IT4IT™ AS A MANAGEMENT OF TECHNOLOGY FRAMEWORK: PERSPECTIVES, IMPLICATIONS AND CONTRIBUTIONS

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ABSTRACT

Information technology (IT) is at the core of digitisation of existing business models and dominates in the innovation efforts of many industries. IT has until now in many ways been regarded as exempted from the structuration and automation represented by IT. The IT4IT framework released by The Open Group in October 2015 suggests to a major change. IT has to be governed and structured along defined processes of value chains, life-cycles, service propositions, customer interaction and cost control as any other area of the organization. The purpose of this paper is to review IT4IT as a practical implementation of a Management of Technology framework and to review its perspectives and implications to the MoT society as well as the contributions it has to IT professionals, innovators and MoT practitioners. Methodologically this paper is based on an extensive case study of a large IT service provider. The IT service provider used the framework, along with other frameworks, to introduce larger degree of homogeneity of its own service "catalogues", improved processes for navigating in the heterogeneity of its customers, and to ensure uniform processes of performance management and reporting. Methodologically this paper has been challenged by the novelty of the topic of IT4IT as only very little peer reviewed materials is available; analogue channel have thus been used. Key findings of this study are: (1) IT4IT as strong idealization of a practical MOT framework implementation especially in conversion from relative mature innovations to operational environments and life-cycle management. (2) IT4IT is driving IT further in the direction of commoditization and consumerization reducing uncertainty in IT implementation and operations and giving business stakeholders better opportunities for innovation. (3) As a MOT framework, IT4IT is taking IT a step further in being a more manageable technology with more specific definitions of services, customer expectations, relationships between innovation and operations, and transparency of processes. IT4IT suggests a highly specific and novel interpretation of innovation and operations value chains that can inspire other MOT processes. The IT4IT framework is an interesting suggestion to the MOT society for a professional framework that has gone further in governance and provides a more holistically approach than probably any earlier framework.

Key words: IT4IT, IT Service Management, Management of Technology, Digital Business Creation, SIAM.

INTRODUCTION

Information technology (IT) is at the heart of digitisation of existing business models and dominates in the innovation efforts of many industries as well as being the locomotive for many new industries and business model (Ba and Nault, 2015; Demirkan et al., 2008; Kodama, 2014). IT has a strongly disruptive impact to many industries (Song, 2017; Gaimon 2008), at proper outcome of development, implementation, and service orientation and quality is the lifeblood of new and mature industries. Despite the criticality of IT, IT development projects are generally regarded to be

high-risk (Standish Group, 2016) with uncertain outcomes, with uncertain transition from development to operations (Sarkis et al., 1995), with unclear life-cycle management, and generally being difficult to measure (McNoughton et al., 2010; Berman et al., 1994). As a core technology of modern business, Management of Technology (MoT) approaches seem obvious to harness and guide processes of IT (Gaimon, 2008).

IT as a technology has largely to this day been controlled by "soft" governance frameworks such as project management systems and service management systems both for controlling behavioural patterns of people related to IT (Lee and Om, 1994). IT has until now, in many ways, been regarded as exempted from the structuration and automation represented by IT itself. Several frameworks suggest that IT governance is critical in obtaining predictable positive outcomes of investments and cost, such as COSO, ITIL, COBIT, BiSL, ISO27000, MOF, CMMI and TOGAF (Lucio-Nieto et al. 2012; Melendez et al., 2016; Berrahal and Marghoubi, 2016).

The IT4IT framework released by The Open Group in October 2015 suggests to a major change (Josey et al., 2015; Moore, 2016; Morlitz, 2016; Ng, 2016). IT has to be governed and structured along defined processes of value chains, life-cycles, service propositions, customer interaction and cost control as any other area of the organization. In simple terms, IT4IT propose to think IT services produced like well-defined products in a modern factory (Westkämper and Walter, 2014; Schrader and Droegehorn, 2016).

The purpose of this paper is to review IT4IT as a practical implementation of a Management of Technology framework and to review its perspectives and implications to the MoT society as well as the contributions it has to IT professionals, innovators and MoT practitioners.

Motivated by IT as a driving force in most organisations technological infrastructure and development, and motivated by IT4IT as a suggestion for re-thinking corporate IT services, the research question of this paper is: How should the IT4IT framework be interpreted as a management of technology framework with respect to the dualism of IT as both innovation driver of the business, but also IT as focal in development and operational resources spend in the organisation?

METHODOLOGY

Methodologically this paper is based on an extensive case study of a large IT service provider (Tambo et al., 2016). The IT service provider used the framework, along with other frameworks, to introduce larger degree of homogeneity of its own service "catalogues", improved processes for navigating in the heterogeneous of its customers, and to ensure uniform processes of performance management and reporting.

Methodologically this paper has been challenged by the novelty of the topic of IT4IT as only very little peer reviewed materials is available. A broad range of analogue communication channels therefore has to be reviewed and, some also, included, a.o. standards, whitepapers, blog postings, student works, professional presentations and Youtube videos. Methodologically, new topics initiated phenomenologically or, as in this case, as a new standard, must fight the weakness of absence of prior work that is challenging the precision of the findings and outcomes.

Limitations of this study are that IT4IT is seen from the service provider's side, and not from the focal organisations side. The service provider has earlier been integrated in a consuming organisation, and has first recently more visible role in the general market.

LITERATURE STUDY

This literature study is first presenting the foundations of MoT in order to establish the referential relationship to the technological framework. Secondly, this section is presenting IT service perspectives in order to define IT as a broader and more complex technology than computing. Lastly, this section is presenting the IT4IT framework.

Management of Technology

Management of Technology (MoT) predominantly addresses strategic design of technological systems of the enterprise (Kerr et al., 2013). However, MoT must be viewed broadly to manage technologies at also tactical and operational levels, or at least design tactical and operational systems (Lucio-Nieto et al., 2012). MoT typically addresses the life-cycle of technologies in the line going from early innovation and up to implemention, operations and end-life matters (Kim, 2013). Complementary to MoT life-cycle orientation, operations management do address the cycle of value creation in the operational longevity of technology expressed by value-chain management and discussions of business model creation. Kim (2013) moreover discusses the phenomenology of technologies using the Gartner Hype Cycle that describes technologies out of public professional interest and current perceptions on solving future anticipated problems.

Although organisations often seem emergent in their design, enterprises must act in distinctive elements of design and engineering to ensure meaningfulness in the relation between organisation and technology (Sarkis et al., 1995) hereby emphasizing MoT importance in the practice. Shalley and Gilson (2016) pinpoint MoT as the discipline of balancing creativity and innovation towards operations and standardisation. This is followed by Gaimon (2008) in a more general introduction to MoT and operations management as tightly connected and mutually dependent in aspect such as technological acceptance and diffusion, adoption of new manufacturing technologies, and technologies affected by and affecting innovation capability and knowledge management. Information systems make up a strong load within the investment budget of many organisations, MoT must be organised to ensure balance between the economic dimension of information technology investment and the organisations ability to embrace new and promising technologies (Ba and Nault, 2015). Berman et al. (1994) express MoT as operating a set of strategic levers within the enterprise to ensure technology – strategy integration and alignment especially activities of planning, organisation and control.

Thinking 'frameworks' is deeply integrated in MoT research (Beard, 2002; van Wyk, 1988) with a MoT framework aiming at technological function, performance, principle, and general features. People, task, technology, structure, and strategy are connecting points in the analogue framework Lee and Om (1994). Kerr et al. (2013) highlight MoT as processes of identification, selection, acquisition, exploitation and protection versus strategy, innovation and operations. Furthermore Kerr et al. (2013) suggest practical toolkits for governance and inclusion consisting of elements of human-centric approaches, workshop-based, neutrally facilitated, modular, scalable and visual. Many classical framework approaches have suffered from overemphasis on tangible technologies

while services connected to tangible technologies and service-based technologies are somewhat overlooked (Martin and Daim, 2012); services are related to a broad range of technologies from telecommunication, information exchange, digital businesses, advanced industrial services, as well as typical manual services with elements of technology like care, teaching, cleaning, gardening, etc (Chang et al., 2014).

As exemplary of one specific technology that penetrates more sectors and attracts more interest than most other technologies is IT. IT is regarded by most a key innovation driver, but at the same time a highly persistent and static part of the corporate infrastructure (Gardner et al., 2016; Iden and Eikebrokk, 2013). This leads to a position of IT as both being of innovation and development and at the same time operation and maintenance. Often this has been formulated as an ambidrextrous capability (Chang et al., 2014).

IT and services

Services are quantifiable abstractions of mostly human work and human intervention using a relatively broad of skills and competencies (McBride, 2009). Services are closely related to human work that both rely on services but also produce services in work-systems (Alter, 2014a; Alter, 2014b). In IT and IT-based business development, the concept of service has several meanings often with a transcendence between professionally defined concepts and colloquialism, a.o.:

i. Human advice and intervention, like a service desk (Kekkonen and Arasmo; 2016)
ii. The perceived quality of interaction, like “a polite service”, or “bad service” (Mesquida and Mas, 2015)
iii. Technical features and available utilities, like a network connection (Mesquida et al., 2012)
iv. Information, information exchange, information provision, like the weather report (Warfield, 2016)

ITIL and the IT service management philosophy define a services hierarchy as (Cruz-Hinojosa and Gutiérrez-de-Mesa, 2016; Lucio-Nieto et al., 2012)

i. Service Strategy
ii. Service Design
iii. Service Transition
iv. Service Operation
v. Continual Service Improvement

Service Design and Service Operations are typically translated into ITIL core services (Ali et al, 2013) of

i. Incident Management
ii. Problem Management
iii. Change Management
iv. Release Management
v. Configuration Management

As services constitutes the configuration of tangible as well as intangible assets, the services have to be registered in a Configuration Management Data Base (CMDB) (Wu, 2014). The CMDB is useful as a reference for services and portfolios making up the architecture. However, CMDB's are demanding to maintain, and may be unprecise. The CMDB might later be interesting as parts of it can be machine-generated, and rightfully designed, it can provide the reference architecture blueprint for some services.

IT is commonly organised as development activities versus operational activities. TOGAF and more frameworks describe and govern development (Tambo et al., 2016; Betz and Jahn, 2016). An over-arching management system pinpoint project and portfolio management focusing on resource allocation and management of time and money invested (Vesterinen, 2015; Wang, 2016; Jolly, 2003). Operations are in professionalised environments often organised as services unrelated to development following the mindset of the ITIL framework (Cruz-Hinojosa and Gutiérrez-de-Mesa, 2016; Keel and Hodges, 2016); however the literature also question separating operations and development.

IT operations has over the last 15 years generally adopted a service-thinking in concepts like "service oriented architecture" and "IT service management". However, the actual meaning of service is highly different from context to context, and it doesn't provide a specific rationale to state that existing IT delivery models and fully service-enabled. Service might though provide a useful level of abstraction for standardisation and structuration, within this also useful services as building blocks in establishing corporate systems architectures. Archimate® is an example of a modelling language supported by several vendors that can represent a service portfolio adding to the enterprise architecture (Band et al., 2015).

A fundamental of IT services is measurability. Services must be defined for expected outcome with associated relevant systems for measuring the performance or quality of the service (Betz and Jahn, 2016; McNaughton et al., 2010).

IT4IT

IT4IT is a standard developed and managed by The Open Group (Josey et al., 2015). The first edition was released October 2015. The Open Group is a standardisation organisation mainly supported by a range of the largest IT companies. The Open Group has developed a range of technology standards within foundations of IT, e.g. UNIX, IT interoperability, e.g. ODBC, and processual guides such as TOGAF. IT4IT introduces a new style of thinking IT with specific aim of presenting IT as being fundamentally a tight knit combination of development and operations. Like a manufacturer of cars. Like an airline company. Like a chain of restaurants. The IT4IT position is making distance from the previous hard line of separating development and operations activities (Dashora, 2015); represented by frameworks like PRINCE2 and ITIL respectively.

More fundamentally, IT4IT is suggesting a position of representing IT from a value chain perspective. From idea to operations, is a value chain. From business requirements and opportunities, to benefit realisation is a value chain. Like any other technology in the company.

The basic concept of the IT value is illustrated in figure 1.

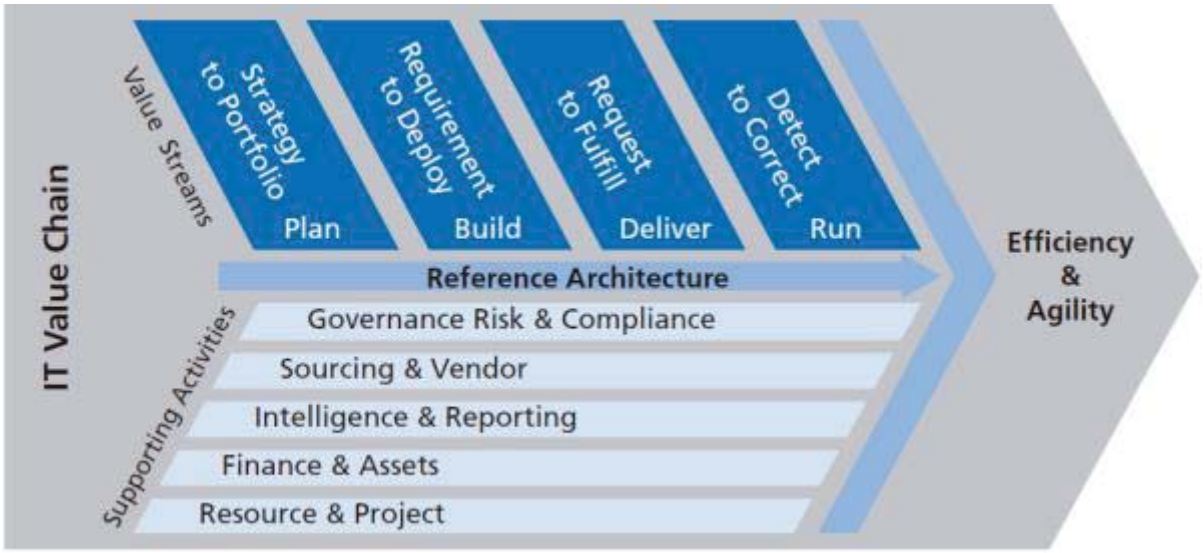

Figure 1. The IT value chain (Josey et al., 2015)

Moore (2016) phrase IT4IT as an inevitable consequence of digital transformation of companies. When digital services become the foundation of the productive technologies of the companie, IT must be used to manage IT. Andenmatten (2016a; 2016b) emphasize that improvement in the development organisation and higher and faster precision of the service organisation is necessitating a common reference architecture with a joint information-, functional- and datamodel as suggested in IT4IT as illustrated in table 1.

Functional model	High level definition of all functional areas for IT Based on customer use case analysis
Service model	Based on ITIL, service lifecycle and high level grouping of: Continuous Assessment, Continuous Integration, and Continuous Delivery –and later into Value Streams
Information model	Identification of key controlling IT artifacts Definition of artifact lifecycles according to lifecycle model
Foundational Integration Layer	Defines key control points for integration, based on artifact Link Information model with lifecycle model

Tabel 1. General approach to the IT4ITReference Architecture (from Price, 2016)

Speed, reduced risk and cost efficiency is also suggest by Marimuthu and Venkatesan (2016). Even for legacy system architectures, IT4IT is proposing a "reinvention" of a high level of transparency, expressed as "Just as cloud is a disruptive force in technology platforms, the IT4IT Reference Architecture, a standard of The Open Group, is a disruption of existing operating models." (Morlitz, 2016).

IT4IT has since its launch in October 2015 gained strong but partial industry attention. During the first draft of this paper in July 2016, there were a few hundred documents on the topic in Google and Google Scholar. In February 2017 there are 50.000 hits in Google on the search string "it4it the open group". At www.hpe.com there are 1.300 hits. Many other defining companies in the vendor segment and analysts have not one single hit at their websites.

CASE STUDY

RexIT is a major IT services provider that employs approx. 2.500 IT professionals. RexIT is a spin-off from a larger research and manufacturing organisation in the life-science segment, and operates mostly in Northern Europe. The IT services are mainly in the field of software infrastructure operations, software systems operations and management, help- and service desks, standard software implementation, application management, cloud services, and database management. Industries of focus are enterprise solutions, governmental services, healthcare and life science, and the financial industry.

RexIT have had a process of departing from its originating organisation and aimed at taking new, larger, professional customers onboard. A customer engagement could start at 1 million USD p.a. and go up to 20 million USD p.a. A customer engagement is normally view over several years and thus the contract amount ranges from 5 million USD to some hundred million USD.

In the process of getting new customers, RexIT has been highly oriented towards documenting and measuring its performance at a very detailed level adapted to the customer specific requests. These requests have been found in the initial customer dialogue based on the specific focal services of the Customer Service Manager (CSM) and the purchasers and decision makers of the customer. The combination and configuration of services have been adapted to customer requirement or perceived customer requirements at a very detailed and somewhat unsystematic level. The unevenness of service configurations for each customer has had consequences. RexIT's ability to deliver has developed with the customer and it has been difficult to utilize services and learning of services quality from one customer case to the next. RexIT has largely avoided scandals but it is in the corporate folklore been interpreted as luck and a culturally-based perseverance of the specialists in the organisation.

RexIT started in late 2015 an initiative towards harmonizing services. Following the ITIL framework, the pool of services within the individual customer service contracts was tentatively merged into more standardised services. The aim of this process was among others to:

- Identify patterns of activity as services entailing people, skill, technology and capability
- Create more standardised and professionalised services
- Present and describe standardised services in a service catalogue
- Base customer expectations and service level on the standardised services of the service catalogue
- Report to customers according to standardised services rather than customised services where this was not necessary; here also to contribute to a simplification of the process of producing service delivery reports

The idealisation operation model of services delivery of RexIT is illustrated in figure 2.

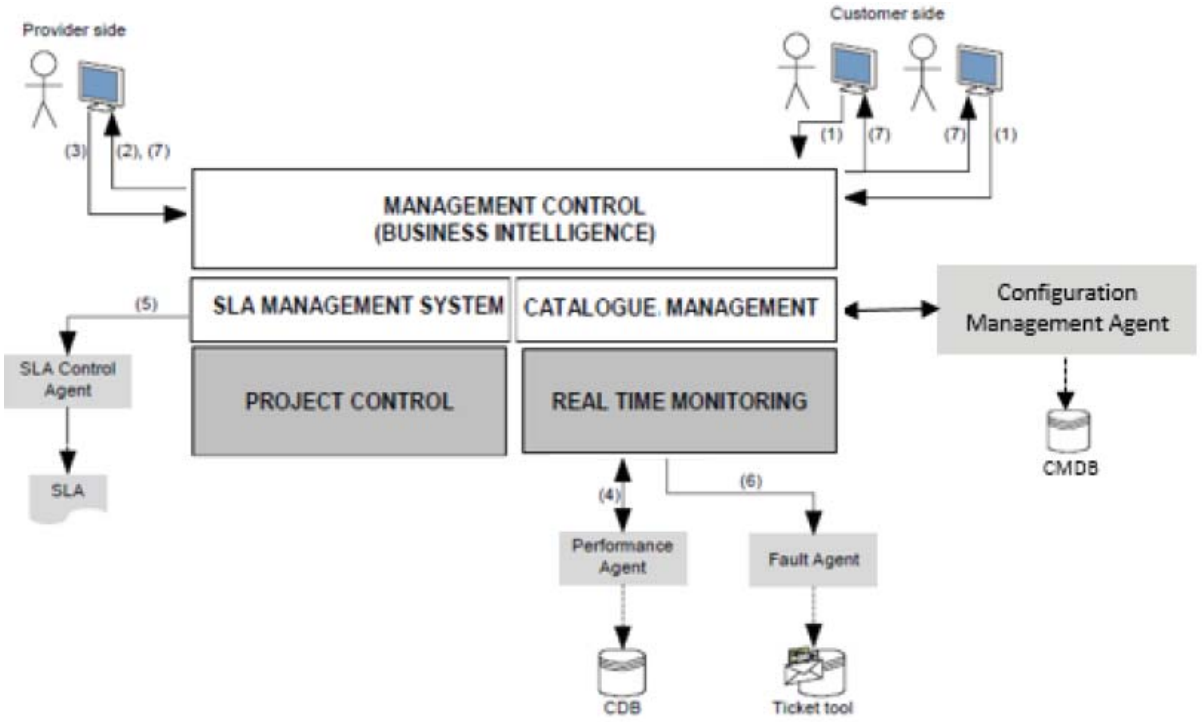

Figure 2. Integrated service level management architecture.

RexIT's position of change is within the ongoing effort to enable a connection from a defined service to the reporting on this service. This is indicated at top level in figure 2 and in a more detailed and process-oriented level in figure 3. In this approach RexIT ensures that processes in between have to transform to support the end-to-end reporting.

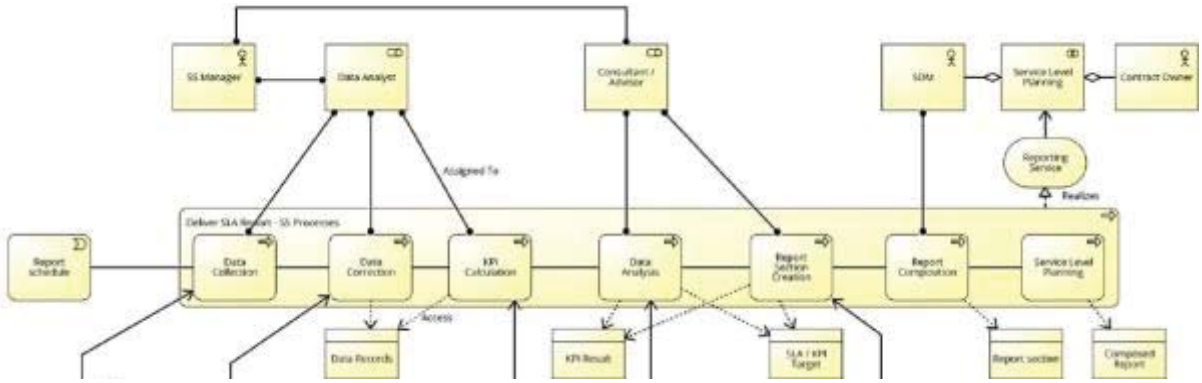

Figure 3. BPMN diagram of process flow from requirement to service reporting

The transformation within RexIT is thus to change customer specific services into generic and standardised services. These services are supported in the service management catalogue. The service management catalogue specifies the KPI of the service level agreement that might be customer specific. The real time monitoring collects data on ongoing service performance. The recording of the monitoring process can be used to generate standardised reports to the clients.

DISCUSSION

In studying MoT frameworks, a number of criteria must be defined to establish meaningfulness for management, technology and the concept of frameworks as processual blueprints for both

academia and practitioners (Kim, 2013; Lee and Om, 1994; Tambo et al., 2016; van Wyk, 1988). On basis of the theoretical review above, the following key points are suggested.

i. The concept of management must be defined

ii. Technology must be definable and characterised in sufficiently generic terms

iii. Life-cycles must be defined. From early innovation at purely conceptual level and to pure steady operations

iv. The framework must be communicable and teachable

v. It should have practical applicability

vi. Assessment tools and efficiency metrics should be integrated

With Beard (2002)'s framework, IT4IT is shifting "unorganised" IT services from subjective to objective, a micro-level perception of IT services is changed to a macro level in using common reference architecture, and technology is used on technology rather than the "story" of technology is told and retold by humans.

As RexIT changed from customised services to standardised services, a number of outcomes were then both planned, but also identified themselves as anticipated positive outcomes. RexIT's change was fuelled and inspired by IT4IT in order to switch from emergent approaches of 'customer first' to standards and structure. Outcomes were in particular

- More organised services with less duplicates of the same services
- Better alignment between competencies and services
- Better and more flexible use of competencies across customer engagements
- Lower learning barrier
- More professionalised image towards customers who actually were asking for standardised services to obtain operational efficiency
- A cross-organisational service catalogue
- Simplified and more efficient reporting on customer services – both to the customers and internally
- A deliberate reorientation towards more advanced customer services and relief in organisational load from simplification of "simple" services
- A preparedness to create an overall service delivery architecture where internal IT services were directed towards the value chain support
- A more manageable business

In having organised activities of the organisation as standardised services, it was furthermore easier and more straightforward to identify the organisation as a producer within the value chain.

Getting back to the MoT Framework consideration, and given the reflections on the outcome of RexIT, the relationship between MoT frameworks and IT4IT can be discussed as:

i. MoT: The concept of management must be defined
IT4IT: Reference architecture for management of IT technologies

ii. MoT: Technology must be definable and characterised in sufficiently generic terms
IT4IT: Neutral to specific IT technologies

iii. MoT: Life-cycles must be defined. From early innovation at purely conceptual level and to pure steady operations
IT4IT: Defines the cycle from inception to end-of-life

iv. MoT: The framework must be communicable and teachable
IT4IT: Several MOOC's have been created and seminars and teaching sessions are made

v. MoT: It should have practical applicability
IT4IT: Contesting other frameworks like TOGAF, ITIL, COBIT. Time has to show.

vi. MoT: Assessment tools and efficiency metrics should be integrated
IT4IT: Metrics miss still some clarity, but SLA KPI reporting is well demonstrated

IT4IT is a strong idealization of a practical MOT framework implementation especially in conversion from relative mature innovations to operational environments and life-cycle management. A critical position to this is the low level of maturity from newly and rather rapid launch. Moreover is the disputable that innovation processes of the enterprise are to precise that service innovation can take place within the framework. Moreover, as IT4IT contains elements of commoditisation of IT services and IT development deliveries, it is not clear how IT4IT can embrace shadow systems, non-IT IT-development, bring-your-own-device, sporadic business-driven Software-as-a-Service, and likewise other commoditisation trends in the technology industry. IT4IT is driving IT further in the direction of commoditization and consumerization reducing uncertainty in IT implementation and operations and giving business stakeholders better opportunities for innovation.

IT4IT process	**General MoT process**
Strategy-to-portfolio	Early innovation initiatives. Technology intelligence. Fuzzy front end. Open innovation.
Requirement-to-deploy	Innovation management. Early supplier involvement. Portfolio management.
Request-to-fulfill	Implementation. User acceptance. Change management. Empowerment. Dynamic capability. Absorptive capacity.
Detect-to-correct	Operations and life-cycle management

Table 2. IT4IT vs MoT

On the comparative position between MoT and IT4IT, table 2 is given selected highlights of interesting fits between the four value chain elements of IT4IT and broad MoT areas of interest.

CONCLUSION

Suggestions for further of this study include full value-chain implementations of IT4IT and associated impact studies. The RexIT case started at the end-points of the value chain in form of standardising the service catalogue, service level agreement KPI's and the reporting for the SLA KPI's. A number of suggestions are suggested for an actual IT-based underpinning of IT4IT, e.g. IT4IT-based knowledge management systems, dedicated management information systems, better connections between portfolio-management, enterprise architecture, project execution, delivery management, and continuous transformation processes. Not one system exists so far for supporting the full IT4IT value chain, but the reference architecture is preparing solid grounds for this. In further projections of research is the IT4IT in a modern-day strongly heterogeneous service landscape of IT, the Service Integration And Management (SIAM) reference model has been proposed to manage multi-vendor environment; SIAM indicates a potential for augmenting IT4IT and control inter-organisational complexities (Armes et al., 2015).

Conclusively, IT4IT is taking IT a step further in being a more manageable technology with more specific definitions of services, customer expectations, relationships between innovation and operations, and transparency of processes. IT4IT suggests a highly specific and novel interpretation of innovation and operations value chains that can inspire other MOT processes. Scholarly, IT4IT is new and lacks lack scale implementations, thus this paper has an ex-ante perspective and longitudinal studies must wait. Furthermore, there are discrepancies and inadequacies that must be subject for further studies. The IT4IT framework is an interesting suggestion to the MOT society for a professional framework that has gone further in governance and provides a more holistically approach than probably any earlier framework.

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REFERENCES

Ali, S. M., Soomro, T. R., and Brohi, M. N., (2013), Mapping information technology infrastructure library with other information technology standards and best practices. Journal of Computer Science, 9(9).

Alter, S., (2014a), Disentangling service: Using a work system perspective to reconcile different but overlapping portrayals of service and service systems. University of San Francisco Working Paper.

Alter, S., (2014b), A unified operational view of service, service systems, and service science. In INFORMS Annual Meeting, San Francisco.

Andenmatten, M., (2016a), IT4IT treibt DevOps – Schneller, besser und sicherer. Retrieved from: https://www.linkedin.com/pulse/it4it-treibt-devops-schneller-besser-und-sicherer-martin-andenmatten

Andenmatten, M., (2016b), IT-Qualität durch Service Management. HMD Praxis der Wirtschaftsinformatik, 53(2), 185-199.

Arasmo, S. and Kekkonen, A., (2016), Future Trends of Service Desk. Retrieved from: itsmf.fi/wp-content/uploads/2016/05/Future-trends-esitelmä.pdf

Armes, D., Engelhart, N., McKenzie, P., and Wiggers, P., (2015), SIAM: Principles and Practices for Service Integration and Management. Van Haren.

Ba, S., & Nault, B. R. (2016). Emergent Themes in the Interface Between Economics of Information Systems and Management of Technology. *Production and Operations Management*.

Band, I., Engelsman, W., Feltus, B. C., Paredes, S. G., and Diligens, D., (2015), Modeling Enterprise Risk Management and Security with the ArchiMate®. Available from https://www2.opengroup.org/ogsys/catalog/W150

Beard, J. W. (2002). Management of technology: a three-dimensional framework with propositions for future research. *Knowledge, Technology & Policy*, *15*(3), 45-57.

Berman, E, Werther, W, and Vasconcellos, E (1994) Executive levers for the strategic management of technology, Business Horizons, 37(1), 53-61,

Betz, C. and Jahn, K., (2016), The IT4IT™ Reference Architecture – An Open Standard for IT Management in the Digital Business Era. Journal of Enterprise Architecture, 12(2), 9-14.

Chang, YC, Miles, I, and Hung, SC (2014). Introduction to special issue: Managing technology-service convergence in Service Economy 3.0.*Technovation*, *34*(9), 499-504.

Cruz-Hinojosa, N. J., and Gutiérrez-de-Mesa, J. A., (2016), Literature review of the situation research faces in the application of ITIL in Small and Medium Enterprises. Computer Standards and Interfaces, 48, 124-138.

Dashora, A. (2015), IT4IT Reference Architecture - a potential replacement of ITIL or a strong successor. Available at https://www.linkedin.com/pulse/it4it-reference-architecture-potential-replacement-itil-dashora

Gardner, D. Fulton, M., Geneste, P., Desiderio, S. David, D. and Akershoek, R., (2016), How the IT4IT™ Reference Architecture Helps Turn IT into a Transformational Service for Digital Business Innovation. Journal of Enterprise Architecture, 12(2), 55-62.

Iden, J., & Eikebrokk, T. R. (2013). Implementing IT Service Management: A systematic literature review. *International Journal of Information Management*, *33*(3), 512-523.

Jolly, D (2003). The issue of weightings in technology portfolio management.Technovation, 23(5), 383 391.

Josey, A., (2015), The Open Group IT4IT™ Reference Architecture, Version 2.0. Berkshire, UK: The Open Group.

Keel, A. and Hodges, R., (2016), IT Service Management. IT Service Management Reference Architecture Series. IBM Corp.

Kerr, C, Farrukh, C, Phaal, R, and Probert, D (2013). Key principles for developing industrially relevant strategic technology management toolkits.*Technological Forecasting and Social Change*, *80*(6), 1050-1070.

Kim, SK (2013). General framework for management of technology evolution.*The Journal of High Technology Management Research*, *24*(2), 130-137.

Lee, M and Om, K (1994). A conceptual framework of technological innovation management. *Technovation*, 14(1), 7-16.

Marimuthu, K. and Venkatesan, P., (2016), An overview of The Open Group's Enterprise Architecture and Evolution of IT4IT. International Journal of Computer Science and Information Technology Research, 4(3), 32-39.

Martin, H, and Daim, TU (2012). Technology roadmap development process (TRDP) for the service sector: A conceptual framework. *Technology in Society*,*34*(1), 94-105.

McBride, N., (2009), Exploring issues within the IT organisation: Four mini-case studies. International journal of information management, 29(3), 237-243.

McNaughton, B., Ray, P., and Lewis, L., (2010), Designing an evaluation framework for IT service management. Information and Management, 47(4), 219-225.

Mesquida, A. L., and Mas, A., (2015), Integrating IT service management requirements into the organizational management system. Computer standards and interfaces, 37, 80-91.

Mesquida, A. L., Mas, A., Amengual, E., and Calvo-Manzano, J. A., (2012), IT Service Management Process Improvement based on ISO/IEC 15504: A systematic review. Information and Software Technology, 54(3), 239-247.

Moore, R., (2016), The IT4IT™ Standard and Digital Transformation: Why we all Work for a Software Company, and putting The Open Group IT4IT Initiative into Context. Journal of Enterprise Architecture, 12(2), 20-23.

Morlitz, D., (2016), The IT4IT™ Standard – As a Technologist Why Should I Care and How Can the Mainframe Help Advance my Career? Journal of Enterprise Architecture, 12(2), 37-40.

Ng, L., (2016), The IT4IT™ Standard as a Model for Managing the Cloud Service Lifecycle. Journal of Enterprise Architecture, 12(2), 31-35.

Price, T. (2016), IT4IT™: the new enterprise architecture framework. Hewlett-Packard Enterprise.

Schrader, I., and Droegehorn, O., (2016), Process-oriented IT-Management as management approach to face digitization. In Proc. of the Int. Conf. on e-Learning, e-Business, Enterprise Information Systems, and e-Government (EEE) (p. 86).

Standish Group (2016). The Standish Group 2015 Chaos Report. Quoted from https://www.infoq.com/articles/standish-chaos-2015

Styles, K., (2016), IT4IT is a push for sexy new IT architecture standards – and it's got a powerful advocate in HPE. New Statesman Tech. Retrieved from http://tech.newstatesman.com/enterprise-it/it4it

Tambo, T., Bargholz, J. M., & Yde, L. (2016). Evaluation of TOGAF as a Management of Technology Framework. In Proceedings of the 25th International Association for Management of Technology Conference, 25, 1-17. Orlando, USA.

van Wyk, RJ (1988). Management of technology: new frameworks. *Technovation*, *7*(4), 341-351.

Vesterinen, P., (2015), Towards Lean-Agile Portfolio Management–Case Kela. Master's Thesis. Haaga-Helia University of Applied Science.

Wang, Y., (2016), Project portfolio management using capability- based planning. Master's Thesis. University of Twente.

Warfield, D., (2016), Why the IT4IT™ Standard is Good News for Architects. Journal of Enterprise Architecture, 12(2), 25-30.

Westkämper, E., & Walter, F. (2014). *Towards the re-industrialization of Europe*. Heidelberg: Springer.

Wu, M. S., (2014), The Benefit and Cost Factors of CMDB Implementations: An Investigation of three Organizations in Taiwan. Procedia-Social and Behavioral Sciences, 147, 64-69.