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CREATIVITY AS THE FOUNDATION OF CONTEXTUAL APPROACH FOR ENTERPRISE ARCHITECTURE DESIGN

Introduction

Organizational research is now characterized by widening boundaries, a multiparadigmatic profile, and methodological inventiveness. Choice of research methods relies not only on research aims and epistemological stance, but also on organizational, historical, political, evidential and personal factors, which are not problems to be solved, but factors to be included in practical research design. The article aims to present that context and creativity are important for corporate architecture development and that creativity development is supported by including context in the enterprise architecture (EA) model. The first part of the article covers explanation of what creativity and context mean for organizational development. The second part includes discussion on creativity in corporate architecture modelling by example of Zachman Framework (ZF).

Literature survey on context

Contextualizing methods choice for research and development has some implications. It is difficult to sustain a model of research as neutral observer. Even the selection of an underpinning paradigm is a politically inspired act, not merely an intellectually informed choice, as this can involve an implicit alignment with particular stakeholders' interest, overlooking or marginalizing issues that may be even more important to others [BuBr09]. The user's information needs are not satisfied by a single ideal set of documented requirements, but also by the analyses of the context of information searching and computing. Context is an all-encompassing term. In practice, context must be defined in relation to a purpose.

The context of use denotes the run-time situation that describes the current conditions of information system use. The target defines a situation of use by the designers during the development process of the system. Context is defined by Rusell-Rose and Tate as where you are, who you are with, and what resources are nearby [RuRT13]. Generally, context is perceived as a user-oriented phenomenon that is focused more on users' immediate surroundings than on their inner state. The framework for context consists of five key elements:

- any goals, tasks, actions or activities associated with what the user is doing,
- space, location, and time,
- user's physiological conditions, mental state and preferences,
- user's role, status, and relationships with other individuals,
- environmental factors including temperature, light, humidity and the information and material resources accessed by the user [RuRT13].

For Robinson et al. context means any information that can be used to characterize the situation of an entity. An entity is a person, place or object that is considered relevant to the interaction between a user and an application, including the users and applications themselves [RoVW05]. Context plays an important role in reasoning domains, such as decision making, understanding, interpretation, diagnosis. These activities rely heavily on a background or experience that is generally not made explicit, but gives an enriched dimension to the reasoning and the reasoning knowledge. Context acts more on the relationships between the items in focus than on the items themselves [BrBr08]. A context is always relative to another context. Context has an infinite dimension and cannot be described completely.

Contextual information can be objective or subjective. Objective contextual information is based on an agreed-upon standard, by which the context value (such as GPS signals) is measured. By contrast, subjective contextual information requires reasoning, on either the part of the searcher or the system to gain value. Such information include mood, experience, information literacy, or domain knowledge [RuRT13]. Contextual information may be individual or group-based. The utilizing of contextual information aims at improving performance or ease of use for individual information technology (IT) users. Contextual information can be meaningful or incidental. Meaningful context can be defined by contextual information that directly affects how a task is performed and the task results are interpreted. Incidental context is contextual information as a part of a situation, but does not affect how a task will be carried out. Contextual information may also be extrinsic or intrinsic. Intrinsic contextual information concerns document language or type, but extrinsic contextual information concerns popularity of docu-

ments. The effects of contextual information may be visible or invisible. Visibility is the degree to which a system captures, uses and communicates contextual information to the users. Hiding the use of contextual information can reduce the cognitive load on users, making the decision processes simpler and quicker. For Holtzblatt et al., context means getting as close to the real work as possible by going to the users wherever they work and interviewing them while they are doing it [HBWW05]. The context of use can incorporate any real world aspect of interest, such as the user, the software-hardware environment, the physical and ambient environment, the socio-organizational environment. Therefore, lately the context awareness has received acceptance by information system developers, The context-aware applications refer to the ability of computing devices to detect, sense, interpret and respond to aspects of a user's local environment and the computing devices themselves [SeJa04]. Context-aware user interface development means tailoring and optimizing of the interface according to the context in which it is used. The use of a consumer's or user's context improves the information system experience and is offering more customized content, so it may remove the need to manually provide additional information [Ask012]. The evolution of the use of context has been developed in the following stages:

- access to the information straight forwarded on smartphones with the user's permission – primarily for location,
- layering in intelligence, to enable the organizations to know if a customer is in their store, or in a competitor's store,
- breaking from personal computer contexts and the merging of the information and physical worlds to deliver an entirely new innovative services,
- embracing motion as a control mechanism, for instance, phones can be controlled with motion today [Ask012].

Nowadays, the context-aware pervasive applications include context-aware mobile services, context-aware devices, appliances, smart things, the integration of context-aware computing with software agents and the Web, the use of context awareness for addressing, and communication between people, devices and software agents, context-aware controlled sensor networks and security frameworks [Loke07]. Context awareness enables the system to take action automatically, reducing the burden of excessive user involvement and providing proactive intelligent assistance.

Mintzberg has recognized that managing is a practice learnt through experience, and rooted in context. Particularly, the tacit knowledge is hidden in organizational context [Mint09]. The tacit knowledge is not easily accessible and is hidden beyond the practice of the job, through apprenticeship, mentorship and di-

rect experience, which as all form the context. Flexible security models are developed and the security levels can be increased or decreased not just based on the identities of people, but on the situation which they are currently in. Context-based security supports the reconfiguration of the security infrastructure according to the situation of use [Loke07]. Context is therefore the knowledge that supports the reliable derivation of meaning in an environment [RoVW05].

The influence of context on creativity

The influence of context can be seen as adjustment for privacy, trust and security in the sense that context information determines how much information could be revealed and to what degree the entities will be trusted. The influence of context shows the need for defining the interfaces, for instance in the domain of pervasive computing. Context contributes to the meaning that people assign to communication. The same data exchanged can mean something completely different in two different contexts. Information about the context, in which human beings' interactions take place can reveal sensitive information about the parties interacting, about their preferences, their goals, and the relations among them [RoVW05]. Creativity is an important consideration for context-aware systems, because an individual's context contains a large amount of personal information. The creative activities always involve change, new ideas, innovation and a certain discomfort of lack of stability. Generally, a certain amount of motivation is needed to make people operate actively. The contextual motivation is perceived as problematic because of consequences and side effects that are unexpected for someone outside the system and often too complex to be foreseen [Appe11]. Creativity is associated with a certain disregard for rules and structures. Creative practitioners are strategic thinkers, planning and making choices and evaluating and positioning themselves and their work according to a range of external and internal parameters. Creativity by Amabile is defined as a function of three components, i.e. expertise, creative-thinking skills and motivation [Amab83]. Organizational creativity can be stimulated, if the business unit is managed in such a way that employees are encouraged to generate and implement ideas for the overall good of the organization. The business organization managing the creativity should tolerate diversity, complexity and contradiction [BiCu10]. They benefit from a combination of different types of thinking and the creativity is embedded in a cultural context of the organizations. Human creativity may be classified into three categories known as the abstract (scientific), concrete (engineered) and art

creativities [Wang11]. According to Goguen [Gogu96] there are two dominant theoretical perspectives within human-computer interaction: the cognitive (cognitive science and experimental psychology) and the postcognitive (sociology and anthropology). Cognitive approaches to task analysis focus on aspects of user performance and their experiences. Postcognitive, or ecological approaches underscore the importance of context in evaluating human praxis. Postcognitive approaches focus on meaningful interaction from careful consideration of the environmental, sociocultural and historical contexts in which an activity occurs.

Context and creativity in enterprise architecture modelling

Creativity can be understood as a confluence of three factors: a domain that consists of a set of rules and practices; an individual who makes a novel variation in the contents of the domain and a field that consists of experts who decide which novel variation is worth further implementation. Creativity is a process to find a solution that is both novel and useful. However, problem solving often deals with issues for a certain goal with unknown paths and different scenarios' opportunities. There are five stages in a creative process, i.e. preparation, incubation, insight, evaluation and elaboration [Wang11]. The EA modelling process demands such a creative approach and provides a holistic expression of the enterprise's strategies and their impact on business functions and processes, taking into account the modern IT solutions. The EA methods help the firm to establish technical guidelines of how the service delivery function needs to operate to deliver cost-effective, flexible and reliable business services. The EA approach is to ensure the comprehensive understanding of the current state of IT in a business organization, the desired state, or the interrelationships of processes, people and technology affected by IT projects. Eventually, the organizations will have a bigger consistency of business processes and information across business units. The EA identifies opportunities for integration and reuse of IT resources and prevents the development of inconsistent processes and information. By understanding an organization's data architecture, there is a possibility to develop a standard data dictionary and metadata standard to minimize data inconsistency. Finally, the EA modelling ensures traceability between business processes, data, user roles, applications and IT infrastructure. Therefore, the EA involves additional domains such as business architecture, process architecture, data architecture, software application architecture and infrastructure architecture. The EA is a creative application of scientific principles to develop enterprise and its information systems. Cogni-

tive foundations of creativity are analyzed on fields such as the space of creativity, the approaches to creativity, the relationships of creation and problem solving, and the attributes of creative researchers. The cognitive process of creation is visible in the Zachman Framework (ZF), which provides a semiformal explanation of human creativity on different levels of business organization. The ZF provides a basic structure for organizing business architecture through dimensions such as data, function, network, people, time and motivation [Zach10]. Zachman describes the ontology for the creation of EA through negotiations among several actors. Each of the actor is working in his/her individual context. The ZF presents various views and aspects of the enterprise architecture in a highly structured and clear-cut form. It differentiates between the levels: Scope (contextual, planner view), Enterprise Model (conceptual, owner view), System Model (logical, designer view), Technology Model (physical, builder model), Detailed Representation (out-of-context, subcontractor), and Functioning Enterprise (user view). Each of these views is presented as a row in the matrix (see Table 1). The lower the row, the greater the degree of detail of the level represented. The model works with six aspects of the enterprise architecture: Data (what?), Function (how?), Network (where?), People (who?), Time (when?), motivation (why?). Each view (i.e. column) interrogates the architecture from a particular perspective. Taken together, all the views create a complete picture of the enterprise.

Table 1

The Zachman Enterprise Architecture Framework

Perspectives	DATA What?	FUNCTION How?	NETWORK Where?	PEOPLE Who?	TIME When?	MOTIVATION Why?
1. SCOPE Planner contextual	Business Things	Business Processes	Locations	Business Units	Events/ Cycles	Business Goals & Strategies
2. ENTERPRISE MODEL Owner conceptual	Semantic Model	Business Process Model	Business Logistics	Work Flow Model	Master Schedule	Business Plan
3. SYSTEM MODEL Designer logical	Logical Data Model	Application Architecture	Distributed System	Human Interface	Processing Structure	Business Rules
4. TECHNOLOGY CONSTRAINED MODEL Builder physical	Physical Data Model	System Design	Technology Architecture	Presentation Architecture	Control Structure	Rule Design
5. DETAILED REPRESENTATIONS Subcontractor out-of-context	Data Definition	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification
6. FUNCTIONING ENTERPISE User	Data	Function	Network	Organization	Schedule	Strategy

Source of the Zachman Framework: [Mino08].

Although Zachman assumes that the first level considerations are strictly contextual and on this level the local environment approach is important, and the fifth level considerations must be strictly out-of-context to provide an objective look at the information system, each of the levels of Zachman Framework reveals a certain context and requires a separate contextualized approach and consideration in the aspect of the actor on that level.

For the design of a particular product, usability, design, manufacturing costs and recyclability are among the fundamental objectives [EiWL10]. However, if the decision was made with respect to the whole range of products, at least some of these would become instrumental, thereby expanding the decision context. In this context, profit, market share, business strategy, growth and liquidity could serve as fundamental objectives. In Zachman Framework, the lower levels objectives and answers the questions included in columns are in a narrow context in comparison with upper levels objectives and questions that are considered in a broader organizational context. From the users' point of view, business planners' or business owners' objectives (last column in Table 1) are instrumental when making decision on whether to hold, sell or accumulate resources in the company. The ZF architecture model development requires two different approaches to creativity: analytic and synthetic. An analytic creativity can be defined on one hand as a topdown (i.e. from the 1st to the 6th level in Table 1) creation process to discover a novel solution to a given problem by reducing it to the subproblem level where new or existing solutions may be found. On the other hand, as bottom-up (i.e. from the 6th to the 1st level in Table 1) creation process, the synthetic creativity can be developed to discover a novel solution to a given problem by inducing it to a superproblem (upper level problem) where new or existing solutions may be proposed. The combination of the two approaches is also permitted.

Conclusion

Rational decision making on corporate architecture development requires a clear understanding of the underlying objectives. Comprehension of objectives helps improve recognizing better alternatives and attractive decision opportunities. Attempting to gain clarity with respect to ZF persons' objectives can be intellectually demanding (see roles specification in Table 1). However, there are a number of indicators that can be focused on i.e. shortcomings in the status quo, comparison of architecture development alternatives, different strategic goals, external guidelines, and the objectives of other people outside the enterprise. Funda-

mental objectives have to be distinguished from means objectives. Only objectives that are fundamental in the given decision context should be considered for an evaluation of the alternatives. Corporate architecture goals do not simply exist, instead, they have to be developed and modelled by a thorough thinking. The key issues are the sources a decision maker can draw on in a specific decision context.

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KREATYWNOŚĆ JAKO PODSTAWA PODEJŚCIA KONTEKSTUALNEGO DO PROJEKTOWANIA ARCHITEKTURY KORPORACYJNEJ

Streszczenie

Celem artykułu jest przedstawienie tezy, że analiza kontekstu oraz kreatywność projektantów są ważnymi czynnikami rozwoju architektury korporacyjnej. Przyjęto, że rozwój kreatywności może być doskonalony przez uwzględnienie kontekstu w modelowaniu architektury przedsiębiorstwa. Pierwsza część artykułu zawiera wyjaśnienie kreatywności i kontekstu w naukach o zarządzaniu i w praktyce rozwoju organizacji. Druga część obejmuje dyskusję na temat kreatywności w modelowaniu architektury korporacyjnej na przykładzie modelu siatki Zachmana.

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