

Urban Enterprise Principles development approach: a case from a European City

Completed Research Paper

Aleksas Mamkaitis
School of Computing
Glasnevin, Dublin 9
Dublin, Ireland
aleksas.mamkaitis@lero.ie

Marija Bezbradica
School of Computing
Glasnevin, Dublin 9
Dublin, Ireland
marija.bezbradica@lero.ie

Markus Helfert
School of Computing
Glasnevin, Dublin 9
Dublin, Ireland
markus.helfert@lero.ie

Abstract

Principles form foundations for the cooperation within enterprises. They unite stakeholders for the common course of action, and help to find agreement where diverse opinions occur. Smart City can be viewed as an Urban Enterprise, which is potentially more complex in terms of governance than a corporate enterprise. For that reason it is highly important to develop the proper foundations for cooperation. This paper shows experience of the European city introducing enterprise architecture into the organization. It describes Urban Enterprise Principles development approach, and an Urban Enterprise Principles Alignment Concept.

Keywords: Urban Enterprise Principles; Principles; Enterprise Architecture; Smart City; Smart City Principles

Introduction

Principles serve as the foundations for understanding between parties that convene to agree on a long-term commitment to work together. In a corporate enterprise world, this is achieved by defining principles that form the foundations for co-operation within, and guide the existence of, the enterprise (Greefhorst, 2011). The importance of principles in an enterprise cannot be overlooked or underestimated as they can be called upon when a decision without a common agreement is difficult to reach. Just some of the examples of type of principles that can be utilized by the enterprises are presented by The Open Group (2011) and cover business principles, data principles, application principles, and technology principles. All these types of principles are applicable to the specific context, and they address a specific area within an enterprise. Also, The Open Group (2011) defines enterprise-wide principles as providing “basis for decision-making throughout an enterprise”, they are “commonly found in governmental and non-for-profit organizations”, and “encountered in commercial organizations also”.

A Smart City can be viewed as an Urban Enterprise (Mamkaitis et al. 2016). However, as we further elaborate in Discussion section in this paper, an Urban Enterprise can be viewed as a special type of enterprise where most of its functions are executed, and delivered upon, largely by the legally independent entities – e.g. smart initiatives. In this context, the governance of an Urban Enterprise should heavily rely on the elementary, and most practical, governance mechanisms. Knowing the role and importance of principles (Greefhorst, 2006) in an enterprise architecture (Meyer et al. 2011), we concur that Urban Enterprise Principles should serve to provide such a mechanism. We however did not find academic literature which specifically addresses the Smart City principles. In this paper we look at the case of one of the European cities, and propose how Urban Enterprise Principles could be developed and their application as in regards to the independent entities such as smart initiatives. We support this by discussing the literature review on the enterprise architecture principles and explaining our reasoning about the types of

enterprises in terms of modelling and governance. This city case served as a validation of the concept that principles in an Urban Enterprise are important. It shows how, in this context, principles should be looked at, and that practical application of the concept is further desirable.

Research Approach

In this paper, we describe a case, in which we collaborated with one European city. This collaboration took place during the introduction of the Enterprise Architecture practice into the city council organization. Here, we developed Urban Enterprise Principles Alignment Concept. To explain and further support our reasoning we used the Design Science (Hevner, 2007) methodology which requires application of both practice and literature review for carrying out the research. In particular, we reviewed academic literature for the knowledge on enterprise architecture principles. We then conducted numerous meetings in the form of discussion with the city council managers during the research process to validate our findings.

Findings: Urban Enterprise Principles Alignment Concept

Smart City can be viewed as an Urban Enterprise (Mamkaitis et al., 2016). It is potentially more complex in terms of governance than a conventional corporate enterprise due to the nature of smart initiatives likely being independent legal entities. For an Urban Enterprise to successfully attract, negotiate, include and govern the various smart initiatives that will bring value it must consider the development of principles as a matter of high priority. The Smart City initiatives at the city government level often include a selection of a framework that prescribe a high-level strategic areas to be addressed such as characteristics (Giffinger et al., 2007), domains (Neirotti et al., 2014) etc. Once identified, selected and tailored, such frameworks can be seen as “a purpose” in the context of an Urban Enterprise. Every smart initiative that is considered for inclusion in the Urban Enterprise will address issues in one, or more, of the Smart City framework domains. It is therefore important to say that strategic alignment of the smart initiative within the Smart City framework is necessary. Also, the primary values that the Urban Enterprise wishes to express must be articulated in the Urban Enterprise Principles. Therefore the values of the smart initiative must align with the values of the Urban Enterprise through the common, or very similar, set of enterprise principles. At this stage we assume that such alignment should be possible in cases where principles are not mutually exclusive, or contradictory. This principles alignment concept is summarized in Figure 1.

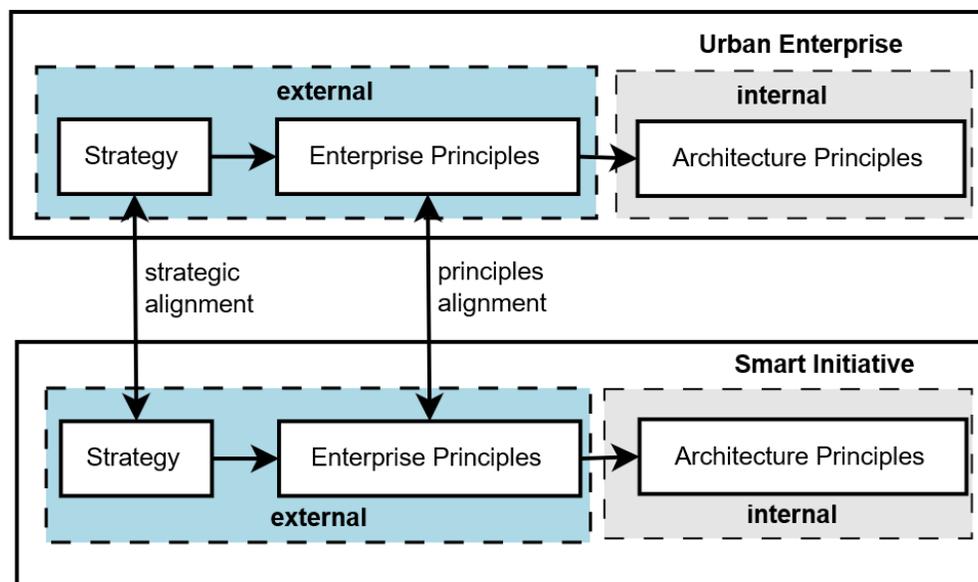


Figure 1: Urban Enterprise and Smart Initiative considerations for alignment.

The extent of principles created for any urban enterprise should be directly related to the extent of strategic areas, domains, which the Smart City framework aims to address. Where a city government, for example, wishes to address the Smart City development in the framework of characteristics or domains (Giffinger et al. 2007, Neirotti et al. 2014) it must consider these domains as individual strategic areas and develop a set of principles for each of the domains – especially given the fact that these domains are the areas that are very specific and differ from one another. Enterprise architecture principles are the set of principles that address the internal aspects of the organization. Within the scope of this research, we consider alignment of architecture principles between the Urban Enterprise and the smart initiative to be of secondary nature. However, further research should be done on how the Urban Enterprise architecture guide and influence the architecture of the smart initiatives that participate in the smart city programmes.

Urban Enterprise Principles development approach: City Case

In this section we present a validation approach for the concept proposed in the previous section. We do this by describing experience of a European city introducing Enterprise Architecture (EA), we will further refer to it as the River City. The progressive government of River City recognizes the importance of Information and Communication Technologies (ICT) in pursuit for advancement of citizens’ quality of life. The government embarked on a digital transformation program, part of which is the gradual introduction of EA practice into the organization. EA explicitly requires consideration of principles. However, the application of Enterprise Architecture aspects in the context of a Smart City has not yet been considered. Therefore the potential importance of those principles to the partner organizations, such as smart initiatives, and how the existing set of principles of the River city relate to various types of enterprise principles was not clear. In the commencement stage, the benefits of the EA and its contribution to the River City strategic objectives were identified and articulated, Table 1.

Strategic Objectives	EA benefit
Enable communities to participate in the digital development	Savings and a unified approach through government integrated systems
Build River City nationally, internationally as a digital ecosystem	By utilizing EA, River City positions itself as a progressive city in terms of technology effectiveness, planning and governance
Create environment for innovation and digital transformation	EA is the main tool for Enterprise planning and transformation
Develop world-class digital services and infrastructure	Enable stakeholders to use similar approaches to planning and deployment of IT services
Digitally enable and transform public services in River City	Apply best practice from the private and public sector

Table 1: Perceived Enterprise Architecture benefits alignment to the strategic objectives (experience from one of the European cities).

Following the objective evaluation of EA frameworks, The Open Group Architecture Framework (TOGAF) (The Open Group, 2011) has been chosen as the enterprise architecture framework by the River City. Specifically due to TOGAF being a consortium driven framework, proven flexibility and wide adoption practices. TOGAF defines an Architecture Development Method (ADM), the Preliminary Phase of which requires to identify and articulate architecture principles. This is where enterprise-wide principles of the River City were presented and shown how they could relate to the principle types addressed by the EA practice, Figure 2.

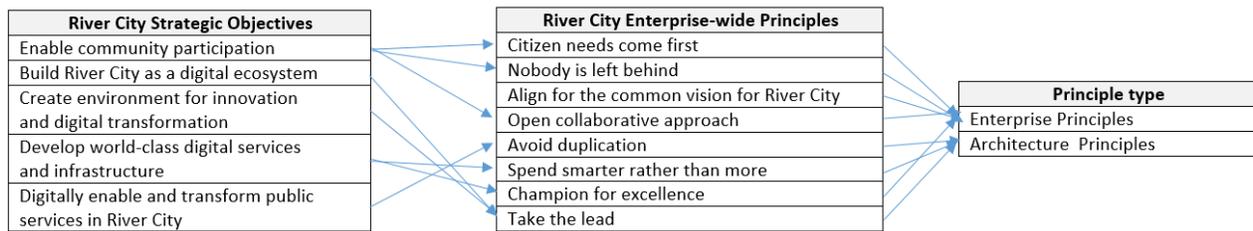


Figure 2: Strategic objectives and their relation to the enterprise-wide principle, enterprise principles, and architecture principles (experience from one of the European cities).

At this stage it is important to consider the strategic objectives of an enterprise that must be taken as a first point of reference when developing new initiatives within an enterprise. It is known that the competition between cities exist (Giffinger et al. 2007, Harrison et al. 2011, Javidroozi et al. 2014), therefore we can say that city strategic objectives change according to the business needs and business drivers, and assume that these are influenced by the external forces of industry competition (Porter, 2008). Enterprise-wide principles, on the other hand, can be considered as the core values that are "the essential and enduring tenets of an organization" and also can be referred to as a "small set of timeless guiding principles" (Collins, 1996). However simple formulated statements principles may be, they will always relate to one of the principle types which are covered in full in the next, Research Back-ground, section.

Research Background: Principles in an Enterprise Architecture

Principles make an important part of the Enterprise Architecture discipline (The Open Group, 2011). As enterprises have to deal with the heterogeneous systems and environments, the operations of the whole of the enterprise must be guided by the set of principles. They should be defined, developed and clearly articulated during the first stages of the Enterprise Architecture initiatives. As suggested by Greefhorst (2011) initial architecture descriptions that are sent to senior management teams should already include the set of EA principles.

As to how principles can be encoded, linguistic analysis (Saeed, 2003) divides the written language into syntactic and semantic. With syntax being the form, and the semantic representing the meaning. Lindstrom (2006) explains that principles syntax can be addressed by asking the question "have we got the principle description right", and principles semantics by asking the question "have we got the right principles". This is very similar to how Pessi et al. (2011) view enterprise architecture principles from the perspective of two dimensions, Table 2. First is the stakeholder expectations management which brings an extrinsic value to the enterprise architecture, and is addressed by concern of "doing the right thing" (Pessi et al., 2011). Second is the knowhow architecting which delivers an intrinsic value to the enterprise architecture, and is addressed by concern of "doing things right" (Pessi et al., 2011). This correlates with the perspective of internal and external value that principles bring to the enterprise. That is, to reap the external benefits it is important for an enterprise to have the right set of principles that will help it to have a 'good face', and lay foundations for an enterprise to operate with the long term perspective. This is the extrinsic value of principles that positions enterprise in the environment as the one which is "doing the right thing" while in the sight of all the externally observing parties. On the other hand, the internal value of principles come from the enterprises' ability to architect itself according to the enterprise strategy. That is, a set of principles that guide the enterprise in "doing things right" for it to succeed in the competitive environment.

Dimension	Concern	Value	Type
Stakeholder expectations management	“doing the right thing”	extrinsic	semantic
Knowhow architecting	“doing things right”	intrinsic	syntactic

Table 2: Enterprise Architecture Principles Dimensions, concerns, & value. Adapted from Pessi et al. (2011) & Lindstrom (2006).

The types of internal value providing principles are wholly contained within an enterprise architecture principles which Stelzer (2006) defines as following: “*enterprise architecture principles are fundamental propositions that guide the description, construction, and evaluation of enterprise architectures.*”. He breaks enterprise architecture principles into two classes 1) “design principles [that] guide the construction and evaluation of architectures”, and 2) “representation principles [that] guide the description and modelling of architectures, as well as the evaluation of architectural representations”, Figure 3. This fits well with how The Open Group (2011) sees the meaning of the architecture from two perspectives. First as a “*formal description of a system, or a detailed plan of the system at component level to guide its implementation*” – this aligns with Stelzer (2006) representation principles. Second is “*the structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time*” – which is expressed as design principles by Stelzer (2006).

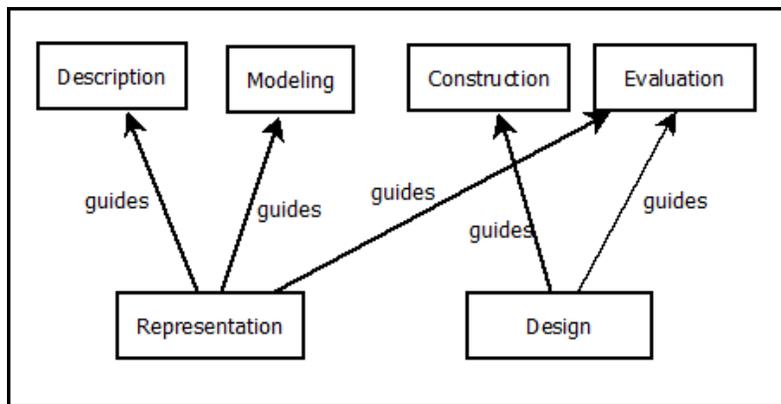


Figure 3: Types of Architecture Principles. Adapted from Stelzer (2006).

Further, basing it on the Broadbent (2005), Lindstrom (2006) elaborates on the positioning of principles, Figure 4, where “principles define the underlying general rules and guidelines for the use and deployment of all IT resources and assets across the enterprise”. This example gives the view on how the strategy comes first, followed by the set of business principles that are external business guidelines, which are leading to the architecture principles that are the internal organization guidelines.

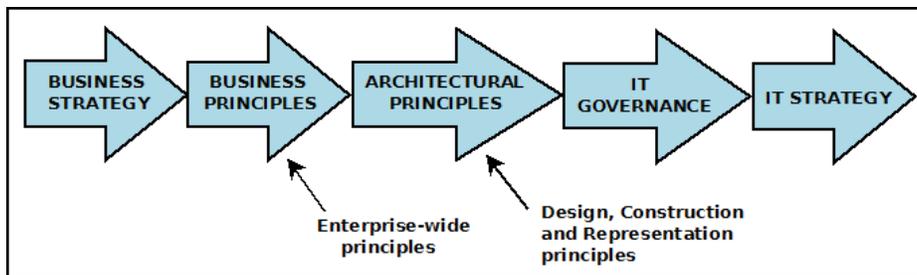


Figure 4: From Business Strategy to IT Strategy. Adapted from Lindstrom (2006).

In the previous section we have described an example from one of the European city government initiatives to introduce the Enterprise Architecture into the organization. The example showed a very similar pattern of relation between the strategic objectives, organization-wide principles, the enterprise principles, and architecture principles.

Discussion: Conventional Enterprise and Urban Enterprise

As described above in Findings section from a conceptual point of view, and in the Principles section from an empirical point of view, EA breaks principles into two types. First are the enterprise principles that are targeted at the outside world of the organization. Second are the enterprise architecture principles that address the inside aspects of organization in terms of design, construction, representation and evaluation of enterprise architecture.

In this section we discuss our findings within the research context. We can say that enterprise-wide principles that exist in an enterprise prior to introduction of the EA are a “small set of timeless guiding principles” (Collins, 1996) which can be assigned to one of the EA principles’ types, and further influence development of specific principles within each of those categories – e.g. enterprise architecture principles have to be developed for the areas of business, application, data, and technology (The Open Group, 2011). Therefore the generic representation of principles development within the city council can be modelled in a sequence by addressing strategic concerns of the enterprise first. This should be followed with mapping the existing, or if necessary creating a, set of enterprise-wide principles that are the outside world facing principles of the organization. Finally, deriving and specifying a set of enterprise architecture principles that guide the development of the enterprise, Figure 5.

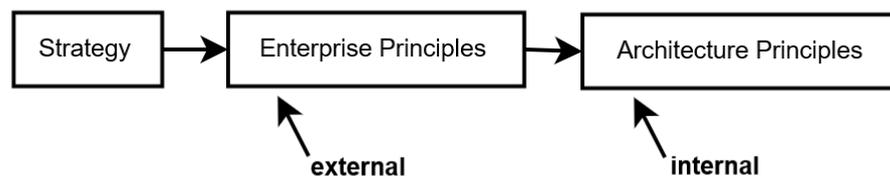


Figure 5: Strategy to enterprise principles, to architecture principles.

Corporate enterprises are run and operated by people all of whom have their own concerns, interests and different degree of influence (Boonstra 2003). This suggests that co-ordination and finding a common agreement between various stakeholders can be challenging even in the small enterprise setting. When considering Smart City, the situation is further more complicated as the different Smart City systems are hardly ever operated by the same organization. Instead, the ownership spans across various smart initiatives (Coletta et al., 2015, Smart Dublin, 2016, Cork Smart Gateway, 2016) which selectively represent individual stakeholders and collectively can be viewed as stakeholders of an Urban Enterprise. Unlike traditional corporate enterprise, Urban Enterprise are a unique form of enterprise with high-degree of partnership and collaboration with third parties. From this we derive that there is a certain degree of association between an Urban Enterprise and smart initiatives. As it is defined in the enterprise modelling, the notion of association “models a relationship between objects that is not covered by another, more specific relationship” The Open Group (2012). We further explain the different levels of association and how they apply to a corporate enterprise setting and an Urban Enterprise.

Conventional corporate enterprise would traditionally be composed of elements such as departments, subsidiaries, and other companies owned by the enterprise. Here, relationship of composition means inseparable parts of the one-whole, and implies high-degree of central, or strongly coordinated, governance. The Open Group (2012) defines composition as a strong relationship where “an object is composed of one or more other objects”, and is essentially inseparable as it “can be part of only one composition”. In an enterprise setting this means departments, subsidiaries and other child companies owned by the enterprise, Figure 6.

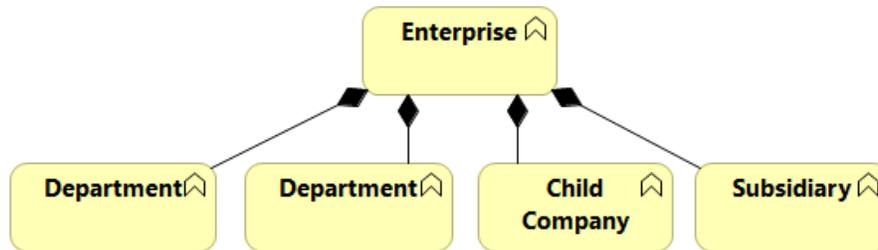


Figure 6: Enterprise composition example.

An Urban Enterprise on the other hand, would primarily be composed of the collaborating parties who would not necessarily be under the strong governance of the Urban Enterprise, and whose participation and collaboration would be somewhat conditional and based on some form of benefit. It is often that in the cases of a Smart City, the various smart initiatives are included as being part of the Smart City, however the level of commitment or clear contract of contribution are not necessarily articulated. Such smart initiatives are often legal entities that are independent from an Urban Enterprise, and therefore execute their own governance. They do not depend on decisions from outside their own organization. However as the smart initiative decides to contribute to, and part-take in, an Urban Enterprise the smart initiative association to an Urban Enterprise takes on a more specific characteristic. From the modelling perspective this can be described as an aggregation relationship which “indicates that an object groups a number of other objects” The Open Group (2012). In this scenario, an Urban Enterprise aggregates various smart initiatives, Figure 7. It however does not own, and is not able to exercise the full control or governance over, those smart initiatives as one of the aggregation characteristics is that “an object can be part of more than one aggregation” The Open Group (2012). In this context an aggregated entity is free from restriction of the aggregator to associate itself with other aggregators. That is, a legally independent enterprise can freely choose what other parties, aggregators, it wishes to be part of and co-operate with.

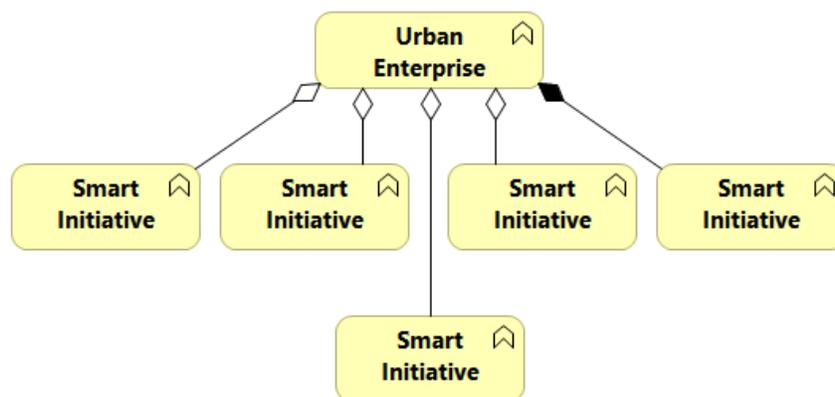


Figure 7: Urban Enterprise aggregation example.

In Table 3 we summarize the characteristics of both Urban Enterprise and Corporate Enterprise. The main difference between the two are mainly that Urban Enterprise represents the public interests which implies that organization is not exclusively profit driven. Also, the way it interacts with, and governs the, smart initiatives is through the legal contracts. Whereas Corporate Enterprise represent private interests and is based around the profit mindset, with its governing influence projected directly through the ownership of its various parts, e.g. departments, subsidiaries, child companies.

Enterprise type	Interests represented	Main collaborators	Governance mechanism
Urban Enterprise	Public	Smart Initiatives	Legal contracts
Corporate Enterprise	Private	Departments, Subsidiaries, Child companies	Equity & direct ownership

Table 3: Urban Enterprise and Corporate Enterprise characteristics summary.

The potential problem with the principles in an Urban Enterprise is directly related to its nature where co-operation of an Urban Enterprise stakeholders, the smart initiatives, can be considered as an ad-hoc. Given the importance of role of principles in an enterprise (Greefhorst, 2011), and the fact the Urban Enterprise is potentially more complex development than the corporate enterprise, we reason that principles in an Urban Enterprise should be given the role of significant importance. However how principles are, or could be, applied at the Smart City level are covered by the Smart City literature to extent which is very limited and non-exhaustive. For this reason we found it necessary to introduce the principles alignment concept which we describe in the Findings section.

Conclusions and Future work

Principles are a foundation for long-term co-operation and are a means to finding a common agreement and understanding on the course of action where disagreements might occur. Principles are highly important in an enterprise architecture discipline where they set the foundations for the enterprise development. In this paper we showed that Urban Enterprise could potentially have a variety of models of governance, and that consideration for development of Urban Enterprise Principles is crucial for the city councils who set out to implement Smart City programmes. We used a case from a European city to show how strategic objectives, enterprise-wide, and enterprise architecture principles are related. Our findings show that strategic objectives and enterprise principles need to be taken into consideration for alignment between the Urban Enterprise and smart initiatives, primarily for the reason of them being external, outside-world facing, enterprise aspects. Considering that smart initiatives are likely to operate as independent legal entities we find that enterprise architecture principles, which are facing the inside of the enterprise and guide its changes, development and evolution might not need an immediate consideration for alignment. However we propose that further research should be done on this aspect as case-specific examples might show that depending on the level of association of smart initiatives with an Urban Enterprise the enterprise architecture principles, and enterprise architecture as such, would require tighter integration and alignment.

Acknowledgement

This work was supported with the financial support of the Science Foundation Ireland grant 13/RC/2094 and co-funded under the European Regional Development Fund through the Southern & Eastern Regional Operational Programme to Lero - the Irish Software Research Centre (www.lero.ie).

References

- Boonstra, A., 2003. "Structure and analysis of IS decision-making processes". *European Journal of Information Systems*, 12(3), pp.195-209.
- Broadbent, M., Kitziz, E.S., 2005. "The new CIO leader". Harvard Business School Press, Boston, Massachusetts
- Coletta, C., Heaphy, L. and Kitchin, R., 2015. "Dublin as a smart city?". *Programmable City blog*, 2 December. www.maynoothuniversity.ie/progcity/2015/12/dublin-as-a-smart-city/ (last accessed 23 June 2016)
- Collins, J.C. and Porras, J.I., 1996. "Building your company's vision". *Harvard business review*, 74(5), p.65.
- Cork Smart Gateway, 2016. www.corksmartgateway.ie (last accessed 23 June 2016).

- Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., Meijers, E., 2007. "Smart Cities: Ranking of European Medium-Sized Cities". Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology. www.smart-cities.eu/download/smart_cities_final_report.pdf
- Greefhorst, D. and Proper, E., 2011. "Architecture principles: the cornerstones of enterprise architecture". Springer Science & Business Media.
- Harrison, C., Donnelly, I.A., 2011. "A theory of smart cities". In Proceedings of the 55th Annual Meeting of the ISSS-2011, Hull, UK, vol. 55, no. 1.
- Meyer, M., Helfert, M. and O'Brien, C., 2011, October. An analysis of enterprise architecture maturity frameworks. In International Conference on Business Informatics Research (pp. 167-177). Springer Berlin Heidelberg.
- Hevner, Alan R., (2007). "A three cycle view of design science research.". Scandinavian journal of information systems 19, no. 2.
- Javidroozi, V., Shah, H., Amini, A., Cole, A., 2014. "Smart city as an integrated enterprise: a business process centric framework addressing challenges in systems integration". In Proceedings of 3rd International Conference on Smart Systems, Devices and Technologies, Paris, pp. 55-59.
- Lindström, Å., 2006, January. "On the syntax and semantics of architectural principles". In System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on (Vol. 8, pp. 178b-178b). IEEE.
- Mamkaitis, A., Bezbradica, M., Helfert, M., 2016. "Urban Enterprise: a review of Smart City frameworks from an Enterprise Architecture perspective". IEEE Second International Smart Cities Conference (ISC2 2016). (Accepted for publication)
- Neirotti, P., Marco, A.D., Cagliano, A.C., Mangano, G., Scorrano, F., 2014. "Current trends in Smart City initiatives: Some stylised facts". *Cities* 38 (2014): 25-36. Harvard
- Pessi, K., Magoulas, T. and Hugoson, M.Å., 2011. "Enterprise Architecture Principles and their impact on the Management of IT Investments". *Electronic Journal Information Systems Evaluation*, 14(1), pp.53-62.
- Porter, M.E., 2008. "The five competitive forces that shape strategy".
- Saeed, J.I., 2003. "Semantics (Introducing Linguistics)". *Semantics-introducing linguistics*. Smart Dublin, 2016. www.smartdublin.ie (last accessed 03 July 2016).
- Stelzer, D., 2010. Enterprise architecture principles: literature review and research directions. In Service-Oriented Computing. ICSOC/ServiceWave 2009 Workshops (pp. 12-21). Springer Berlin Heidelberg
- The Open Group, 2012. "A Pocket Guide to ArchiMate 2.0".