008). Ideal is that every input should be considered and covers one or more goal/sub goal. Recently, researches pay attention to considering goals in service identification (Arsanjani *et al.*, 2008; Kim *et al.*, 2008; Andersson *et al.*, 2009). This idea has highlighted when business services became a trend instead previous that the focus was on producing software services (Arsanjani *et al.*, 2008; Zhang *et al.*, 2008; Kohlborn *et al.*, 2009). Arsanjani *et al.* (2008) has developed a method that has combined decomposition idea to decomposing the goals to sub goals until reach functions that fulfill them. Consequently, selected input should give possibility to considering and addressing the enterprise goals.

Possibility to decomposition: In order to explore all parts of an enterprise precisely and discover the related processes and tasks to a specific goal, decomposition considered as a suitable technique. This criterion has been used to decomposing goals, business processes, domain and functions (Arsanjani *et al.*, 2008). Output of decomposition depicts the dependencies between detailed elements and so it could be useful in degree of granularity' decisions (Ma *et al.*, 2009). Decomposition is possible to apply to inputs that are traceable and also be a very useful to trace any task in a service to reach a business goal/goals.

Clarity: Easiness of understanding an input type could raise the level of applicability of it in SMEs. Using clear type of inputs specifically in graphical form is effective for staff without enough knowledge in methodological background. This factor motivates SMEs to participate in inputs preparing.

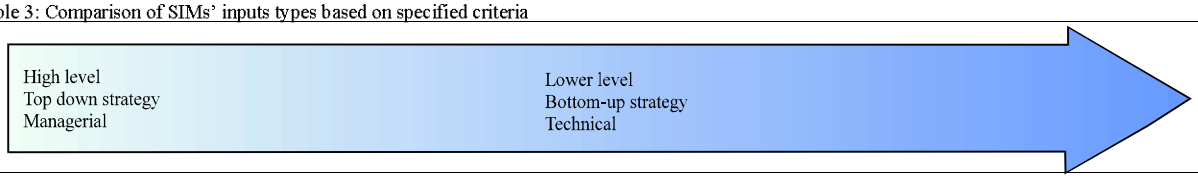
Choreography: This factor is enumerated as one of quality criteria of the SOA. Inputs that contain and prepare clear details about swapping of data between their elements and built consistent set of elements to reach particular goal/goals will prepare the background for effective choreography in output services.

Easy to achieve by SMEs: Some of the input types are compatible and easier to prepare and use by SMEs. This criterion considers potential abilities and challenges in SMEs to achieve and apply a specific input. For example simple structure of SMEs could act as catalyst to providing BPMN documents by short number of interview sessions with SME staff and with a limited number of BPMN elements.

COMPARISON OF SIMs' INPUTS

The comparison of SIMs' inputs types based on criteria that illustrated in previous section was presented in Table 3. We used a three degree of scale.

Table 3: Comparison of SIMs' inputs types based on specified criteria



Criteria / Input	Enterprise goals	Domain knowledge	Business process: BPMN	Business process: C3	Use case	Activity diagram	Source code	Data base
Machine readability	○	○	■	○	◆	◆	■	■
Interaction details	○	◆	■	◆	◆	■	■	■
Goals coverage	■	■	◆	◆	◆	○	○	○
Possibility to decomposition	■	■	■	◆	◆	◆	◆	○
Clarity	■	◆	◆	◆	◆	◆	○	○
Choreography	■	○	■	◆	◆	◆	◆	◆
Easy to achieve by SMEs	■	○	○	◆	◆	◆	■	■

■: The input type completely fulfils the criteria , ◆: Inputs that only fulfil some part of the criteria, ○: Signifies that the related input cannot fulfill the criteria

The results of the comparison have been assigned according to two factors, firstly analysis of each input type that mentioned above and get the results out of 50 literatures related to SIMs that referred in input types description section, secondly, reflecting the case study that have been done in an SME in order to implementing service identification.

In the following we illustrate each criterion status for each input type according to the two factors mentioned above.

In the following we discuss the merits of each criterion for each input type as follows:

Machine readability: The comparison indicates that only BPMN and legacy code could be used directly to be processed by computer systems. BPMN could be easily transformed to BPEL and this ability has been used by Kabilan. (2005). In addition, source code systems that are by nature could be executed in computer systems. While, UML and activity diagrams requires additional activities to be transformed to BPEL and gain executability, as example the method that proposed by Mantell (2003), Zhang and Duan (2008) and Vemulapalli and Subramanian (2009).

Interaction details: Degree of available details and prescriptions has related to the capabilities of an input type. BPMN as a comprehensive notation has ability to cover all details about systems. Besides, source code and activity diagrams include the interaction details between system entities. On the other hand, goals by their nature does not present adequate details, also C3 and UML because of lack in their graphical elements in comparison with BPMN have not completely fulfill this criteria (Nielen and Jeske, 2006).

Goals coverage: Input types that have bound explicitly or implicitly to goals or sub goals will satisfy this criterion. In some scholars goals have considered as main input, for example (Arsanjani *et al*., 2008; Kim *et al*., 2008) and in others goals have used in implicitly way, for example when using business processes or domain knowledge documents that have aligned to goals. Relying on goals and then decomposing them until reaching enterprise functions that addressed each goal or sub goal is addressed by Arsanjani *et al*. (2008). Besides, goals have clarity because of their simple format and thus SMEs' employee could achieve and apply them easily. Moreover, collecting goals of an SME is not a challenging task within interview sessions. However, Use cases, activity diagrams, source code and Databases due to low level of their abstraction do not necessarily have bound to a goal/sub goal.

Possibility to decomposition: Decomposability strongly has tied to input types that initiate from high level of abstraction and could decompose hierarchically until reaching functions. Previous scholars has used different methods that act to decompose domain, component, capability, business process and use cases (OASIS, 2005; Arsanjani, 2004; Erl, 2005; Sehmi and Schwegler, 2006; Yahya *et al*., 2011). Consequently, goals and business processes that has roots in high level business point proves their ability in previous researches (Arsanjani *et al*., 2008). Nonetheless, activity diagrams, source code and data bases could not address this criterion because of their language that has focuses on operational data.

Clarity: Enterprise Goals those are understandable for managers and employee and besides, often presented in simple and clear form completely fulfil this criteria. Furthermore, BPMN, C3, Use case and activity diagrams that reveal the systems entities and their relations are

more complex due to its necessity to level of familiarity with those models. Source code and database indicates and focuses on operational environment and data that increase the complexity and thus decrease the clarity.

Choreography: Enterprise goals/sub goals form a consistence set of entities that each sub goal could add value and address prerequisites of another goal/subgoal. Consequently, the set of goals could be seen as choreography tree of goals and thus effects positively to choreography of output services. In addition, BPMN as standard model provide an appropriate situation to considering activities of all system entities and thus could be referred easily as reference to redesign and improve the choreography of services. However, domain knowledge that is constituted of variety of data and information without systematic relations cannot offer a good base for choreography. Moreover, other types of inputs due to their nature and functionalities do not necessarily prepare to increase choreography of services.

Easy to achieve by SMEs: This criterion is fulfilled completely when we select source code or databases as input because those type of input are available in SMEs environment insides their legacy systems. In addition, goals could be collected easily by interview sessions while, C3 according to its simplicity has potentials to be used by SMEs (Nielen and Jeske, 2006). Furthermore, Use cases and activity diagrams that could be found as attachment to existing systems is another input type that has potential or require little efforts to be reach easily by SMEs. On the other hand, achieving domain knowledge and BPMN documents needs to time, cost and efforts of experts in extracting and building those inputs.

The comparison' results emphasis on considering enterprise goals as input of SIM in SMEs as well as existing systems assets (source code and databases). In addition, BPMN is revealed as input type that should be considered. It could be clear to recommend that a combination of inputs should be considered to fulfil all mentioned criteria.

MAPPING BETWEEN ENTERPRISES GOALS AND EXTRACTED DATA FROM SELECTED INPUTS

In order to validate the input type selection artifacts with enterprise goals as most important assets, a mapping between enterprise' goals and extracted data from selected inputs is proposed.

This mapping shows the relation degree of inputs with enterprise goals as high number of mapping and relations between extracted data and goals will indicates usefulness of output services upon those data. In addition, it will warranty the tendency of identified services as business oriented services instead of technical oriented ones and so that it eliminates the problem of majority of SIMs that have focused on technical services while lastly researches revealed this gap between business and output services as defect and try to highlight business services (Kohlborn *et al*., 2009).

This mapping phase is worthwhile so that it acts as prevention of undesired services. Figure 1 represent

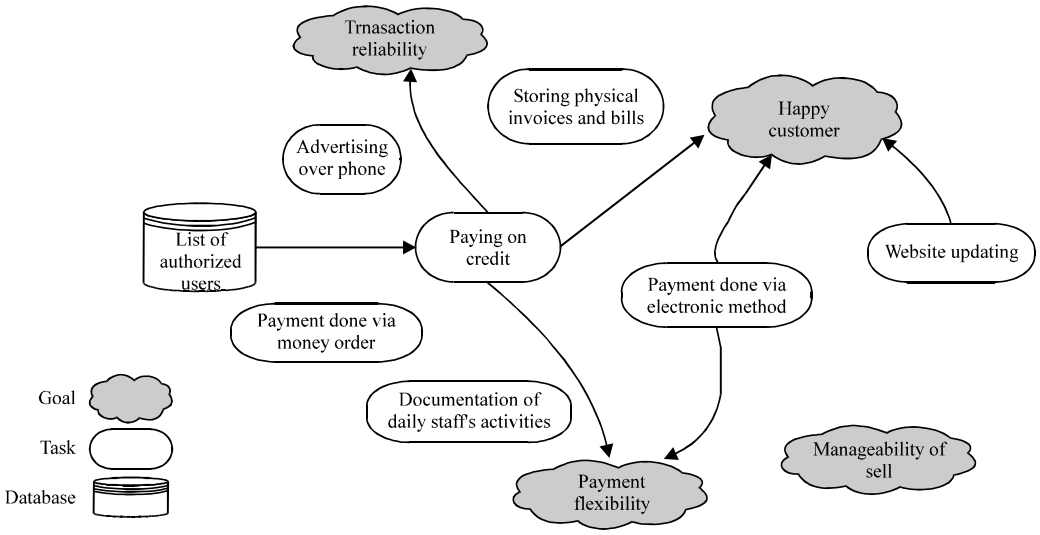


Fig. 1: Goals and tasks mapping

an example of using goal and extracted data mapping to reveal the amount of affinity between goals and extracted data to involve in SIM process. Example represents some goals that addressed by more than one task such "making happy customer" while others such "manageability of sell" that has not supported with any task.

The committee should follow some general advices in order to select an appropriate input. A list of applicable points that can be considered and built on literature discussed before is presented:

- **Point 1:** Determine the priority of input types according to enterprise capabilities and goal mapping process that has presented
- **Point 2:** In order to take the benefits of low level abstraction, inputs and preserving of legacy systems' value, consider at least one technical input within set of selected inputs
- **Point 3:** Plan an education program that include principle concepts such as process, task, service and so on for who participate in the committee to make them an active part of the enterprise service enablement
- **Point 4:** Determining appropriate scope that seriously considers the costs, risk, time and possibility of extracting the selected inputs is important. It avoids of collecting the input data for SIM that is a costly task especially when it is outsourced to an external consultant, group and so on
- **Point 5:** Focusing on identifying informal type of data about enterprise processes that could be in no standard forms or even non written knowledge as individual experience or intangible routine is essential in SMEs, because of the lack in their documentation

CONCLUSION

SOA is not only a technology trend but is first and foremost considered as architecture. Thus modeling is a critical part of SOA and influences all stages in the SOA life cycle. Consequently, service identification plays an important role in that it determines the services that serve as building blocks for all other SOA layers. Business competence encourages applying SOA in order to achieve its benefits such as agility and flexibility. Besides, SMEs specific solutions that consider their situation and environment did not reach the desired point. In this research as initial requirement the appropriate inputs that could be involved in service identification are discussed. Then a set of criteria based on SMEs is described and a comparison based on those criteria is performed. As result, based on comparison's output and mapping the goals and collected inputs effective and appropriate inputs have been achieved. As future work suitable scope determination process and a specific method for SME in order to identifying the services and also focusing on relation of each input type with quality factors of services is necessary. Furthermore, quantifying the measures and value of inputs and outputs of the SIM is also helpful in increasing the clarity and applicability of the method.

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