Architecting information: A Delphi study of South African perspective

Abstract:

Information and Communication Technology (ICT) has transformed society at large, with the Internet and World Wide Web (WWW) revolutionising the access, flow and use of information within the societal context. For organisations to maintain and increase their competitive stance within the market, attention should be focused on how the information is structured within the organisational context.

Considering information may be regarded as the catalysts of change within the economy, the objective of this research is to determine how important the architecture of information is to organisations operating in South Africa. The research design utilised to answer the question is based on a pragmatic ontological stance. Building onto the ontological stance, the research employs an abductive epistemological assumption to rationalise the nature of knowledge. The pragmatic approach to the research applied a qualitative research methodology to answer the research problem under investigation. The Delphi technique was used to gain insight into how a purposive sample of 15 experts in the field of information architecture perceive the maturity of the architecture of information within the South African context.

The results of the study indicate that system and data architecture is common in South Africa. Furthermore the study reveals that the maturity of information architecture within the South African context is relatively low, but there is room for growth. Based on the findings of the research the study postulates the definition, description and creation of a South African based professional body or centre of excellence that should further the profession of information architecture in South Africa.

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The results of the study indicate that system and data architecture is common in South Africa. Furthermore the study reveals that the maturity of information architecture within the South African context is relatively low, but there is room for growth. Based on the findings of the research the study postulates the definition, description and creation of a South African based professional body or centre for excellence that should further the profession of information architecture in South Africa.

Architecting information: A South African perspective

1. Introduction

Drucker (1992:95) is of the opinion that society at large rearranges and transforms itself in terms of its views, values, fundamental social and political structures and institutions every few hundred years. Information and communication technology (ICT) may be regarded as a catalyst of transformation within the current economic climate. Furthermore it should be noted that the Internet and WWW have revolutionised the access, flow and use of information, thus for organisations to maintain and increase their competitive stance within the market, attention should be focused on how the information is structured within the organisational context.

Godinez, Hechler, Koenig, Lockwood, Oberhofer and Schroeck (2010:5) identify some existing challenges faced by modern business:

- the accuracy and timeliness of the information do not support decision making within the organisational environment,
- the information environment is usually built in an ad hoc manner with no central planning about the vision or architecture thereof,
- a multitude of data repositories or warehouses exists within the organisational environment with limited accountability of role or function thereof,
- there are limited governance and data quality standards that the organisation adheres to,
- the integration of legacy and multiple application systems is expensive, problematic and sometimes impossible to manage,
- in some instances data and technology may be redundant,
- the inability of creating an integrated management information system,
- no cohesion between management and information technology (IT) leadership within the organisational context,
- the inability of the total organisational system to produce valid and reliable analytical data and information, and
- IT management is often done in a triage mode and the total cost of ownership is very high.

Based on the challenges identified, it can be inferred that the current IT and business architecture is not providing adequate business value. Considering the inference, Godinez *et al.* (2010:7-8) are of the opinion that the current business case for information and the architecture of the information may be narrated in the form of an evolutionary function. This evolutionary function can be illustrated as follows:
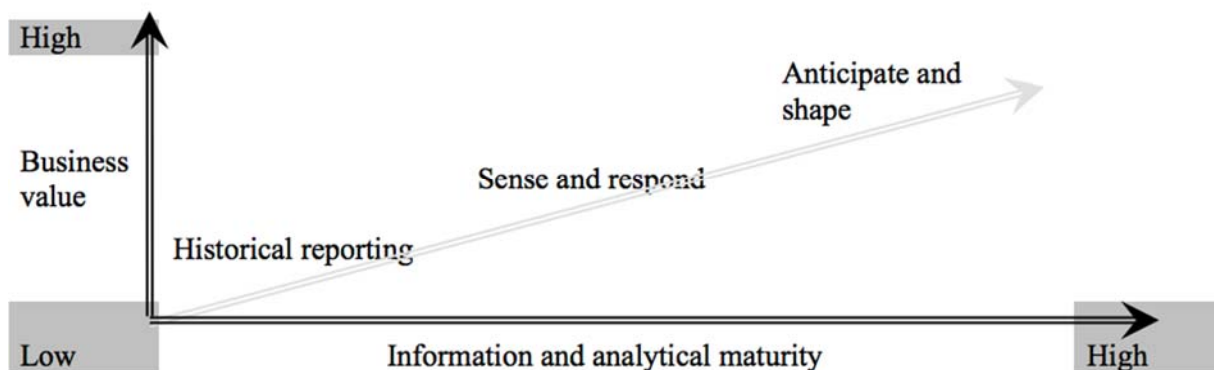

Figure 1 The evolutionary business case for information (Adapted from Godinez *et al.*, 2010:8)

Considering the graphical representation of the business case for information it is evident that although technology might facilitate the process of reporting on the historical events of the organisation, i.e. the daily, weekly, monthly and yearly reports, some organisations still cannot

mitigate business problems and issues, for the data and information contained in the historical reports are neither reliable, nor accurate. This scenario is represented by a low business value and related low information and analytical maturity level. Some organisations are evolving into a higher level of information and analytical maturity, where the organisation is able to sense and mitigate opportunities and threats, and responds to the issues within acceptable levels utilising the basic premises of information management. The last level within the evolutionary business case for information represents organisations with a high level of information and analytical maturity. These organisations are able to anticipate, and to a large extent shape, their information environments to gain a competitive advantage by means of analysing the information generated within the micro, market and macro environments. The aforesaid analysis is represented by means of a high business value and equally high information and analytical maturity levels.

Central to the evolutionary business case for information is the utilisation of information generated from both internal as well as the external environments. In other words it is how the micro environment is structured or architected to facilitate the flow of information.

2. Literature review
This research investigated the need for an architecture, information architecture strategy formulation, the approaches to architecture construction, the contextualisation of information architecture and the link between informational flexibility and information architecture. Literature covering these topics were reviewed in order to provide context for the study.

2.1 Defining architecture
The focus on architecture may be regarded as popular and common within the current academic and non-fictional discourse and literature. The term architecture is used within multiple spheres and across disciplines to describe both physical as well as conceptual manifestations relating to the structure, structuring and the organisation of various elements within the real world.

Building on the previous section, it should be noted that Nuseibeh (2001:115-117) is of the opinion that the formation of an organisational architecture can provide a basis for discovering further necessities, restrictions and determining solutions to the information demands imposed by the hypercompetitive global market environment. Deliberating on the importance of defining architecture, the IEEE Computer Society (2000) has incorporated a systems theoretical point of view when compiling the IEEE Standard 1471-2000, postulating that an "architecture is the fundamental organisation of a system embodied in its components, their relationships to each other, and to the environment, and the principle guiding its design and evolution". Also building on the systems theoretical point of view, Sundberg (2007:287) identifies the importance of control when acknowledging that an "architecture is referred to as one of the most important issues for control of the interfaces and the integration of all the individual components into one system." Extending the concept of a system, Greefhorst, Koning and Van Vliet (2006:103) define architecture as the "high-level structure of a system". Jonkers, Lankhorst, Ter Doest, Arbab, Bosma and Wieringa (2006:63) also emphasise that architecture may be defined as a visionary, integrated view of a system in design or under investigation. For the purpose of the current research an architecture is defined as the high-level strategic formulation of rules, processes and principles in guiding the design and future evolution of the various components of a system into an operational whole to ensure and maintain operational longevity.

Based on the definitions identified it is evident that the term architecture is used in a very broad manner. Different types of architecture can be identified based on the definitions above. These types of architecture include:

- enterprise architecture,
- business architecture,
- application architecture,
- information architecture,
- infrastructure architecture,
- operational architecture,
- website architecture,
- information technology architecture,
- communication architecture,
- security architecture, and
- network architecture.

It should also be noted that this list cannot be regarded as a comprehensive or exhaustive list of architectures.

Taking cognisance of the current business environment that is information-based and the need for flexibility in terms of organisational structure, a paradigmatic mind shift is needed from an organisational managerial perspective. For organisations to gain and maintain a competitive edge, organisational design should be governed by information, culminating into an information architecture that will feed and inform the business architecture, which in turn will dictate the various other sub-architectures.

2.2 Information architecture

The term "information architecture" was coined by Richard Saul Wurman in the mid-1970s during the American Institute of Architects' National Convention in Philadelphia. The conference theme was entitled "Information Architects" (Wyllys, 2001; Farnum, 2002:34; Evernden & Evernden, 2003:139). According to Farnum (2002:34) Wurman defines the information architect as:

- "an individual who organises the patterns inherent in data, making the complex clear",
- "the person who creates the structure or map of information that allows others to find their personal paths to knowledge", and
- "the emerging twenty-first century professional addressing the needs of the age focused on clarity, human understanding and the science of the organisation of information."

The overall methodological stance of the definition relates more to the visual design of information resources and thus emphasises Wurman's own experience in the conceptualisation and designing of printed media. It should however be noted that since the initial conceptualisation of the information architect, the importance of the concept within academic discourse has become pronounced. The importance is based on the various definitions that have been contributed throughout the years. Brancheau, Schuster and March (1989:9) extend the initial definition by stating that an "information architecture is a high-level map of the information requirements of an organisation. It is a staff, organisation and technology independent profile of the major information categories used within an enterprise". Extending the information categories Brancheau *et al*. (1989:9) define IA as a method to plot the information needs of the organisation, the identification of the business functions and the possible interrelationships that may exist between them. Thus, ensuring a proactive, rather than a reactive information architecture design. In real terms Kettinger, Teng and Guha, (1996:28)

extend the interrelatedness of the various functions and related information assets by defining IA as the "blueprints or diagrams which reflect, satisfy, and adapt to the needs of business functions, operations and decision making".

Kettinger *et al.* (1996:28) make a clear distinction between IA and IT stating that IA is "a high-level model of a set of data classes configured to support the organisation's value adding business processes. The model may be portrayed in graphical form and is independent of technology and organisational structure". In contrast to Kettinger *et al.* (1996:28), Periasamy and Feeny (1997:197) consider an IT stance when defining IA as "a set of high-level models which complements the business plan in IT related matters and serves as a tool for Information Systems (IS) planning and a blueprint for IS plan implementation".

Considering the information perspective stance of the research, the view by Evernden and Evernden (2003:1) of IA as a management, and more specifically an information management issue, needs mentioning. They postulate that "information architecture is a foundation discipline describing the theory, principles, guidelines, standards, conventions and factors for managing information as a resource. It produces drawings, charts, plans, documents, designs, blueprints and templates, helping everyone make efficient, effective, productive and innovative use of all types of information". Byrne (2004:22) concurs with Evernden and Evernden (2003:1) and adds that IA is "commonly understood to be the art and science of structuring, organising and labelling information so that owners can better manage it and users can find what they are looking for more effectively".

Building on IA as a management activity, some authors consider IA as a strategic tool of intent for the organisation. Razak, Dahalin, Dahari, Kamaruddin and Abdullah (2008:1011) regard IA as "a blueprint for how an organization achieves the current and future business objectives …". Hinton (2009:47) foresees that "Information Architecture is about using information as raw material in the service of architecture for a new contextual reality".

For the purpose of the current research IA can be defined as the identification, organising and/or implementation of a flexible information architecture blueprint of the internal and external organisational information environment, including the flow, use and dissemination of information as a methodology and tool, capturing the strategic intent within the organisational environment. Extending and building on the definitions identified, the following section will elaborate on the importance of IA.

2.3 The importance of an information architecture

Greefhorst *et al.* (2006:103) are of the opinion that IA has in recent years received recognition as being a catalyst of change within the business environment. Building on the idea of IA being a catalyst of and for change within the new business context, Evernden and Evernden (2003:14) are of the opinion that IA can be seen as a possible solution to the following issues within the organisational environment:
- increased volume of information that is generated within the boundaries of day-to-day activities,
- advances in ICT that have created a diverse and complex set of internal and external information sources for the organisation,
- the increased generation of information-based products and services within the organisation, geared at markets in the information economy,
- the speed of information delivery, via various push and/or pull technologies,

- the growing dependency of and on technology within the organisational context to ensure the smooth functioning of the organisational processes,
- knowledge workers within the information economy, ensuring increased productivity through the facilitation of an infrastructure, and
- increased value of information as a direct result of the increase in the quality of the information.

White (2004:219) concurs with Evernden and Evernden (2003) when considering the importance of IA in cost terms. The aforesaid authors (White, Evernden and Evernden) are of the opinion that an IA will impact the cost(s) of:
- sourcing information,
- not finding information,
- the construction and maintenance of an architecture, and
- training people within the organisation.

Evernden and Evernden (2003:22) extend the cost impact of an IA in real terms by stating that "a rough estimate of the typical costs in not having an explicit information architecture is 10% of the organisation's total expenses". Because of the monetary impact that IA has on an organisation, the identification, implementation and management of the appropriate IA typology is an important consideration for the management of the organisation.

3. Methodology[2]
It should be noted that research does not by implication mean that something is wrong with the current status quo and that this problem needs to be rectified as a matter of urgency. Sekaran and Bougie (2013:30), indicate that a research problem may also be viewed as an indication of interest in an issue and that the rectification or the solution to the problem may lead to an improvement of the current status quo.

The interest in this research can be attributed to the significant impact that the advent and use of ICTs within the society and organisations have brought about. The volume, variety and velocity of information generated by the use of ICTs, especially within the business environment, have necessitated businesses to rethink and realign costing structures to maintain profitability. According to White (2004:219), when quoting Rosenfeld and Morville (2002), the architecting of information is considered as an important element in the cost management function. The objective of the research is to determine how important the architecture of information is to organisations operating in South Africa. Therefore the following formal research question may be postulated:

What is the current status of information architectures in terms of information and analytical maturity?

In accordance with Hauer and Muntean (2010:3), the ontological stance of this research concurs with and will portray the existence of multiple realities that may be subjectively interpreted and result in a social construct. The paradigmatic moment identified for this research is pragmatism, and more specifically neo-pragmatism. Jacobs (2010:725) summarises the neo-pragmatist approach simply by stating that the "methodology embraces trial and error". Sekaran and

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[2] *The methodology of the current research is based on the research methodology and design of an unpublished PhD study submitted in January 2018. The methodology of the current study forms part of two papers that will be submitted for the Academy of World Business, Marketing and Management Development Conference in Athens, Greece, 17-20 July 2018.*

Bougie (2013:30) extend the viewpoint of Jacobs (2010:725) and add that the "[neo]-pragmatists do not take on a particular position on what makes good research". The neo-pragmatic researcher is of the opinion that both observable, real life phenomena as well as subjective research can produce and contribute towards the body of knowledge under investigation, depending on the research question of the research. Pragmatism is attributed to Charles Sanders Peirce, the nineteenth-century American mathematician and logician. In an attempt to understand how researchers come to know, Jacobs (2010:725) postulates that "Peirce argued for abduction" as epistemological assumption. Reichertz (2014:126-127) points out that the research activity starts when the researcher realises that there is an imbalance between expectation and reality.

The premise of this research is based on the fact that there is an imbalance between organisations' expected ability to manage the ever-changing business environment and reality thereof.

Kelemen and Rumens (2011) state that "in accordance with pragmatism's theoretical cornerstone, the pragmatist researcher is most likely to adopt research practices that will allow him/her to solve a practical problem in an efficient way". From the epistemological stance of the research it is evident that the pragmatist researcher needs to be able to acknowledge all interactions between knowledge and action within a specific area of investigation. Kelemen and Rumens (2011) are also of the opinion that "the pragmatist researcher tends to concentrate on human actions".

The research under investigation is best described as qualitative research. The Delphi technique was used to collect data and was originally developed to predict future events as well as the outcomes of the events, based on the inputs from and the circumstances present in the environment. The data therefore describes the reality as it is experienced by the participants in the research in order to investigate how experts in the field experience the reality of the architecture of information to facilitate flexibility and longevity in the business environment.

Hsu and Sandford (2007) state that no exact criteria currently exist in the literature concerning the selection of Delphi participants, Linstone (1978), as quoted by Thangaratinam and Redman (2005), is of the opinion that "a suitable minimum panel size is seven". Hsu and Sandford (2012) are of the opinion that the number of contributors in a Delphi technique is generally between 15 and 20 experts in the field of research. The authors considered the opinion of Hsu and Sandford (2012) and implemented the suggested 15-20 experts as official sample size for the research. Because the Delphi technique is based on expert opinion and input, Skulmoski *et al.* (2007) agree with Fink and Kosecoff (1985) that a purposive sample is necessary for the technique

The research applied a purposive sampling technique using contact details from a LinkedIn group (South African Enterprise Information Architecture Group) to identify and request participation in the research. The Massachusetts Institute of Technology (MIT) Architecture Position Description report were used to identify specific criteria for the participants of the Delphi technique, namely that the participants be willing and able, and have time to participate in the research. The participants should be associated with, employed by or participate in a South African based organisation. They should exhibit basic managerial characteristics including consulting and change management skills. The most important consideration to qualify is sufficient expertise in the field of information architecture.

Considering the methodological assumptions and prescriptions, 15 invitations were sent to experts, who adhered to the selection criteria. These invitations were sent out during March 2017.

Adams *et al.* (2014:21) are of the opinion that in "any research there is an ethical responsibility to do the work honestly and with integrity". The research adhered to all the ethical conditions and policies set forth by the University of Johannesburg's ethical committee, with specific emphasises on:
- ethical access to the field of study,
- obtaining informed consent from the participants,
- ensuring confidentiality of the information pertaining to the participants, and
- protecting the participants in the research.

4. Reporting on the Delphi process
Fourteen out of a possible 15 experts agreed to participate in the research, resulting in a positive response rate of 93,3%. These individual experts were provided with an outline of the research, the purpose of the research as well as the intended use of the responses and data provided by them. A description of the research process detailing the number of rounds and researcher expectations were also provided. The Delphi panel members therefore consented to the research based on the axiological assumptions of the research.
The expert panel were required to offer insight into the following question in Round 1 of the Delphi process:

"What is the current status of information architectures in terms of information and analytical maturity?"

The experts were given two to three weeks to complete the Round 1 questionnaire. The response rate for Round 1 was 78,57%, thus 3 of the experts did not complete the questionnaire, but the remaining 11 experts considered and answered the Round 1 questions and all correspondence were received by the end of April 2017. Due to the open-ended nature of the first round of questioning in gaining insight into the opinions and expertise of the panel members, the method of analysis used was based on a qualitative approach. A thematic classification of the most important themes identified in the responses from the experts was compiled. The thematic analysis formed the basis for the content analysis to provide a review of the opinions of the panel in relation to the questions posed. The thematic constructs identified were then used as departure point for the subsequent rounds of questioning.
Using the thematic classification as basis, all the ideas, comments and points of view of the experts were listed to construct a consensus-seeking questionnaire for Round 2 of the Delphi technique. The consensus-seeking questionnaire consisted of 12 statements or elements grouped according to the thematic classification. Round 2 required the experts to indicate their level of agreement or disagreement to each of the 12 statements or elements. The Delphi technique and its associated processes also dictate that no indication of the reason why the experts agree or disagree should have been included in the Round 2 questionnaire. Including a possible reason for agreeing or disagreeing with a specific statement during this round was deemed to potentially jeopardise the trustworthiness of the responses received, as it could have influenced whether an expert agreed or not agreed considering that it would require additional effort. The Round 2 questionnaire was sent out mid-May 2017 and the experts were given two to three weeks to respond. The Round 2 questionnaire yielded a response rate of 81,81%, i.e. 9 out of 11 responses, as two experts exercised their ethical right to withdraw from the research at this point in time.

Round 3 of the Delphi technique offered the panel of experts an opportunity to provide additional statements, comments and reasons for agreeing or disagreeing to a specific statement or element identified in Round 2. The Round 3 questionnaire was sent out in early July 2017 and the experts were given four weeks to respond. Round 3 yielded a response rate of 55,5% where another four experts exercised their ethical right to withdraw from the research at this point in time.

After scrutinising the reasons and responses as captured in Round 3, the statements that did not achieve 100% consensus during Round 3, were revised and reformulated and offered to the expert panel members for reconsideration in an attempt to reach consensus. The final statements were shared with all initial participants as a final round of consensus-seeking and courtesy to all the Delphi members, even those who withdrew from the research. It should be noted that Round 4 did not produce any additional statements, comments or reasons to change the statements and elements. Thus, Round 4 achieved the ultimate objective of the Delphi technique, i.e. consensus among a group of experts pertaining to a specific topic under investigation. Therefore consensus was declared with the original sample of experts.

The following sections present the research findings from the Delphi study. The presentation of the research findings are based on the thematic classification and content analysis identified during the Delphi technique and the processes as discussed.

4. Results of the current status of IA in terms of information and analytical maturity

All verbatim quotes received from the respondents were referenced based on a coding convention. This coding convention indicates the panel member number and the specific round within which the verbatim quote was captured, for example if panel member one stated an important concept during round two of the Delphi technique, the coding convention used to reference the quote is PM1R2.

Round 1 of the Delphi technique revealed that the expert panel concurs with the fact that within the South African context the maturity of information architecture is currently low, but increasing in importance. The low levels of maturity may have been attributed to issues surrounding the accuracy of the architectures, i.e. the architectures often only "represent a snapshot in time when the architecture was developed" (PM1R1) and there is a lack of "processes to maintain [the] currency" (PM2R1) of the architectures. According to a panel member (PM10R1), there is currently a higher maturity level associated with data architecture, re-emphasising the importance to distinguish between data architecture and information architecture.

In an attempt to further rationalise the maturity levels of information architecture, some of the panel members hinted at a correlation between maturity levels and budgetary allocation for this function and activity. The analysis revealed that larger organisations, with the necessary financial resources, would have had higher levels of maturity in terms of their information architecture. The correlation between higher levels of maturity and budgetary spent may be attributed to employing "technologies like automatic content categorisation and classification, deep learning, semantic web" (PM12R1) and "the use of statistical and machine learning technologies" (PM12R1) to enhance their information architecture. All the identified technologies to enhance information architecture require large financial investments.

Following the analysis of the responses of the Round 1 questionnaire, important statements and elements were identified and formed the basis for consensus seeking in Round 2. Table 1 provides an overview of the level of agreement pertaining to the statements and elements of the theme: "What is the current status of information architectures in terms of information and analytical maturity?"

Table 1 Level of consensus pertaining to the research question

Statement from Round 1 (N=11)	Totally agree	Neither agree nor disagree	Totally disagree
	Consensus Round 2 (%, N=9)		
1. Most large (South African) businesses would have system, architectures and data architectures that represent information residing in traditional systems, but not many have comprehensive information architectures.	89	11	0
2. When it comes to analytical maturity, information architecture is still very immature and has opportunity for growth, especially within the South African context.	89	11	0
3. At present data architecture is more mature than information architecture.	67	33	0
4. Larger organisations have more mature information architectures.	0	56	44
5. Information architecture has reached end of life in terms of software architecture and has been primarily used for the consolidation of financial reporting parameters.	11	44	45
6. Where organisations have had the necessary resources to invest in their data and information architectures, these are more mature than in others where resources were limited.	44	56	0
7. Maturity of an information architecture is budget dependent.	11	78	11
8. Few organisations recognise the true value of their information resource and intellectual property.	100	0	0
9. The accuracy and currency of the architectures are generally poor, meaning the architectures often represent a snapshot in time when the architecture was developed.	78	22	0
10. Information architecture is still greatly misunderstood and undervalued and hence exposing potential business information areas for analytical benefit are still to be arrived at.	100	0	0
11. The use of statistical and machine learning technologies has greatly enhanced the process of implementing information architecture.	33	45	22
12. Technologies like automatic content categorisation and classification, deep learning and the notion of a semantic web are being implemented more and more in organisations across the board to enhance their information architecture.	33	45	22

As discussed in Section 4, the experts were offered the opportunity to provide reasons for neither agreeing nor disagreeing or totally disagreeing with statements and elements made in Round 2. With a response rate of 55,5%, Round 3 as presented in Table 2 provides an overview of the reasons why some of the respondents neither agreed nor disagreed or totally disagreed with the statements and elements identified in Round 2.

Table 2 provides the original statement as well as the verbatim quote of the expert/s. The number, e.g. PM1, before the verbatim quote relates to the number associated with a specific panel member (i.e. the expert). Furthermore, it should be noted that the grey cells in Table 2 focus on reasons for totally disagreeing with a statement or element, and the areas or cells without any colour relate to reasons for neither agreeing nor disagreeing with a statement or element. The cells in black present the revised statements to be considered as the Round 4 consensus-seeking methodological process.

Table 2 Verbatim quotes pertaining to the research question

Original statement Round 1 (N=11)	Verbatim quote Round 3 (N=5)

1. Most large (South African) businesses would have system, architectures and data architectures that represent information residing in traditional systems, but not many have comprehensive information architectures.	• PM12: *Only panel member 12 neither agreed nor disagreed with statement 2.1. No response was recorded by the panel member. Furthermore, the panel member withdrew from the study during Round 3, thus a response cannot be elucidated from this panel member.

Original statement remained unchanged.

2. When it comes to analytical maturity, information architecture is still very immature and has opportunity for growth, especially within the South African context.	• PM12: *Only panel member 12 neither agreed nor disagreed with statement 2.2. No response was recorded by the panel member. Furthermore, the panel member withdrew from the study during Round 3, thus a response cannot be elucidated from this panel member.

Original statement remained unchanged.

3. At present, data architecture is more mature than information architecture.	• PM6R3: "[Data architecture] keeps on developing and driven by new developments in Big Data, [Internet of Things], Data Governance, Cloud solutions – we're probably only starting to see the tip of the ice berg." • PM8R3: "Data architecture is indeed mature. And while information architecture might not be as widespread because it's perhaps not perceived as an essential element, it is relatively mature among those organisations that value its worth. • PM9R3: "The ideas on data architecture is more mature. Larger companies go for "off-the-shelf" products, where data architecture then becomes more irrelevant. I believe both practices are undervalued and not matured."

Because of new developments in Big Data, Internet of Things, data governance and cloud solutions, data architecture is more mature than information architecture. Both practices have room for growth in maturity as well as its value proposition.

4. Larger organisations have more mature information architectures.	•PM9R3: "Very siloed [sic] approach. I believe that larger organizations does not share easily between departments or divisions. Lots of duplication and semantic misalignment."
4. Larger organisations have more mature information architectures.	•PM1R3: "Even larger organizations [sic] like banks have pockets where [information architecture] are still very immature." •PM2R3: "Sometimes they do but not always." •PM6R3: "Due to legacy systems, processes that are more mature – driven by finance and [human resource] departments – fairly well understood and regularly audited – they would be more mature BUT given new requirements for reporting, business processes, and mashing-up of data these legacy processes are mature but sometimes incompatible with new requirements." •PM8R3: "In my experience it's not necessarily the size of the organization [sic], but rather the understanding people in decision-making roles have of the value of information architecture."

Information architecture maturity is independent on organisational size, but perhaps connected to the value that decision-makers attach to it.

5. Information architecture has reached end of life in terms of software architecture and has been primarily used for the consolidation of financial reporting parameters.	•PM8R3: "Information Architecture is very relevant in web development, and is a branch of "software architecture"-since web applications make up a great portion of the web."
5. Information architecture has reached end of life in terms of software architecture and has been primarily used for the consolidation of financial reporting parameters.	•PM1R3: "Traditional [information] architecture is reaching end of life in terms of traditional implementation and deployment methods. Where it involves high technical expertise, [infomrmation technology] involvement and long development life cycles. [Information architecture] is moving towards self-service, business driven requirements with agile deployment and implementation." •PM2R3: "I have no basis to provide a direct answer." •PM9R3: "I don't believe that this statement is true. But I do not have a way to measure my belief."

Traditional information architecture is reaching end of life in terms of traditional implementation and deployment methods. Information architecture is moving towards self-service, business-driven requirements with agile deployment and implementation.

6. Where organisations have had the necessary resources to invest in their data and information architectures, these are more mature than in others where resources were limited.	•PM1R3: "Even in Banks, some pockets have the resources, but are still immature, where smaller organizations have developed more mature environments with less resources." •PM6R3: "Over time these legacy structures have been maintained and built up over the years. Some 'bleeding' edge companies may have had the luxury of keeping ahead of times by constantly adopting to new requirements – especially with the advent of the Internet." •PM8R3: "It seems obvious that more resources would lead to greater maturity, but in my experience it depends on the people and their understanding of data architecture and information architecture."

Information architecture as process and activity is not purely dependent on financial resources, but several variables, including human resources, commitment and understanding will determine the success of the initiative.

7. Maturity of an information architecture is budget dependent.	•PM9R3: "Even though budget might be assigned, the understanding of building an information architecture that really adds value, that will be maintained and used, is mostly not understood and executed. So I will rather put the dependency on understanding and skills than budget."

7. Maturity of an information architecture is budget dependent.	• PM1R3: "Budgets does go a long way, but if fundamentals are not put in place, even big budgeted IA environments will fail." • PM2R3: "Sometimes it is and sometimes it isn't." • PM6R3: "More budget could imply more resources, documentation of processes, implementation of standards, be able to audit – but on the other side this could also become a mess – mechanic's car is always broken?!" • PM8R3: "Available budget may make the motivated take more of a lead. However, it is the attitude of the decision-makers who will then budget appropriately."
Information architecture as process and activity is not purely dependent on financial resources, but several variables, including human resources and commitment will determine the success of the initiative.	
8. Few organisations recognise the true value of their information resource and intellectual property.	• *Consensus was reached on this statement during Round 3. Refer to Table 6.4.
Original statement remained unchanged.	
9. The accuracy and currency of the architectures are generally poor, meaning the architectures often represent a snapshot in time when the architecture was developed.	• PM7 & PM12: *Only panel members 7 & 12 neither agreed nor disagreed with statement 2.9. No response was recorded by the panel members. Furthermore, the panel members withdrew from the study during Round 3, thus a response cannot be elucidated from these panel members.
Original statement remained unchanged.	
10. Information architecture is still greatly misunderstood and undervalued and hence exposing potential business information areas for analytical benefit is still to be arrived at.	• *Consensus was reached on this statement during Round 3.
Original statement remained unchanged.	
11. The use of statistical and machine learning technologies has greatly enhanced the process of implementing information architecture.	• PM2R3: "I have no basis to provide a direct answer." • PM6R3: "Likely for bleeding edge companies, but traditional risk averse companies probably not yet." • PM8R3: "While available technologies have enhanced the process to some degree, it has possibly made the process more complete." • PM9R3: "It should, I have not seen it implemented."
Available technologies have enhanced the process of information architecture and ensure a higher level of implementation and completion of the activity, taking into account the risk vs. the relevance of the technology as well as the activity.	
12. Technologies like automatic content categorisation and classification, deep learning and the notion of a semantic web are being implemented more and more in organisations across the board to enhance their information architecture.	• PM2R3: "I have no basis to provide a direct answer." • PM6R3: "Manual work is painful and users do not want to do it – automated solutions are starting to take over but at a cost – issue is to look at risk vs relevance (80/20)." • PM8R3: "I have little experience in working with organization in which these technologies have been fully implemented to see the effects they have on their information architecture." • PM9R3: "Theoretically yes. Again, I have not seen it implemented."
Available technologies have enhanced the process of information architecture and ensure a higher level of implementation and completion of the activity, taking into account the risk vs. the relevance of the technology as well as the activity.	

5. Analysis and discussion

From a South African perspective most large businesses would have system architectures and data architectures that represent information residing in traditional systems, but not many have comprehensive information architectures. Furthermore, the South African perspective suggests that the accuracy and currency of the architectures are generally poor, meaning that the architectures often represent a snapshot in time when the architecture was developed.

A global perspective suggests that because of new developments in Big Data, Internet of Things, data governance and cloud solutions, data architecture is more mature than information architecture. Both practices have room for growth in maturity as well as its value proposition, but it should be noted that traditional information architecture is reaching end of life in terms of traditional implementation and deployment methods. Information architecture is moving towards self-service, business-driven requirements with agile deployment and implementation.

Furthermore, information architecture as process and activity is not purely dependent on financial resources, but several variables, including human resources and commitment from management, will determine the success of the initiative. Information architecture as a process and activity should not be associated with the size of the organisation, but rather with the value it adds.

The results pertaining to the IA will set the scene in the development of a matrix to measure the effectiveness of an IA. The specific results will enable the identification of elements that will need to be audited and considered as part of the matrix.

6. Conclusion

Based on the literature review and the result of the Delphi technique it is evident that the architecture of information within the South African context is limited to systems and data architectures with limited contextualisation of the architecture of information. Taking the aforesaid into consideration information architecture within the South African context has room for growth in terms of maturity and the value the function can add to the organisation.

Future research within the South African information architecture field should endeavour to identify, define and describe technologies to enhance the process of information architecture. These technologies may include statistical and machine learning technologies. Within the South African context a need for association, standardisation, articulation and expansion of the information architecture profession was identified. Based on the results, i.e. that not many organisations will have a formal information architecture, the current study recommends the definition, description and creation of a South African based professional body or centre for excellence that should further the profession of information architecture in South Africa.

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