

Design Research: How to Find Unexpected Connections Between Analyzed Objects for Sustainable Development with the Support of Information Technology?

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Abstract: - A large volume of data is the basic characteristic of modern information and a global society. A natural requirement is to use this data for resolution of the everyday needs of companies, organizations and individuals. In this situation, cooperation, innovation and user-friendly IT (information technology) products are needed for the support of sustainable development. The aim is to seeking out unexpected connections between data. This paper is focused on complex work with data with respect to needs of global society. There are many approaches and to find suitable relations between stored data is difficult. Key is a complete perception of reality based on an optimal design research. Such approach works with many objects and continuous exploration of different contexts using available analytical disciplines (layers). Needed spectrum of suitable analytical disciplines is wide. In this paper, presented design is focused on browsing selected layers via disciplines such as Artificial Intelligence, Business Intelligence, Customer Intelligence, Competitive Intelligence and Swarm Intelligence. For active work with data in various layers, a good helper is simulation and multidimensional approach. Work with simulation has to be adapted to a wide range of researched reality. The resolution is verification identified with business limits and improved results in additional layers from selected analytical disciplines. These layers such as indicators involve internal map reality. A natural request is simple and intuitive movement from one layer to another in the form of a zoom to needed data.

Key-Words: - Design, information, information technology, research, sustainable development, unexpected connections.

1 Introduction

Needs of people are continually higher, wider and more complicated. A similar situation occurs in companies, organizations and individuals. Such a reality creates numerous contact surfaces for cooperation, but also for difficulties. There are various interests in the form of competition pressure, consumer requests and default requirements on profit and cost reduction.

The list of the spectrum of powers which have effect on our reality is unlimited. We have to respect powers such as:

- Access to new information via learning.
- The available competencies of the brain.
- The existing processes around us.
- Facts in the form of data and information.
- Limited natural resources.
- Logic and emotions.

All these powers create the map of reality where we live. This is not only a question concerning the internal skills of everyone, or an individual company or organization. There is a global perception of our reality with all the positives and negatives. The Internet and social networks provide space for information and experience sharing. Appropriate interest is also focused on its future and architecture design. [1] There are many of these social networks [2] such as:

- Ask_fm.
- ClassMates.
- Facebook.
- Flickr.
- Google Plus+.
- Instagram.
- LinkedIn.
- MeetMe.
- Meetup.
- Pinteres.

- Tagged.
- Tumblr.
- Twitter.
- Vine.
- VK.

This composition of powers has a direct influence on the research which influences our reality, realized processes and a new vision. The work is difficult with all objects (powers which influence reality) and an optimal design research is need. The reason is the ability to focus on important objects for an optimal links on complete perception of context and information technology for large data, existing problems with unexpected connections between data and designed solution based on simulation and combination with new challenges for research in this matter. These themes gradually constitute the structure the paper.

2 A Dynamic and Compete Perception of Context

In business, companies, organizations and individuals are searching for a gap in the market for successful implementation of offered goods and services. The key is innovation and an upgrade with a regard to customer demand. The reason is clear – the more attractive a product, the higher the demand from customers and the more customers are willing to pay. The global market is overstocked, and also consumers are looking for optimal goods or services with the support of the Internet.

It is not enough to have an attractive product. There is a need to listen to customer requirements, and offer expanded programs of cooperation with customers, contractors, partners, competitions, science and also all other interested persons. The mutual cooperation must be dynamic with a higher level of quality. This request is standard because new approaches, products and services, and of course, new technologies are being introduced.

A number of companies, organizations and individuals have to face at present new conditions for realized activities. This environment has its mirror in science and its design. And, conversely, science affects our reality. It is a truly indispensable connection for further vision and sustainable development support. The question of sustainable development [3] is a basic theme for human life in the future. There are connections with expected topics such as:

- Biodiversity.
- The life environment. (water and atmosphere)
- Non-renewable resources. (metals, coal and petroleum)
- Renewable resources. (solar, wind, geothermal and biomass energy sources)

This approach is extended to other topics [4] which are also important for human life:

- The optimal utility of goods and services to society.
- The promotion of employment.
- The support of acceptable limits for a growing economy.
- The wise utilization of all resources with support innovation and an active approach.

Acceptable limits were, are, and will be a question for further development and science in all fields of human activities. The difficulty is that an inviolable limit for one is an acceptable limit for another. The actual decision depends on the point of view which is based on an accepted abstraction level, the adopted boundaries of the researched system, defined objects and their properties, and the created connections between objects and the ability to change the arrangement of the adopted design.

For innovation and research, design is important. [5] Interest is focused on suitable architecture and approach involving active implementation of new or innovative products and services. The arrangement of the adopted design is the first step to innovation for sustainable development. Such a design has to be verified and realized in practice via an optimal method. A good helper is simulation with IT support and models of data, information, knowledge, and intelligence [6].

Information technology has a major influence on all disciplines and realized activities. The reason is that people work with great volumes of data and information. This volume exceeds our senses, and the new concept is created in the form of “a Digital Universe”. Based on a research study, a digital universe such as a stack of tablets creates two-thirds of the distance to the Moon in 2013. This figure should reach approximately 6.6 stacks from the Earth to the Moon by 2020. [7] Data availability is the primary power to work with new approaches for increasing the value of our activities based on large data.

3 Information Technology for Large Data

Large data and increasing value, the Internet of Thinking with benefits and opportunities, needs and imperatives, weaknesses and negatives are at the centre of numerous analysis and surveys. [8] The primary topic of interest is focused on the connection between the digital universe and:

- The expanding.
- The influence on business.
- Opportunities.
- Power.
- The connection around the world.
- Transformation.
- Visualization.

A number of people ask how large the digital universe is and how can I work with this universe. The size of this digital universe is easy to calculate and estimate. With a verified analysis, the digital universe is doubling in size every two years and between 2013 and 2020 will grow from 4.4 trillion gigabytes to 44 trillion gigabytes. [9]

This space is large enough for intensive searching of a new connection between stored data from various sources. This space is fully comparable with the number of stars, planets and other objects in the universe. The benefit is that the universe offers a great deal of inspiration for work with data under unusual combinations. Similar unusual combinations are needed for an innovative approach and the development of new products with services.

Gig data provides many important connections for an active approach in companies, organizations, and individuals with regards to a global society. There are examples of good practice, but also projects which ended in failure. [10] It is understandable why information technology does not help enough here. Information technology has enough available software, applications, systems, and utilities for optimal resolution of selected activities.

Every IT user can select from open-source and commercial IT products with specified preferences. This spectrum of IT products involves needs and provides suitable support realized activities via implemented processes. The successfully completed projects often need connections with many operations:

- Automation communications.
- Automated offering and alarms.
- Basic and advanced analysis.
- Clustering data into large data sets.
- Configuration needed processes.

- Detection of unexpected situations.
- Early detection of problematic activities.
- Non-stop algorithms.
- Prediction of further development.
- Setting rules for statistical matters.
- Simulations.

The description of such a complex unit has an optimal link to data science. [11] The differences between data science and other disciplines are extremely slight. For an active and complete approach, there is a need for interaction between all available analytic disciplines for searching out unexpected connections between data on a large-scale. Well-known analytic disciplines [12] are:

- Business analytics.
- Computer science.
- Data analysis.
- Data engineering.
- Data mining.
- Econometrics.
- Mathematical optimization.
- Operations research.
- Predictive modeling.
- Six sigma.
- Statistics.

The above-mentioned list is not complete of course. One should probably add additional forms of intelligence such as Artificial Intelligence, Business Intelligence, Customer Intelligence, Competitive Intelligence and Swarm Intelligence.

From the complete view, the searching out of unexpected connections between data is not all that easy. We have to respect:

- Benefits of analytical disciplines.
- Data science and the digital universe.
- Dynamic IT development.
- Hunger for innovation.
- Limits to our knowable reality and skills.
- Needs of companies, organizations and individuals.
- New scientific knowledge.
- Positives and negatives of global society.
- The power of large data.
- Strengths of all intelligence forms.
- Wide spectrum of interests.
- Work with social networks.

Based on these lists, problems are visible in searching out existing connections between data. The challenge is to search for unexpected connections between stored data.

4 Problems with Unexpected Connections between Data

Connection searching between stored data is a standard activity realized with the support of information technology. This task has links to monitoring, alert processes and security needs. For standard IT users, there are natural requests based on implemented IT support. The well-known tasks are:

- Analysis of priorities and the overall time required to solve user requests.
- Detailed overview of activities.
- Key Performance Indicators and their development.
- List of transactions.
- Performance by price development.
- Relationship sales and margins.
- Sales development by prices, customers, location, or product and time.

Needed analyses are shown via dashboards with various graphs, lists, or summaries and filters. The

Qlik Sense Desktop [13] is a good example which provides a complete approach.

For example, the average time to solve a request (in days for system development, standard surgery, web infrastructure, IT operations, web infrastructure, or other requirements outside of IT) use dimension (Case Owner Group), facts (Avg Case Duration), and filter (by average time and case owner group).

IT users use priorities for better resolution in detail with an advantage. There are also:

- A number of cases with high, medium and low priority.
- Open and resolved cases by the time required to solve
- Open cases and their term solutions.

For these analyses, the dimensions create a Case Owner or Date, and the facts create Avg Case Duration, Open Cases, Overall, Total New Cases, Total Closed Cases. Please see Fig. 1.

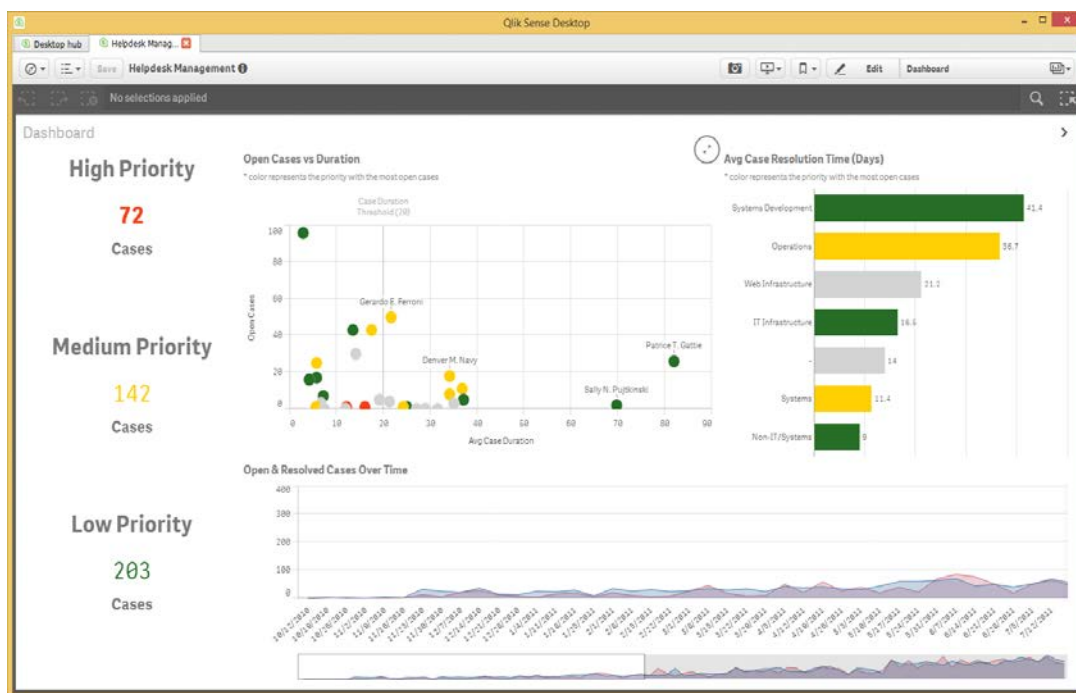


Fig. 1: A window for active work with data in QlikSense Desktop.

It is not a problem to design an optimal dashboard for default and well-known connections with stored data. The question is going further and designing new unexpected connections. A suitable way is to attempt to combine existing analyses based on dimensions and facts. This approach is haphazard and requires cooperation between

business managers and IT specialists on large data and data science.

Many IT users (and also business managers) prefer individual work with data; therefore, Excel is very popular for work with data. Everyone is familiar with contingency tablets. For suitable work with large data, it is insufficient. Initial activities

have to be focused on clarification of specified requirements and needs:

- To identify business limits.
- To remove these limits.
- To look for suitable replacements.
- To look for improved results.

Business limits constitute a list that includes the unfulfilled processes and the limiting business associated with the negative activities. For active identification of business limits, good helpers are the following questions:

- What do you think you are not so successful at? In what area would you like to improve?
- What processes of your business would you specify as unqualified?
- What new processes are you afraid of realizing?
- What are your favourite processes?
- When you wish to create an optimal business, what do you realize?

Removal of existing limits has close links with difficult conditions in a dynamic and competitive market economy. The interest is often focused on the question of the price of the offered products, and searching for suitable substitutes, innovations via processes, products, or organization of work. The default part of this question is the correct evaluation of specified limits and their influence on competition and customers. Looking for suitable replacements is focused on realization of selected activities in a different way in order to produce optimal results using available sources, processes and skills. The aim is to define processes for change that will be able to produce positive results. Looking for improved results represents knowledge about existing processes which are suitable for change based on knowledge management. [14] The interconnection of all the specified requirements and needs creates a good starting-point for accepting business into a new internal map of reality.

Based on this internal map of reality, needed objects are easy to create. The benefit object approach [15] is the ability to define optimal properties and methods for active work and searching for unexpected connections between data. Good results provide a combination object approach with multidimensional methodology [16]. This approach uses various levels as adopted abstraction, IT support, needed time, but also interest which is

focused on data, information, processes, functions, organization, finance, management, software, and hardware. Based on such information, simulation provides space for a combination of defined objects with needed connections.

5 A Solution Based on Simulation and Combination

Effective resolution actual question of business and society needs is challenge for all disciplines that work with data. Initial work is oriented on data collection and specification areas of interest. There are default thousands and thousands of lines of records about current events in the company or organization. These lines are often complemented by other external sources of data.

Immediate results bring well-known an analysis of selected topics by experience, advices of suppliers implemented IT products, but also other users' experiences with support the Internet. In this point, there are created basics for further search unexpected connections between data.

The optimal solution has two ways:

- To create a team of experts with good orientation on all disciplines for suitable impact on work with data.
- To create a team of a few experts with good orientation on selected disciplines for suitable impact on work with data.

The first way needs many resources and support rather large teams in the opulent and global companies. Cooperation is the key for their success. The second way needs also resources a work with team, but range is variable according to existing options. This approach has good links on agile methods and agile development tools. There is also risk that given team does not use all the opportunities of current knowledge.

Such risk is limited by a continuous shift between disciplines supported by the zoom on the present question. The benefit is work with only a few selected objects, and obtained results are compared via further analysis with orientation on other disciplines by preferences. This approach reduces errors caused by the omission of important objects from various disciplines. If important object is deprived then the substantive context is naturally addressed via other zoom. Please see Fig. 2.

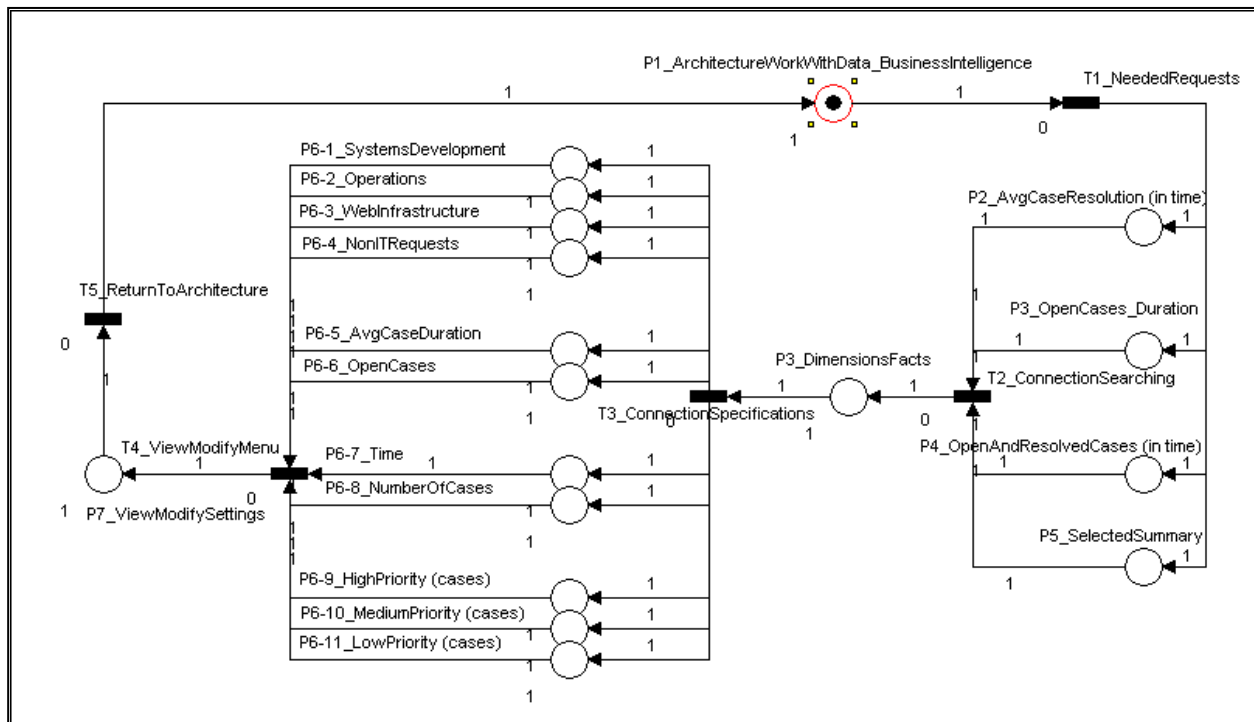
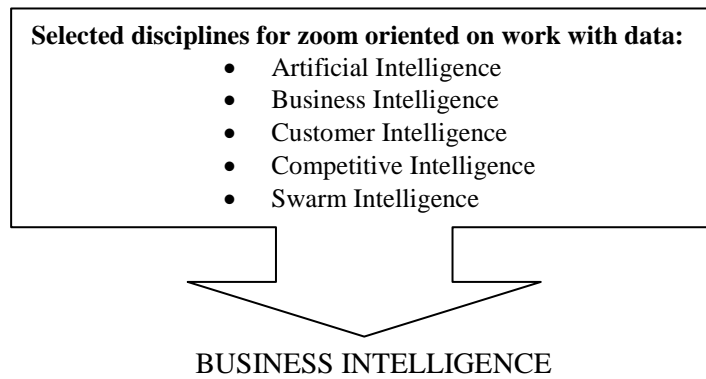


Fig. 2: An architecture for active work with data based on selected dimensions and facts (Business Intelligence).

Active work with data is based on available skills and knowledge of selected team. Hardware and software needs are known with support the Internet. This sharing information is positive force for creation of general awareness about needs for implemented software and hardware. Searching unexpected connections between data uses individual zoom as level for work with data. Further work continues via other zoom, for example, based on Customer Intelligence.

6 New Challenges for Research and a Global Society

The problem of searching for unexpected connections between stored data provides many

challenges. These are closely linked to dynamic changes:

- Available resources.
- Available skills.
- Balancing benefits and losses.
- Customer needs.
- Different experience.
- Different perspective.
- Global changes.
- Information technology.
- Competition pressure.
- Perception of reality.

This high level of instability needs regular actualization for a background of created simulation. Every simulation provides the benefit of

simple manipulation with objects. Created objects are deleted, and new objects are similarly created with only a few clicks of a mouse. The changed simulation is run for searching for a hidden relationship.

7 Conclusion

Data, information and knowledge are needed for active resolution of various interests in the form of competition pressure, requests by consumers, default requirements for profit and cost reduction. The resolution of the hard pressure of the market economy is optimal support for information technology with all the benefits of a global information society. A number of companies, organizations, and individuals work with data on a basic or average level in terms of closely defined interests, skills, sources, and processes regarding all realized business activities. In this situation, it is difficult to search for unexpected connections between data.

The creation of a new connection between data from the digital universe entails interest about opportunities, power, expanding, transformation, visualization, influence on business, and connections in global society. This complex reality is reflected in many forms of intelligence such as artificial, business, customers, competition and also swarm. Current work with these intelligences is not easy. A solution is needed which provides simulation with a combination of individual intelligences as additional layers. The transition has to be easy such as with Petri Nets based on defined objects and their properties.

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