A Practical Methodology to Plan Automation of E-Services in Public Agencies

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Abstract

Implementation of transactional services in e-government is a very critical function for the development and success of a comprehensive e-government. Empirical efforts to conceptualize the organization, definition and delimitation to implement transactional services are often limited, to making public services available by means of online facilities on the internet, without taking into account government organization. This paper provides a practical methodology to guide professionals to realign customized procedures (according to the organization's strategy)in order to automatize the delivery of services among public agencies. Such methodology is based on Systems approach, aiming to create a modular system. The methodology consists of four sequential phases, with positive results obtained through its application in a decentralized agency of the Ministry of Health in Mexico, to improve the management of their Human Resources. Results on improvements were manifested in time efficiency, and transparency of procedures.

Keywords: Transactional e-government services, practical methodology, Systems approach, planning customized realignment

1. Introduction: Transactional E-Government Services in Public Administration

The importance of transactional services in e-government comes from its impacts on improving the management of public services, and forms online by means of working database supporting online transactions; that is, focus on connecting an internal government system to online interfaces, and allowing citizens to transact with government electronically (Cordoba-Pachon & Ochoa-Arias, 2010; UN E-Government Survey, 2010).

For example, citizen facilities include payment of taxes, renewal of licenses or acquisition of permits and certificates. Results are seen as an enhancement of efficiency that is visible in shorter administrative procedure execution times, reduction of costs, and improving of transparency of government methods and processes (UN E-Government Survey, 2010).

Logically, the transition to implement a paper format to an e-government service is not a trivial task, and should not be only limited to making public services available by means of online facilities on the internet, but ought to represent a change in the way government reaches its objectives (Chlivickas & Melnikas, 2010). Under this view, it is crucial to focus on environment, structure, functions and processes that entail a complete redefinition of transactional services to be automatized (OCDE, 2009).

The condition represents a massive realignment of state activities and expenditures (Cegarra, 2006). However, the organization and management to design and implement transactional services for e-government usually constitutes an "artisanal process", mostly based on the expertise of politicians and decision makers in public administrations (Gutierrez, 2007). It is not surprising, that this condition, in Latin America, frequently leads to issues in representing procedure models that do not correspond to reality (UN E-Government Survey, 2010; IACD, 2003), and is prevalently disadvantaged by the automation of partial procedures (Kavanagh et al., 2012; Bondarouk & Ruël, 2009).

What is even more concerning, are the definitions of the scale and the scope of the automation, resulting in filling out a web task at the e-government portal, and being printed on paper by a clerk and processed manually, exactly in the same way as applications submitted originally on paper (Cegarra, 2006). Negative consequences are noticed by citizens, business and other government entities; as partial automation, slow and non-transparent procedures, and the lack of trust on e-government services (Kö et al., 2012; UN E-Government Survey, 2010).

Unfortunately, this situation is not improving a lot, when Information Technology (IT) professionals usually dedicate and at the same time circumscribe their activities merely to dealing with open data, designing proper mobile applications, as well as intelligent and learning systems (Kö et al., 2012; OCDE, 2009).

Additionally, literature of e-government tends to focus on the „value‟ of how technologies can leverage for clients, and of the importance of aligning plans to those that aim to implement systems and technologies, all in the name of improving services (Cordoba-Pachon & Ochoa-Arias, 2010; UN E-Government Survey, 2010), yet it is not explained how to do it. It is also found typologies of administrative services (Irani et al., 2006), as well as very specific topics such as software applications, hardware, and IT architectures files that do not take into account strategies, activities programs of the public organization as a whole (Bondarouk & Ruël, 2009; OCDE, 2009).

This partly explains why now in the realm of public administration, it is vaguely understood new forms of organization and management, when automating transactional services within e-government (UN E-Government Survey, 2010). Although governments devote greater resources on improving online services, no practical outline currently exists for managers who require implementing transactional services, considering the realignment of procedures (Ehnert et al., 2014; Kavanagh et al., 2012).

Therefore, this paper contributes to the e-government literature by developing a practical methodology to orient the transformation of manual-transactional procedures into e-services for public administration that includes realignment of processes, public expenditures, and considerations of technological and organizational requirements as a whole, by means of using principles and methodological basis of Systems Approach.

2. Research Methodology

For this study, transactional e-services are defined as a stage of e-government, where it is possible to gather massive up-to-date information, deliver government catalogues of information, and focus on connecting an internal government system, to online interfaces and allowing clients to transact with government electronically.

Also, it is considered the perspective of Government to Government, in the sense that government agencies interact with other public agencies. Therefore, paper´s research methodology is comprised by;

1. Analyze theoretical background related to transactional e-services in order to identify main approaches in the context they were proposed and being used, by means of elicit academic research from literature related to e-government. Results aim to identify requirements and constraints that should be taken into consideration when achieving the automation of transactional e-services.
2. Determine methodological basis to support process specification, enactment, monitoring, coordination and administration of workflow processes through the execution of software, whose order of execution is based on workflow logic.
3. Develop a heuristically methodology for the transformation of manual-transactional procedures into e-services for public administration. Activities are used as basic building blocks.

3. Theoretical Background

Transactional services can be seen as the conjunction of diverse processes and their procedures to be executed in an organized way, and their dependencies that control requirements and outcomes. There are complete internal processes within an agency while some others; involve tasks from other agencies. Also dependencies across processes can be classified as control-flow dependencies, value dependencies and external dependencies (Rusinkiewicz & Sheth, 1994).

Thus, transactional services involve permits from different agencies, procedures, and the sequence in which they are executed (processes) by an agency and/ or inter-agency flows. To aim researchers and practitioners in automating the delivery of transactional e-services, there are approaches and frameworks. Table 1 shows a sample of main approaches posed in the e-government literature.

According to the research framework from Van der Aalst and Van Hee (2002), organizations can be described as workflows of businesses and Information Technology (IT). Therefore, the management of workflows performed on tactical levels requires from formal techniques, and standard set of fundamental and well defined concepts. Van der Aalst's comprehensive framework showed the effects on how IT could be used to increase productivity in administrative procedures using workflow systems.

However, benefits focused on partial processes to develop, operate and evolve Information Systems(IS) artifacts (Avgerou, 2008; Pan et al., 2006). From this point, diverse architectures emerged, i.e. multiagent systems; the Business Process Management solutions, in order to deal with not predefined processes (Ko et al., 2009), and the adoption of new architectures such as cloud computing in public sector from the Composable Modeling and Execution of Administrative Procedures, to uniformly cover whole organizations with e-government solutions (Strykowski & Wojciechowski, 2012).

The adoption of new architectures facilitates the provision of compound services covering customer processes, where a customer may be a citizen, an enterprise or another public organization. These ones are focused in specific types of IS, and omit the organizational environment. Consequently, outcomes in terms of improving development and efficiency may be limited by environment and socio- political subsystems constraints (Heikkilä et al., 2014).

Also, transactional e-services have been reanalyzed through the consideration of performance metrics; in order to deal with low organizational productivity rates despite large investments on IS (Hawryszkiewycz, 2012). Yet, replication of such efforts may not be in accordance to third world countries, especially when considering concepts of governance, Human Resources (HR), education to improve outcomes through ICT interventions and investments (Qureshi, 2011).

Analyzed frameworks define the importance of identifying procedures embedded in service processes that represent real contents (Hawryszkiewycz, 2012; Conzorzio CBI, 2011; Mâruşter & van Beest, 2009). Processes can be functionally simplified, by being translated into cause and effect procedures, which can be easily streamlined and inscribed into an electronic (online) system (Conzorzio CBI, 2011; Mâruşter & van Beest, 2009). Authors also identify major requirements and constraints that should be considerate as activities for the development of a methodology (Table 2).

4. Methodological basis of Systems Approach

Identified requirements and constraints showed relevant outcomes, yet, they were partial. Also, they represented a real challenge, in the sense of the difficulties to determine the exact steps needed, and the order they must be performed to achieve the automation of a manual transaction procedure into an e-service.

Therefore, to supplement the findings of the above theoretical background, information was gathered from federal, state, local organizations, private and non-profit organizations of Mexico. The information included both generic and e-Government implementation management information, ranging from guides to specific best practices.

The research began by identifying the e-Government strategic plans on the information technology/ e-Government office websites. It was also analyzed websites from the USA and Canada, as examples of developed countries.

Methodological basis of System Approach was employed to define an object of study as a system, and implied the classic view to identify its purpose, vital functions, active elements, and critical processes, and defined the nature of the interaction among them (Flood & Jackson, 2002).

Therefore, Systems Approach provided the tools to determine how different subsystems are organized within a particular system, and attempted to estimate how this can result or is resulting in a larger system, that is qualitatively different from the sum of its parts (Gelman & Garcia, 1989). In this sense, components were to be studied as a whole, rather than looking at them in isolation (Rigaud-Téllez, 2013; Gelman & Garcia, 1989; Rapoport, 1968).

Systems Approach aimed to organize and structure concepts carefully reviewed from strategic plans and best practices in e-government.

It was noted that the proposed methodology ought to take into account functional components of mapping workflows, redesigning, and transforming new defined workflows into e-services (Fig. 1).

Mapping customized workflows share awareness among the pluralism of a public agency. The phase makes evident complex implications related with the development and implementation of transactional services. Moreover, it helps to identify problems related to providing up-to-date information on new ways of operating. Also, the identification of problems can also trigger reflection on how services content could facilitate or inhibit learning about e-government.

Generating a map of dynamic and customized workflows require to be based of parameters, needs and constraints. Thus, it allows realigning different activities. For instance, review and reflect cognitive patterns to develop transactional services and exploit them as a source of knowledge, in other words, to incorporate new *know-how* to allow e-government be part of facilitating an Information System (IS).

Second phase, realignment of procedures, involves appropriate sequences by authorized individuals, adhering topublic agencies policies and regulations. Consequently, to generate realignment, workflows should be built to distribute tasks to appropriate systems, assuring that tasks dependencies can continue, only if preconditions are satisfied. Naturally, Information Systems (IS) should be designed to receive requests in a central system and forwards results to users, including generations of reports.

Thus, IS evaluate conditions to execute tasks, fulfilled them, evaluate control information and forward results to a subsequent agent. As a result, HR interprets workflow specifications and results, dedicate to contingent matters, and can assume some functions of central control to improve service to clients. Note that the issue of released Human Resources (HR) from routine procedures is treated at this stage.

Third phase, implementing transactional e-services refers to integrating new practices and outcomes for public administration that helps to appropriate new designs of activities and their expenditures (Marler, & Fisher, 2013; Rupidara & McGraw, 2011). During implementation, reports progression of e-services support decisions about current status of workflows.

5. *A heuristic Methodology to Guide the Design and Implementation of Transactional Services*

A practical methodology was built upon a set of core values and concepts, considering normativity, objectives of a public agency and its outcomes. Following subsections describe details of the proposed methodology which were taken from multiple sources as part of the research and document analysis presented in previous sections (Fig. 2).

5.1 Mapping a Current Document

The phase aims to achieve three main objectives. Objective 1 refers to organize and plan the alignment between strategy and organizational objectives, considering diverse constraints; performance criteria (i.e. service time, waiting time, resource utilization, number of errors, etc.) (Heeks& Bain, 2007), including identification of stakeholders (Marler, & Fisher, 2013; Kavanagh et al., 2012).

Objective 2 is related to identify current procedures, based on composition of tasks (input, output, responsibility, and dependency).In objective 3, it is considerate users' preferences in visualizing information. Thus, objective refers to identify consequences of administrative acts, according to rules and forms, especially those concerning to decisions of public administration.

Graphical representations of information workflows and tasks are built in a hierarchical arrangement. Then, graphical representations relate to record communicated information, and recording justifications of decisions. Thus, mapping a procedure should show impressed thoughts and decisions of a public administration on documents, as interrelated workflows (Li-RenYang, 2009; Mâruşter & van Beest, 2009).

Key actors support expression of information, according by current legislation that regulate the production of administrative activities (Rupidara & McGraw, 2011), and its interpretation according to performance criteria. Concluding the above, the composition of interrelated activities, in the form of procedures, aims to further decide if mapped procedures correspond to repeated activities, or non-routine ones.

5.2 Realignment of Procedures

This phase has the objective to analyze performance of mapped procedures, focusing on throughput times and determining bottlenecks in order to realign procedures and their expenditures.

It is suggested for routine transactional procedures, checking their interrelations with other routine ones, based on an analysis of value-adding activities (i.e. visible importance to clients), and established performance criteria (Mâruşter & van Beest, 2009). Synthesis involves combining multiple procedures into a single composite process, enhancing the manageability of a process by removing redundant activities.

Therefore, for the automation of transactional services, it is included structure forms with precise contents which can be processed electronically. Note that automation entails new forms of organization, due to it allows clerks to be released of routine activities to focus in non-routine activities, and those that mixes decision making with unstructured paper documents (Navarrete, 2010).

Track testing can be done by simulation schemes, which leads to the discovery of how to change existing procedures, and moreover to improve and become them in transactional e-services ready to be implemented in the organization. Then, appropriate technologies such as XML or UML schemas can be implemented (as a software package executed by a computer system).

5.3 Design of Implementation of Transactional E-Services

An additional phase is proposed. This phase looks to improve mechanisms used for accountability on the resources, based on prioritization of actions and adaptation of Information Technology (IT) (Navarrete, 2010). At this stage, analyzing technologies infrastructure allow elaborating an infrastructure inventory to design a logic structure for a system, whereas it is identified functional dependencies to support IT.

IT for workflows is designed to receive requests at a central server, and fulfill functions of interpretation, according to workflows specifications. Also, IT coordinates tasks to be sent to an appropriate system, and keep control of flows, to forward remaining workflows to subsequent systems. Thus, workflows are partitions of procedures that contain information of a task, relations of a task, and dependencies among tasks, requirements to execute a task and its execution. Tasks are to be managed by IT agents (software agents), which components evaluate preconditions and execute its task, partitions the remaining workflow, constructs sub-workflows, evaluates control information, and forwards each sub-workflows to its subsequent agent.

Therefore, algorithms have to preserve the attribute to partition workflows and at the same time respect contents of workflows (semantics) by evaluating preconditions and execution of its task. Also, at this stage designed modules are supporting security, data and information interoperability, and rules and regulations databases.
Outcomes from this phase are a designed strategy to manage e-services, including models, database scripts, portfolio services and results of pilot tests. At this point, to guarantee appropriation of technology by line managers; documents, manuals for system administration, technical, users and good practices are to be formalized.

5.4 Implementation of Transactional E-Services

This phase looks to develop and implement an architecture system, based on defined design and development of tools to system's operation (Fig. 3).

IT tools can be an intranet space, called portal or universal window (Navarrete, 2010), where clerks execute transactional services; starting to select an appropriate type of service within a range of services organized as a hierarchy, and allowing clerks to initiate procedures for internal/ external clients, perform human activities, access to status of an administrative procedure, elaborate reports and get information of notifications.

A visual query submitted by a client is distributed to relevant databases through a server. From this point, server selects the target database sites by consulting a system database which houses abstract data about individual image databases. The query is then posed to the selected databases in an acceptable form. The searching mechanism of the local database searches its repository for possible answers to the posed query. The answer is then fed back to the client.

In other words, workflows are executed through agent software. The agent software interprets a workflow specification and interacts with other task agents, either human clerks or a software programs, for task execution.

Once the scheduled task at an agency is finished, the agent software generates sub-workflows for the subsequent agencies and forwards to other workflows.

In the following section it is described an experience to look to summarize main aspects of technical and organizational challenges, when implementing transactional e-government services. The presenting case does not seek to prove a relationship between the practical methodology and its outcomes (Yin, 2009), but to explore, the issues that arise from designing and implementing transactional services, and to reflect on how these issues further help to study the interrelation between Systems approach, and e-government.

6. Considering a Case in Focus

The project was carried out in a decentralized organ of the Ministry of Health in Mexico in the Department of Human Resources Management (HRM). The unit is organized in four functional directions: a. Human Development and Personnel Services, b. Integral Training to Public Employees, c. Planning, Evaluation and Coordination of Career Service, d. Human Capital Management.

The department deals with activities and tasks related to employee shortages, absence rates, work-related health problems or loss of meaningfulness and sense at the workplace, high rates of fluctuation in the „stock" of employees, and employees with inadequate skills and commitment. Besides, the function has to deal with external drivers, such as regulations from the World Health Organization, and quality control standards (Secretaria de Salud, 2003).

To start an organizational intervention, it was organized a team that represented the pluralism of the unit. After several meetings and workshops it was agreed techniques to fulfill mapping of procedures and formats to analyze and store data.

Criteria were determined according to the Mexican regulations that included categories and possible methods of measurement to apply such criteria (Arellano-Gault, 2011; Transparencia Mexicana, 2005):

- Leadership and governance (transparency, participation, values, …)
- Workforce Management (environment, engages, competencies, …)
- Process Management (time and costs, service convenience to citizens and to public administration, improvement on information access, accountability to deliver services to government employees, …)
- Management (simplicity in the administration of volumes of information, information services, secures communication, ...)
- ICT Focus (infrastructure, affordability, development of ICT Skills, …)

Initially, the revision of federal documents showed 13 main formalized procedures for the HRM's unit. However, outcomes of mapping provided information of 70 real procedures. A classification was done according to dependencies across processes.

From this point, 58 procedures represented an opportunity due to they involved routine activities, such as ongoing reporting, insurance payment, motherhood permissions, tax payments, HR tax withholding, and so on. Moreover, in some directions efforts were being duplicated.

Participants got a systemic insight of their organization. However, there was the issue of finding resistance in adding more activities to one direction, as well as the sense of losing power.

Graphical alternatives were proposed to participants with the purpose to start changing cognitive patterns and altogether realign procedures as schemes. Thus, new realigned schemes were achieve by explicating tangible benefits to HRM directions. This approach was good, yet it was time consuming. Finally, 21 transactional services were integrated at the level of delivery that became a basis of an ICT architecture design, including a government portal.

So, it was proceed to design the implementation of e-services in "real time". That included selection of appropriate software systems, and the lock-in practices in the organization. Also, issues turned up during the change of activities of the organization, and the determination of decision making responsibilities. Therefore, it was necessary that involved stakeholders and decision makers supported and prepared the conditions to face resistance of change, training and capacitation, in order to prepare for an implementation process (Olivas-Lujan et al., 2007; Parry & Tyson, 2011).

Besides, transactional services schemes were evaluated under IT systems and policy levels (platforms, language, infrastructure protocols, security, and privacy) (Tan, & Pan, 2003).

Transactional services provided direct interchange of documents and information between participating service providers, using workflow logic to accomplish the "single session" property of the service provision scheme from the end users" perspective (Heikkilä et al., 2014; Rao, 2009; Pan et al.; 2006).

Finally, HR administrators and employees were able to conduct complete online transactions according to the realignment of procedures. It also integrated the access of informative catalogues and documents. This effort brought together basis for other organizational units from the decentralized organization to start designing their own criteria to map their procedures, and further to implement transactional services.

7. Discussion

This paper has provided a heuristic methodology to automate the deliverance of transactional e-services in public agencies. The methodology takes into account the complexity of administrative procedures, involving the entire scope of administrative actions, and taking into account functional components of mapping workflows, redesigning, and transforming new defined workflows into e-services.

Systems Approach provided a holistic perspective, which methodological basis allowed capturing, and structuring major elements of existing efforts from managerial requirements, described on different scholarly works, infrastructure protocols and standards related to the e-government literature, which were fundamental to develop the practical methodology.

Therefore, benefits for academics are the improving the organization, integration of disperse knowledge of research findings. For practitioners are the gains of common knowledge to plan, design, develop, and implement transactional services for e-government to assure organizations, the expected benefits by their use.

In terms of management, redefinition of governmental processes means elimination of inconsistencies, when representing real procedures. Furthermore, bottlenecks are distinguished, allowing the modification of administrative procedures less prone to errors, and resulting in transparency of decision making. It also means IT enhances effectiveness, quality and efficiency of service provision. Thus outcomes are visible in shorter administrative procedure execution times, and improving of transparency of government methods and processes.
It is important to consider that in government arenas, administrative activities tend to be informational in nature. Thus, design and implementation of e-services enable understanding relations among processes and knowledge to improve the design of IT services provisions, and the allowance to implement a portal that involved entire scope of administrative activities.

From a practical perspective, the methodology was employed in a Mexican government entity, as a case in focus. Results showed definition of performance criteria, shared vision of the role of transactional services between participants, effectiveness and simplicity of innovative procedures, architectural design and government portal. An important change is the common understanding of know-how and the support of a democratic culture. As noted in the case study, when transactional services are appropriately implemented then, they suit to local conditions and cultural sensitivities successfully.

8. Conclusions

Overall, these results lead to efficiency in time and conduct complete online transactions. Due to the robustness and generality of Systems Approach, this methodology can be employed, replicated and adapted to other government organizations. By following this methodology decision makers could respond adequately to concrete actions, especially for establishment of communication and coordination mechanisms. It is suggested for further researches, to assess success factors, the conditions that should precede the horizontal integration of e-government services.

Also, how to assess the influence of electronic services provision to the exploitation of knowledge, especially in areas of e-HRM and sustainability.

Acknowledgements

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Approaches to automatize procedures	Reference
Administrative procedures using workflow systems	Van der Aalst, W.& van Hee, K., 2002
Business process management solutions	Ko, R.K.L., Lee, S.S.G., Lee, E.W., 2009 http://www.omg.org/spec/BPMN/2.0/
Composable Modeling and Execution of Administrative Procedures (CMEAP)	Strykowski & Wojciechowski, 2012
Framework for Collaboration in Systems of Systems	Hawryszkiewycz, 2012

Table 1: A Sample of Approaches related to Transactional e-Services

Requirements	Constraints
Focus on a specific user group (Van der Aalst and Van Hee, 2000; Gibbon et. al., 2002), their own values and their „ideals" need to be part of e-government initiatives.	Lessen technological obstacles as „locked in" systems (Marler, & Fisher, 2013; Li-RenYang, 2009).
Determine series of architectures at a technological level to define ways clients of the organization will operate with administrative units (Content, 2009).	Organize gateways and interlocking mechanisms (Kotteman& Boyer-Wright, 2010)
Ensure "legality" of redesigned procedures to be automatized (Kotteman& Boyer-Wright, 2010)	Respect legal standards and political- statutory changes to ease translation of procedures (Kotteman& Boyer-Wright, 2010).
Determine the role of Human Resources who are released from routine operations to focus on making decisions based on information prepared and provided by information systems (Ehnert et al., 2014; Kavanagh et al., 2012)	Consider people who represent pluralism in an organization (Contini, 2009), including Labor Unions from public agencies.
Organize workshops and training sessions to deal with new ways of implementing procedures and management more efficiently (Lips& Organ, 2009).	

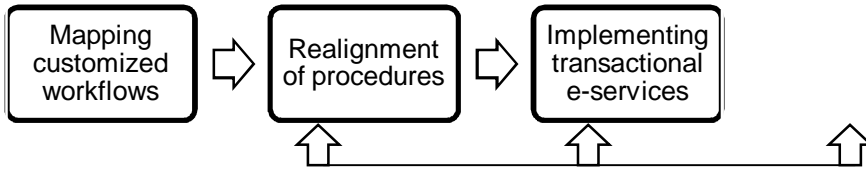**Table 2: Managerial Requirements and Constraints**

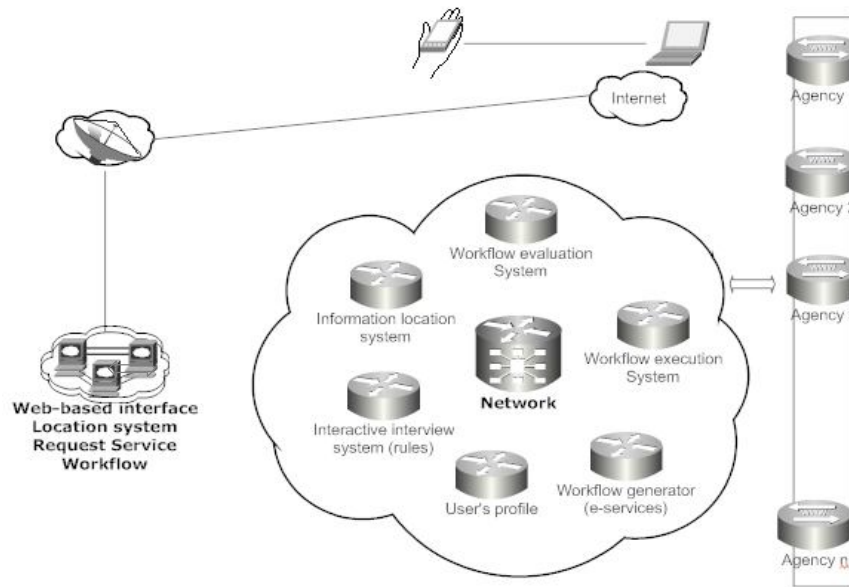**Fig. 1: Planning a Structure to Design and Implement Services for E-Government**

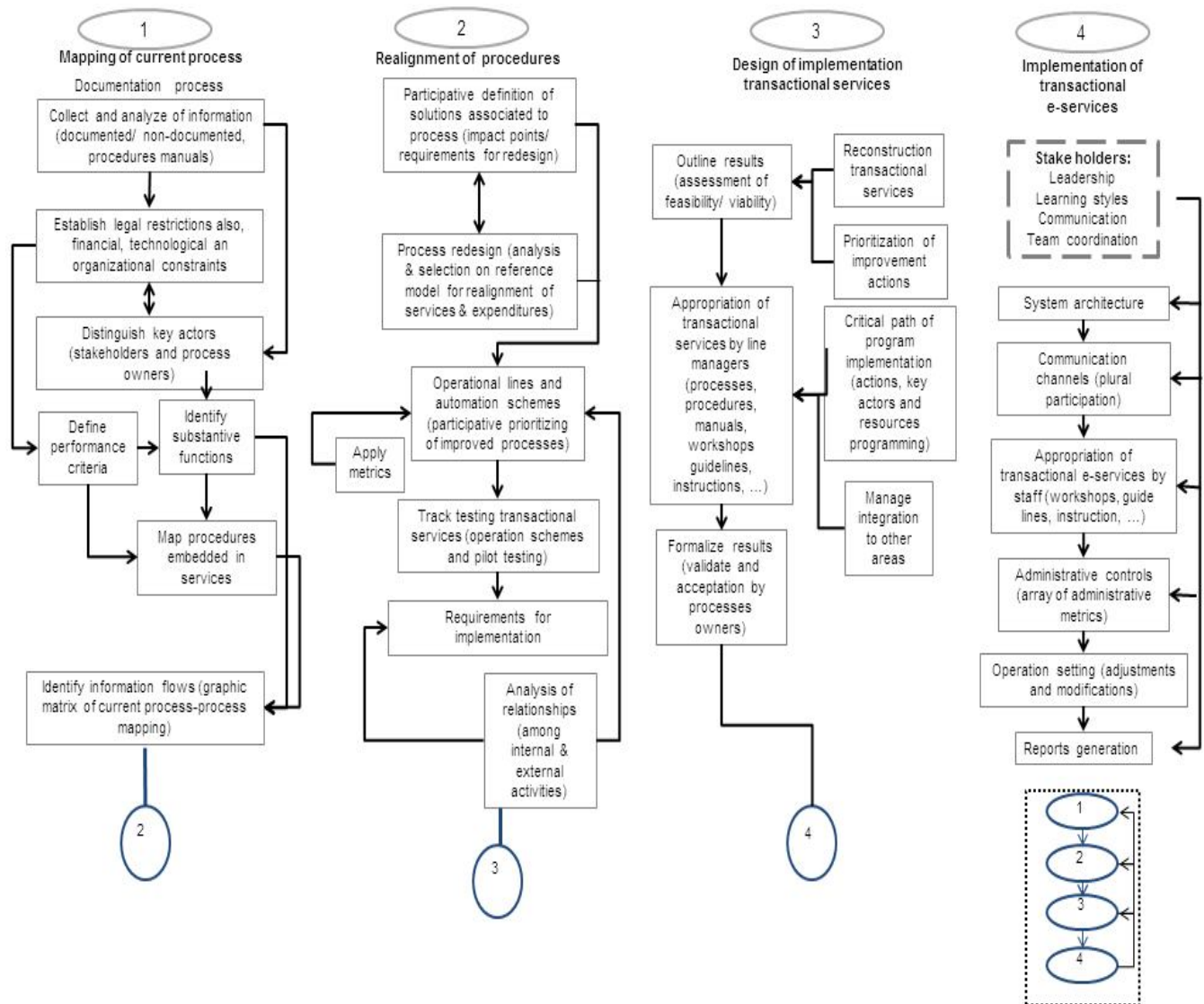**Fig. 3: Architecture of Content Delivery System**

Fig. 2: Methodology to Automate the Deliverance of Transactional E-Services in Public Agencies