Cloud Computing Governance Reference Model for Cloud Service Consumers

Soňa Karkošková, University of Economics, Prague, Czech Republic, xkars05@vse.cz
George Feuerlicht, University of Economics, Prague, Czech Republic, Unicorn College Prague, Czech Republic, University of Technology, Australia, jiri.feuerlicht@vse.cz

Abstract
Cloud computing is changing the way organizations utilize IT resources with a corresponding impact on the role of IT governance. This paper describes proposal of adapting SOA Governance Framework and COBIT 5 framework to govern cloud computing services from cloud consumer perspective. Proposed Cloud computing governance reference model takes into account the structure of SOA Governance Framework. Cloud computing governance reference model serves as a basis for the definition and establishment of Cloud computing governance and defines a set of new or redefined guiding principles, governing processes and governed processes based SOA Governance processes and COBIT 5 governance processes which are fully adapted to cloud computing environment from a cloud service consumer perspective. Proposal of Cloud computing governance reference model is an output of research process according to the Design Science Research Methodology.

Key words: Cloud computing governance, SOA Governance, the Open Group, COBIT, Cloud computing governance reference model, guiding principle, governing process, governed process

1 Introduction

Cloud computing emerged as an evolving approach of delivering shared, scalable and configurable IT resources as a service over network across a large pool of service consumers in accordance to their demand (Wattal, Noida & Kumar, 2014). Cloud computing has become highly demanded due to advantages such as IT cost reduction, scalability or accessibility but these advantages are followed by a number of issues which require careful consideration (Bailey & Becker, 2014; Vitti, et al., 2014). From consumer perspective, some aspects covered by IT governance become more important and others dwindle in importance since cloud service provider and cloud service consumer is aiming to achieve different business objectives (The Cabinet Office, 2011). Utilization of cloud services critically affect business processes and through them influence business performance and successful achievement of business objectives and stakeholder needs (Bailey & Becker, 2014).

Over the last decade, a number of IT governance frameworks including COBIT, ITIL, ISO 38500 for Corporate governance of information technology or SOA Governance have been developed and widely used in organizations worldwide (Buchalcevova, 2016). None of these widely-accepted IT governance frameworks fully reflect the characteristics of cloud computing services and no one is primarily intended for governing services in cloud computing environment (Feuerlicht, Schneider & Tranter, 2012). Utilizing cloud computing services does not change the IT governance principles and processes but it however requires an extension of IT governance frameworks to reflect the specifics of unique characteristics of IT services provided as cloud public services by third party cloud service provider (Bailey & Becker, 2014).

This paper introduces Cloud computing governance reference model for cloud service consumer based on SOA Governance Framework and COBIT 5 governance processes. To design proposed Cloud computing governance reference model, the approach of the Design Science Research Methodology presented by Peffers, et al. (2008) was applied. Each step of the research process according to the Design Science Research Methodology includes activities whose output is an artefact Cloud computing governance reference model. Based on literature review research problem and objectives were defined. Research objectives are as follows:
RO1: Analysis of SOA governance and COBIT 5 framework in terms of governing cloud computing services from cloud service consumer perspective.

RO2: Adaptation principles and processes of SOA Governance and COBIT 5 framework taking into account the specificities resulting from the environment of cloud computing services from a cloud service consumer perspective.
RO3: Development of Cloud computing governance reference model from a cloud service consumer perspective.
RO4: Verification and evaluation of proposed Cloud computing governance reference model on a case study.

Literature review enabled to formulate research questions that help to define the current state of the real environment. The first research question asks (1) how the existing IT governance frameworks support governing of cloud computing services from a cloud service consumer perspective? This research question examines of whether and at what level the existing IT governance frameworks supports governance of cloud computing services from a cloud service consumer perspective and whether any existing support is or is not at a sufficient level. The second research question asks (2) how can be adapted SOA Governance and COBIT 5 to govern cloud computing services from a cloud service consumer perspective? This research question is aimed mainly at the level of adaptability of IT governance processes for cloud computing environment. Finding answers to these research questions helped to meet the above listed objectives and to developed Cloud computing governance reference model.

2 Literature review

Although benefits of cloud computing are well known and widely recognized (Barde, 2013), adoption of cloud computing services usually results in conflicting situations such as disruption of existing business culture or organizational structure or in conflicts between business processes supported by cloud services and business processes supported by traditional IT services (Trivedi, 2013). Some authors deal with adapting widely accepted IT Governance frameworks such as COBIT, ITIL, ISO or SOA governance for cloud computing environment (Bailey & Becker, 2014; Laird, 2011; Litoiu & Litoiu, 2010; Stanley, 2014). Application of IT governance principles for governing cloud services is essential for their adoption and for creation expected business value from the use of cloud services (Bailey & Becker, 2014). IT governance must be adapted to new conditions of cloud computing environment to ensure business continuity and performance requirements (Van Grembergen & De Haes, 2009). IT governance is in cloud computing environment influenced by the following factors:

- Separation consumer from provider – cloud service consumer has no responsibility for risks associated with provision, maintenance and management of cloud infrastructure and those responsibilities are transferred to an external cloud service provider (Schneider & Sunyaev, 2015)
- Service monitoring – for each cloud service set of objectives is defined including parameters to measure level of achievement of these objectives with respect to agreed service levels agreement (SLA) (Rehman, Hussain & Parvin, 2012). An important thing is transparent measurement and reporting of service performance achieved in real time using technology ideally integrated into existing governance systems both on provider and consumer side
- Operational transparency – transparent operation of services enables effectively analyse problems and their root causes including identification of potential impact of infrastructure unavailability on business services
- Exposure of business assets to external environment – business assets should be evaluated and categorized according to their valuableness and suitability for cloud computing environment (Maghrabi & Pfluegel, 2015)
- Compliance with legislative requirements – in cloud environment must be ensured availability of methods (eg. contractual agreement between cloud service provider and consumer) that take into account legal requirements relating to use of cloud computing services

Compliance with legislative requirements – in cloud environment must be ensured availability of methods (eg. contractual agreement between cloud service provider and consumer) that take into account legal requirements relating to use of cloud computing services Cloud computing governance

can be considered as a specialized governance system which can be implemented by cloud service consumer to govern cloud computing environment. Figure 1 shows governance of information technology and its relationship in hierarchical structure of governance systems.

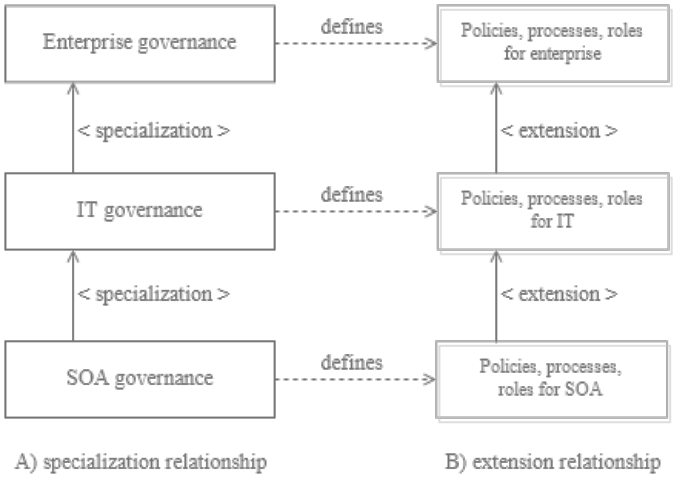

Fig. 1. Specialization and extension relationship between organization's governance systems, source: (Ondruška, 2010)

Cloud computing governance can be seen as specialization or extension of IT governance or SOA governance (Fortis & Munteanu, 2014). Implemented IT governance model in organization simplifies creation of effective cloud computing governance. Cloud computing governance makes easier decisions about cloud services, facilitates and make more transparent communication between provider and consumer and balances the investments and risks while gaining benefits from cloud (ISACA, 2014). The level of risk must be taken into consideration especially in case of public cloud computing. Risks associated with the use of cloud services without governance processes can be very high and it is necessary to optimize risk, otherwise it could lead to a decrease in the flexibility of business processes and thus reduce business agility (ISACA, 2014). Cloud computing governance should define organizational roles and responsibilities, processes to govern cloud services and controls to assure that processes operate in compliance with governance policies (Saidah & Abdelbaki, 2014). Unfortunately, in science community there exist no unified definition of cloud computing governance (Saidah & Abdelbaki, 2014) and there is no generally accepted framework for cloud computing governance as well (Feuerlicht, Schneider & Tranter, 2012).

Recognized framework for governing and managing enterprise IT is COBIT 5 (Youssfi, Boutahar & Elghazi, 2014). Although COBIT 5 is not primary designed for cloud computing (Bailey & Becker, 2014), some processes can be used as a basis for governing cloud services (ISACA, 2014). SOA Governance was ratified by the International Organization for Standardization ISO as an international standard ISO/IEC 17998: 2012 Information technology - SOA Governance Framework (ISO/IEC 17998, 2012) in 2012 (Kreger *et al*, 2012). SOA Governance enables organizations to define and deploy their own SOA Governance Model adapted for specific business environment. Because of service orientation some authors consider SOA Governance as an ideal framework for cloud computing governance (Linthicum, 2009). On the other side, SOA Governance assumes that traditional service lifecycle is govern internally and therefore each service is designed, developed, operated and provided by internal IT department of organization which acts as service consumer. SOA Governance principles and processes can be after their adaptation suitable for cloud computing governance (Laird, 2011). Bailey & Becker (2014) proposes Cloud IT Governance Dial, which identifies five areas of IT governance, serve as a basis for IT governance framework modified for cloud environments. Namely application/process, delivery model, deployment model, cloud formation, risk management framework, and control framework (Bailey & Becker, 2014). Saidah & Abdelbaki (2014) proposed a governance model for cloud computing called New Cloud Computing Governance Framework in which governance components and management activities are grouped into three categories which are policy model, operational model and management model

(Saidah & Abdelbaki, 2014). New Cloud Computing Governance Framework can be implemented through the cycle enabling its continuous improvement. Stages of this cycle are strategic trigger, define and align, build and implement, deliver and measure and operate and feedback (Saidah & Abdelbaki, 2014). Litoiu & Litoiu (2010) proposes a governance model for efficient use of resources in cloud computing environment based on SOA Governance where optimization process of resource allocation is seen through three basic blocks of SOA governance, which are people, processes and technology (Litoiu & Litoiu, 2010).

There exist many IT governance solutions, but comprehensive cloud computing governance is missing (Fortis, Munteanu & Negru, 2012) and research into cloud computing governance is still in its early stages (Munteanu, Fortis & Copie, 2013). There is also a lack of available information resources which address adaptation or extension of principles and processes of COBIT 5 or SOA governance framework in greater detail.

3 Cloud computing governance reference model

Proposed Cloud computing governance reference model is based on the Open Group SOA Governance framework and reflects COBIT 5 governance processes. It is created by modification of SOA Governance Reference Model and COBIT 5 governance processes to govern public cloud computing services from a consumer perspective. Structure of proposed Cloud computing governance reference model takes into account the structure of SOA Governance Framework Reference Model.
Proposed Cloud computing governance reference model serves as a basis for definition of specialized governance system which can be implemented by cloud service consumer to govern cloud computing environment. Proposed Cloud computing governance reference model defines guiding principles, governing processes, governed processes, roles and artifacts. Figure 2 shows conceptual model of Cloud computing governance reference model, its key entities and relationships between them.

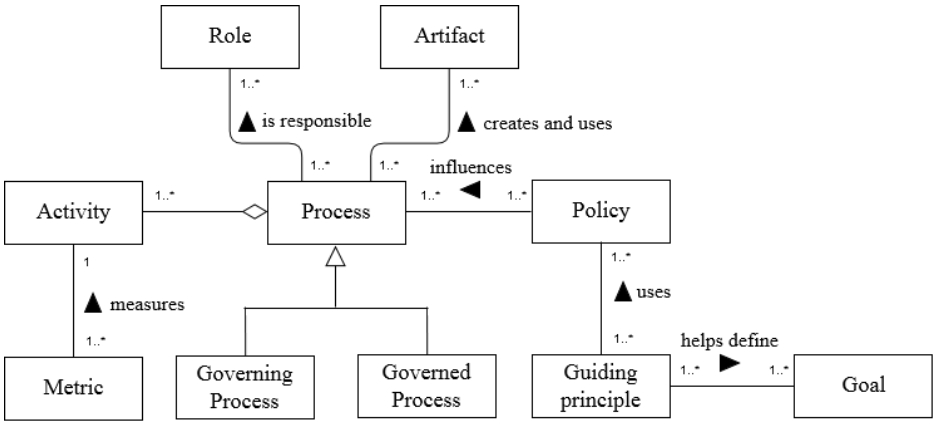

Fig. 2. Conceptual model of proposed Cloud computing governance reference model, source: (Karkošková et al, 2015)

In this paper, we introduce proposed Cloud computing governance reference model principles and processes including:

- Cloud computing governance guiding principles
- Cloud computing governance governing processes
- Cloud computing governance governed processes

3.1 Cloud computing governance guiding principles

Cloud computing governance guiding principles define common rules to apply a consistent approach of using cloud computing services at all levels of the organization. Guiding principles provide a reference for policy makers to support decision making during the design, deployment and operation of cloud computing governance. Cloud computing governance guiding principles are as follows:

Principle 1. Strategic cloud computing initiatives must be in alignment with business strategy and must be supported by executive management
Principle 2. Cloud computing governance must be aligned with enterprise governance and IT governance and must be supported by executive management
Principle 3. Value delivery from the use of cloud computing services must be ensured and the level of value must be clearly defined, accepted and continuously measured
Principle 4. Risk related to utilization of cloud computing services must be continuously optimizing
Principle 5. Use of cloud computing services must be in compliance with legal and regulatory requirements
Principle 6. Cloud computing governance should recognize the rights of stakeholders established by law or through mutual contractual agreements which maintain their relationship
Principle 7. Cloud computing service costs must be continuously optimizing so that use of cloud services is cost effective
Principle 8. Cloud computing governance policy must be communicated and available to the relevant stakeholders
Principle 9. Effectiveness and performance of implemented cloud computing governance system must be monitored
Principle 10. Enabling capabilities and environments must be available to support implementation and operation of cloud computing governance

3.2 Cloud computing governance governing processes

Governing processes in cloud computing environment are processes that cloud computing governance model uses for managing implemented governed processes. Three proposed Cloud computing governance governing processes are:

- Managing compliance
- Managing dispensation
- Managing communication

Managing compliance process ensures that governed process is in compliance with the policies of cloud computing governance. In case that governed process does not reach the level of compliance, process generates a dispensation.
Managing dispensation process manages detected dispensation and determines whether that dispensation may be under defined conditions and for a limited period accepted or rejected with the reason that a cause of discrepancy must be removed. If dispensation occurred at provider side, escalation manager must report dispensation to provider and on the basis of communication with provider establishes how the given dispensation will be processed by cloud service consumer.
Managing communication process ensures that necessary and relevant information relating to cloud computing governance are communicating to relevant stakeholders.

3.3 Cloud computing governance governed processes

Cloud computing governance governed processes ensure enforcement of cloud computing governance. Proposed Cloud computing governance governed processes are following:

- Ensure cloud computing governance setting and maintenance
- Ensure benefits from cloud computing services
- Ensure risk management system
- Ensure system for managing compliance with legislative, regulatory and contractual requirements
- Ensure system for monitoring and reporting utilization of services in cloud environment
- Ensuring optimization of cloud computing service selection

Detailed description of the processes is shown in Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6.

Table 1: Cloud computing governed process GP1: Ensure cloud computing governance setting and maintenance, source: (author)

Process ID:	**GP1**
Process name:	**Ensure cloud computing governance setting and maintenance**
Process goal:	Creation, maintenance and enforcement of cloud computing governance in accordance with stakeholder needs and business goals.
Process description:	Process provides a consistent approach which in alignment with enterprise governance ensures definition of principles, processes, organizational structures, roles, and responsibilities in order to achieve business objectives and stakeholder needs. Process ensures that decisions with regard to use of cloud computing services are made in accordance with business strategy and business goals. Process establishes control mechanism that monitors compliance of cloud computing governance processes with policies, legal and regulatory requirements.
Process trigger:	Strategic decisions on use of cloud computing services, change in cloud computing strategy.
Inputs:	Business strategy, cloud computing strategy, legal and regulatory requirements.
Outputs:	Mechanisms and principles ensuring cloud computing governance setting and maintenance.
Process activities:	Creation, enforcement, monitoring and assessment of cloud computing governance.

Table 2: Cloud computing governed process GP2: Ensure benefits from cloud computing services, source: (author)

Process ID:	**GP2**
Process name:	**Ensure benefits from cloud computing services**
Process goal:	Optimising benefits of value creation from use of cloud computing services at acceptable costs.
Process description:	Process ensures that any approved cloud computing service, as well as the entire portfolio of approved cloud computing services, produce the expected value at acceptable cost. Process enables to determine the likelihood of each service achieves expected benefits and sets metrics to measure actually achieved value compared to planned value.
Process trigger:	Decision on adoption of new cloud computing service, change in cloud computing strategy.
Inputs:	Business strategy, cloud computing strategy.
Outputs:	Mechanisms and principles ensuring the creation of benefits from cloud computing services.
Process activities:	Creation, implementation, maintenance, evaluation and improvement of system for the creation of benefits from cloud computing services.

Table 3: Cloud computing governed process GP3: Ensure risk management system, source: (author)

Process ID:	**GP3**
Process name:	**Ensure risk management system**
Process goal:	Ensure that risk related to using cloud computing services is analysed, identified, evaluated and monitored, risk appetite is understood and communicated.
Process description:	Process ensures that risk management system for cloud computing services is effective and efficient and it is an integral part of organizational risk management system. Process coordinates definition and communication of risks associated with the use of cloud computing services. Process ensures that changes in the environment are constantly monitored. The process establishes risk management practices so that risks do not exceed the level of acceptable risk, procedures for continuous monitoring and evaluation of the

	level of acceptable risk and procedures for the identification, reporting and implementation of measures to reduce risks associated with the use of cloud computing services and procedures for defining roles and responsibilities.
Process trigger:	Decision on adoption of new cloud computing service, change in cloud computing strategy.
Inputs:	Business strategy, cloud computing strategy.
Outputs:	Mechanisms and principles ensuring optimization risks arising from utilization of cloud computing services.
Process activities:	Creation, implementation, maintenance, evaluation and improvement of system for risk management.

Table 4: Cloud computing governed process GP4: Ensure system for managing compliance with legislative, regulatory and contractual requirements, source: (author)

Process ID:	**GP4**
Process name:	**Ensure system for managing compliance with legislative, regulatory and contractual requirements**
Process goal:	Ensure that cloud computing services are used in accordance with the requirements of both internal and external standards, legislative and regulatory requirements and contractual requirements, that procedures for analysis and evaluation of level of compliance are defined and that measures to remedy non-compliance will be carried out.
Process description:	Process ensures establishment of system for managing compliance with legislative, regulatory and contractual requirements. Process ensures that relevant compliance requirements relating to use of cloud computing services are identified, evaluated with respect to their importance to organization and communicated to relevant stakeholders and that procedures for monitoring compliance with requirements are established.
Process trigger:	Decision on adoption of new cloud computing service, change in cloud computing strategy.
Inputs:	Business strategy, cloud computing strategy, critical change in legislative.
Outputs:	Mechanisms and principles ensuring managing compliance with legislative, regulatory and contractual requirements.
Process activities:	Creation, implementation, maintenance, evaluation and improvement of system for managing compliance with legislative, regulatory and contractual requirements.

Table 5: Cloud computing governed process GP5: Ensure system for monitoring and reporting utilization of services in cloud environment, source: (author)

Process ID:	**GP5**
Process name:	**Ensure system for monitoring and reporting utilization of services in cloud environment**
Process goal:	Establishment of internal control system to monitor and evaluate effectiveness and efficiency of cloud services and their compliance with business needs, governance policies, contracts, laws and regulations.
Process description:	Process ensures establishment of internal control system to monitor performance of cloud environment in terms of compliance with business needs, governance policies, contracts, laws and regulations. Monitoring system must constantly compare claimed parameters of cloud services with actually achieved and in case of deviation must initiate generation of reports and their escalation to authorized roles. Process establishes communication between stakeholders and ensures that communication is effective and timely.
Process trigger:	Decision on adoption of new cloud computing service, change in cloud computing strategy.
Inputs:	Business strategy, cloud computing strategy.

Outputs:	Mechanisms and principles ensuring monitoring and reporting utilization of services in cloud environment.
Process activities:	Creation, implementation, maintenance, evaluation and improvement of system for monitoring and reporting utilization of services in cloud environment.

Table 6: Cloud computing governed process GP6: Ensuring optimization of cloud computing service selection, source: (author)

Process ID:	**GP6**
Process name:	**Ensuring optimization of cloud computing service selection**
Process goal:	Ensuring that cloud computing service selection is carried out in such a way that portfolio of cloud computing services is optimized in terms of cloud service performance and cost.
Process description:	Process ensures that cloud computing service portfolio will be managed so that organization uses only a set of cloud computing services which optimally supports business processes. Process further ensures that cloud service operation costs are managed to maximize benefits of using cloud computing services.
Process trigger:	Decision on adoption of new cloud computing service, change in cloud computing strategy.
Inputs:	Business strategy, cloud computing strategy.
Outputs:	Mechanisms and principles ensuring optimization of cloud computing service selection.
Process activities:	Creation, implementation, maintenance, evaluation and improvement of system for optimization of cloud computing service selection.

4 Verification of Cloud computing governance reference model

Verification of the practical applicability of proposed Cloud computing governance reference model is realizing on a case study conducting in large IT organization. IT organization provides IT services to a large retail organization operating within EU. The case study was carried out in accordance with the methodology of the case study design and implementation for scientific purposes as defined in publication Case Study Research: Design and Methods (Yin, 2009). IT organization decided to utilize a cloud computing service. Given that IT organization had not used any cloud computing service so far, project of Cloud computing governance reference model adaptation and implementation was considered as Proof-of-Concept project. The aim of case study was to adapt existing IT governance model by using proposed Cloud computing governance lifecycle. Based on the experience gained during project about the actual progress of applied processes and based on discussion with professional IT staff, initial proposal of Cloud computing governance reference model has been within each iteration adjusted in its current form (see Figure 3).

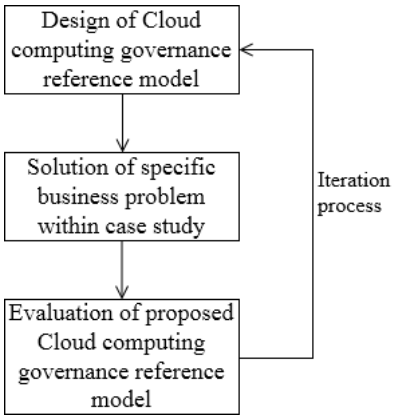

Fig. 3. Specialization and extension relationship between organization's governance systems, source: (author)

At the beginning, we analysed the current state of existing IT governance model, structures and processes in IT organization. IT governance model in IT organization was built based on ITIL. Cloud computing governance model was not implemented. IT organization did not use any cloud computing service and therefore the need for cloud computing governance was not even recognized. Department of Consulting & IT Governance department is incorporated into organizational structure of IT organization. This department includes the project team and a team of IT governance. IT governance team is responsible for the definition, enforcement, optimization and harmonization of IT processes, definition of process metrics, coordination, communication and training IT staff, administration of process documentation and maintenance of IT governance manual. Analysis of future state was focused on the definition of scope of cloud computing governance model. Based on proposed Cloud computing governance guiding principles, new organizational policies were set and applied. Cloud computing governance governing processes extended existing governance processes in the organization. All Cloud computing governance governed processes were applied. At the end of the project, seven IT specialist staff (Head of Consulting & IT Governance, IT governance specialist, Process Analyst, IT Analyst, IT Services Team Leader, Head of IT operations, Senior IT Project Manager) completed a questionnaire. The questionnaire aimed to determine the accuracy, comprehensibility and usability of the proposed Cloud computing governance reference model. Figure 4 shows the results of the questionnaire. The evaluation criteria are as follows:
EC1: Cloud computing governance reference model is understandable and implementable.
EC2: Scope and structure of Cloud computing governance reference model are defined clearly and comprehensibly.
EC3: Methodological elements (principle, process) of Cloud computing governance reference model are clearly, comprehensibly and correctly defined.
EC4: Cloud computing governance reference model enables to ensure the effective adoption and use of cloud computing services aligned with business requirements and needs while minimizing costs and risks.
EC5: Cloud computing governance reference model helps to define decision-making process, rules and restrictions that on a strategic level govern and control the use of cloud computing services with the aim to achieve business needs.
EC6: Processes of Cloud computing governance reference model enable to solve the real problems and to delivery of results of specific solutions to these problems.
EC7: Processes of Cloud computing governance reference model are defined correctly and at the necessary level of detail.

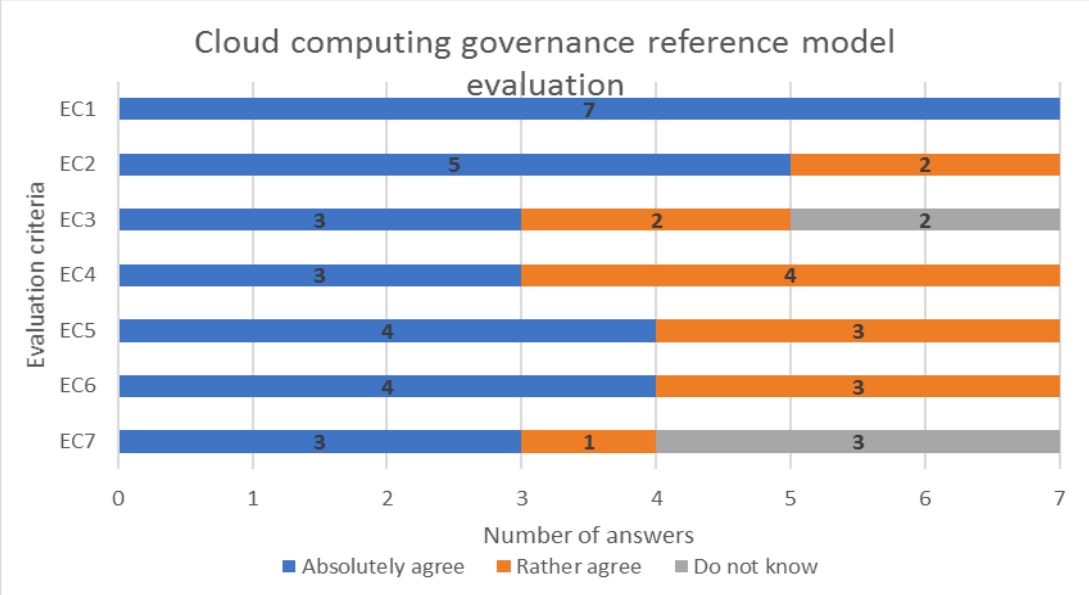

Fig. 4: Evaluation of Cloud computing governance reference model by IT specialist staff, source: (author)

5 Conclusions

This paper proposed Cloud computing governance reference model as a result of Design Science Research in the field of governing public cloud computing services from cloud consumer view. There is no widely accepted governance framework intended for cloud service consumer to govern IT environment where cloud computing services owned by third parties are utilized to support business processes. None of widely accepted IT governance frameworks fully reflect the characteristics of cloud computing services. Certain research into cloud computing governance has been conducted. Larger organizations on proposal of cloud computing governance either working (The Open Group, 2016) or cloud computing governance is a part of their commercial product (Chan, 2015). Existing research often focus on cloud provider perspective rather than cloud consumer perspective, which differs mainly in the fact that provider is an external company, usually a third party and that consumer does not deal with the design phase of cloud computing services and with their maintenance. Existing proposals are not comprehensive and often do not separate cloud computing governance from cloud computing management. Some proposals are based on the synergy of SOA and cloud computing as service-oriented approaches when SOA governance is considered as a good predisposition for unified service governance system. The recent shift towards utilization of externally provided cloud computing services has altered the basic premise of SOA and its governance and from the perspective of cloud service consumer it requires a re-assessment of SOA governance. Existing research does not give detailed guidelines how adapt SOA governance to cloud computing environment.

Proposed Cloud computing governance reference model reflects SOA Governance and COBIT 5 framework. Based on re-assessment of SOA Governance guiding principles, Cloud computing governance guiding principles were proposed. Cloud computing governance guiding principles provide references or rules during design, deployment and operation of Cloud computing governance. Governing and governed processes defined in SOA Governance Reference Model were redefined a modified and Cloud computing governance and governed processes were proposed reflecting the specifics of cloud computing. Cloud computing governing processes correspond to SOA Governance governing processes but their content was redefined to be more suitable for cloud computing environment. Governed processes defined in SOA Governance are in terms of cloud computing unsuitable and therefore a new set of Cloud computing governance governed processes was proposed with respect to COBIT 5 governance processes. For these processes a uniform process description was established, which includes process ID, process name, process goal, process description, process trigger, inputs, outputs and process activities. Proposed Cloud computing governance reference model serves as extension of Management of Business Informatics (MBI) framework (Voříšek, Pour & Buchalcevová, 2015) which was developed to help organizations in the Czech Republic with the management of their business informatics (Buchalcevová, 2016).

6 References

Bailey, E., and Becker, J.D., (2014). A Comparison of IT Governance and Control Frameworks in Cloud Computing, Proceedings of the Twentieth Americas Conference on Information Systems.

Barde, A.S., (2013). Cloud Computing and Its Vision 2015!!, International Journal of Computer and Communication Engineering, 2(4). doi: 10.7763/IJCCE.2013.V2.225

Buchalcevova, A., (2016). Analysis of the management of business informatics framework from the green ICT viewpoint. International Journal of Information Technology and Management, 15(1), pp.41-58. doi: 10.1504/IJITM.2016.073913

Chan, A., (2015). Infrastructure Guardian launches free Cloud Governance Portal for Microsoft Azure, New Signature, [Online]. Available at: <https://newsignature.com/articles/infrastructure-guardian-launches-free-cloud-governance-portal-for-microsoft-azure> [Accessed 23 May 2016].

Feuerlicht, G., Schneider, S., and Tranter, L., (2012). Towards Enterprise Architecture for Cloud Computing Environments. Proceedings of the 11th Workshop of on e-Business.

Fortis, T. F., Munteanu, V. I., and Negru, V. (2012). Towards an Ontology for Cloud Services. Sixth International Conference on Complex, Intelligent and Software Intensive Systems (CISIS), pp.787-792. doi: 10.1109/CISIS.2012.138
Fortis, T.F., and Munteanu, V.I., (2014). From Cloud Management to Cloud Governance. Continued Rise of the Cloud. Advances and Trends in Cloud Computing, pp.265-287. doi: 10.1007/978-1-4471-6452-4_11
ISACA, (2014). Controls & Assurance in the Cloud: Using COBIT 5.
ISO/IEC 17998, (2012). ISO/IEC 17998:2012 Information technology -- SOA Governance Framework. Standards catalogue ISO/IEC JTC 1 Information technology, [Online]. Available at: <http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=61240> [Accessed 2 May 2016]
Karkošková, S. and Feuerlicht, G., (2016). Cloud Computing Governance Reference Model. 15th International Conference, BIR 2016. Proceedings Perspectives in Business Informatics Research, pp. 193-203. doi: 10.1007/978-3-319-45321-7_14
Kreger, H., and Harding, C., (2012). The Open Group SOA Governance Framework Becomes an International Standard. The Open Group Blog, [Online]. Available at: <http://blog.opengroup.org/2012/10/12/the-open-group-soa-governance-framework-becomes-an-international-standard/> [Accessed 1 June 2016].
Laird, R., (2011). SOA Sets the Stage for Cloud: SOA Governance Makes It Work. Service Technology magazine.
Linthicum, D.S., (2009). Cloud Computing and SOA Convergence in Your Enterprise. A Step-by-Step Guide. Boston: Pearson Education.
Litoiu, M., and Litoiu, M., (2010). Optimizing resources in cloud, a SOA governance view. GTIP '10 Proceedings of the 2010 Workshop on Governance of Technology, Information and Policies, pp.71-75. doi: 10.1145/1920320.1920330
Maghrabi, L., and Pfluegel, E., (2015). Moving assets to the cloud: A game theoretic approach based on trust. International Conference on Cyber Situational Awareness, Data Analytics and Assessment (CyberSA), pp.1-5. doi: 10.1109/CyberSA.2015.7166120
Munteanu, V.I., Fortiş, T.F., and Copie, A., (2013). Supporting Cloud Governance through Technologies and Standards. Proceedings of the 7th International Symposium on Intelligent Distributed Computing, pp.271-280. doi: 10.1007/978-3-319-01571-2_32
Ondruška, M., (2010). Model propojení IT Governance a životního cyklu aplikace. Systémová integrace, 17(3).
Peffers, K., Tuunanen, T., Rothenberger, M.A., and Chatterjee, S., (2008). A Design Science Research Methodology for Information Systems Research. Journal of Management Information Systems, 24(3), pp.45-78. doi: 10.2753/MIS0742-1222240302
Rehman, Z., Hussain, O.K., and Parvin, S., (2012). A Framework for User Feedback Based Cloud Service Monitoring. Sixth International Conference on Complex, Intelligent, and Software Intensive Systems, pp 257-262. doi: 10.1109/CISIS.2012.157
Saidah, A.S., and Abdelbaki, N., (2014). A New Cloud Computing Governance Framework. CLOSER 2014 - 4th International Conference on Cloud Computing and Services Science.
Schneider, S., and Sunyaev, A., (2015). CloudLive: a life cycle framework for cloud services. Electronic Markets, 25(4), pp. 299–311. doi:10.1007/s12525-015-0205-y
Stanley, R., (2014). Cocreation and Implementing ITIL Service Management in the Cloud: A Case Study. The 8th International Conference on Knowledge Management in Organizations, pp.61-71. doi: 10.1007/978-94-007-7287-8_6
The Cabinet Office, (2011). ITIL Service Strategy. 2nd ed. Norwich: The Stationery Office (TSO).
The Open Group,(2016). Cloud Computing. Open Platform 3.0™. The Open Group Cloud Computing Work Group, [Online]. Available at: https://collaboration.opengroup.org/cloudcomputing/ [Accessed 20 May 2016].
The Open Group, (2009). SOA Governance Framework. Technical Standard. Berkshire: The Open Group, 2009.
Trivedi, H., (2013). Cloud Computing Adoption Model for Governments and Large Enterprises. Massachusetts Institute of Technology, Sloan School of Management.
Van Grembergen, W., and De Haes, S., (2009). Enterprise Governance of Information Technology - Achieving Strategic Alignment and Value. New York: Springer.

Vitti, P.A.F., Santos, D.R., Westphall, C.B., Westphall, M.C., and Vieira, K.M.M., (2014). Current Issues in Cloud Computing Security and Management. The Eighth International Conference on Emerging Security Information, Systems and Technologies, pp.36-42.
Voříšek, J., Pour, J., and Buchalcevová, A., (2015). Management of business informatics model: principles and practices. E+M. Ekonomie a Management = Economics and Management, Informační management, Vol. 18, Iss. 3, pp. 160-173. ISSN: 2336-5604.
Wattal, S., IBM India Ltd., Noida, I., and Kumar, A., (2014). Cloud computing - An emerging trend in information technology. International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT), pp.168-173. doi: 10.1109/ICICICT.2014.6781273
Yin, R.K., (2009). Case Study Research: Design and Methods. 4th ed. SAGE Publications, Inc.
Youssfi, K., Boutahar, J., and Elghazi, E., (2014). A Tool Design of Cobit Roadmap Implementation. International Journal of Advanced Computer Science and Applications, 5(7), pp.86-94. doi: 10.14569/IJACSA.2014.050714