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BUSINESS ANALYTICS FOR VISUAL MANAGEMENT WITH APPLICABILITY IN E-COMMERCE

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ABSTRACT

The purpose of the paper is to study the interconnection between Visual Management and Business Analytics and to suggest practical framework to monitor E-commerce processes. Based on a theoretical approach regarding Visual Management, Business Analytics is proposed to optimize operations and decisions. The design of Visual Management boards is theoretically substantiated and implemented in an E-commerce case study.

Keywords: Visual Management; Business Analytics; MS Power BI

INTRODUCTION

The principles of Visual Management (VM) have been applied in some production and service organizations for a long time (Tezel, 2009). VM is part of the lean production system and can be approached from different scientific disciplines e.g. management disciplines, data science or IT& C. As mentioned in (Eaidgah, 2018), Visual Management is a solution to improve the information own in organizations. It helps operational teams to evaluate their Key Performance Indicators (KPIs) as part of their daily management. VM uses visual interfaces to make the data more attractive and accessible to teams. With techniques that make performance more visible, less time will be needed to identify problems and performance-related issues. Once visual displays have been created and teams and employees at all levels have visual access to key information, Visual Management "should extend to setting up daily, weekly and monthly routines around these scoreboards".

Visual Management was initially designed to be applied to the Japanese automotive industry, but later VM methods have been adopted by other industrial sectors. Areas like management, production or process control can benefit from VM, business users are supported in decision-making, and performance is improved when using Visual Management in a company (Galsworth, 2017). The scope of VM is: information for employees; display of problems or deviations from the actual state; promotion of identification with the company; motivation of employees. Visual Management uses the following methods: 5S method, the Visual Management Board and KanBan. In addition, further methods are considered: Andon, A3 reports and Ishikawa diagram (Ortis & Park, 2010).

Concluding, Visual Management is "a management system focusing on performance management and continuous improvement based on the use of graphic visualization techniques

and information sharing" (Liff & Posey, 2004). According to the same authors, it should be integrated into the overall management system and "it makes strategic elements tangible and visible by integrating them into the daily business routine and by taking the organizational vision, the core values, the goals and the corporate culture into account".

Despite the existence of typical VM software, e.g. Kanban tools, we propose a Business Analytics (BA) framework for developing VM boards. Business Analytics involves working with and manipulating data, extracting insights from data, and using that information to enhance business performance. The scientific approach has a practical purpose in the field of e-commerce.

RESEARCH METHODOLOGY

Design Science Research (DSR) is a research paradigm accepted in disciplines such as engineering. Nowadays, the research paradigm has been extended to information systems science (Hevner et al., 2010). The DSR methodology is "an artifact-centric creation and evaluation approach". The research methodology implies the design cycle of "artifacts of practical value to either the research or professional audience" (Pfeffers et al., 2006). In information system science artifacts are systems, applications, methods, data models, data visualizations, and others "that could contribute to the efficacy of information systems in organizations" (Prat, Comyn-Wattiau & Akoka 2020).

According to a previously initiative presented in (Muntean et al., 2021), the key element of the BA framework are the information artifacts. "The information artifacts are generated from available data, through modeling and transformation, to the desired form for visualization in order to satisfy the need of information of the business users" (Muntean, 2021).

Design Science Research as an artifact-centered research approach. The DSR process establishes the way in which the desired artifacts are designed and developed. The following phases are part of the process (Figure 1):

- Initial phase: Problem identification and motivation; Defining the objectives of the solution ;
- Phase 1: Designing and developing the initial artifacts; Evaluation of the initial artifacts; Communication the results of phase 1;
- Phase 2: Designing and developing of some intermediate artifacts; Evaluation of the intermediate artifacts; Communication the results of phase 2;
- Phase 3: Designing and developing the artifacts; Evaluation of the final artifacts; Communication the results of phase 3.

The transition from one phase to another is conditioned by the validation of the results.

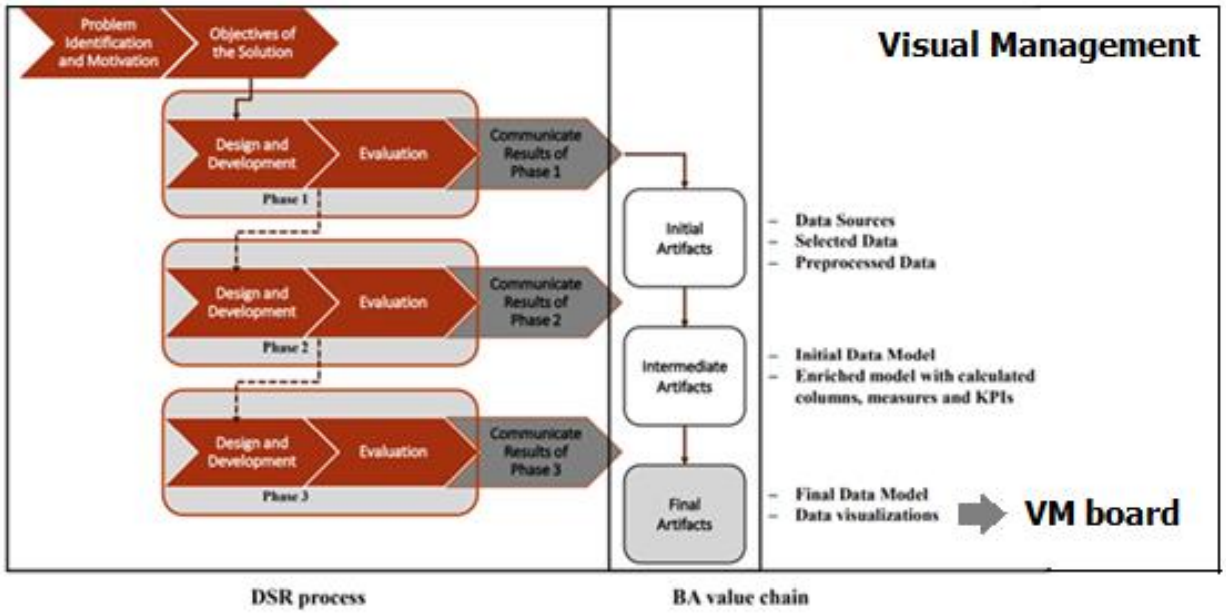

FIGURE 1. BA FRAMEWORK. INFORMATION ARTIFACTS BUILT DURING THE DSR PROCESS (MUNTEAN ET ALL, 2021)

The main information artifact in BA are:

- Initial artifact: data sources; selected data; preprocessed data that is prepared for integration into the data model;
- Intermediate artifacts: initial data model; intermediate data model that contains further data columns, measures and KPIs;
- Final artifacts: final data model; data visualizations.

We translate the artifact oriented development process to Visual Management. With the help of the data visualizations, we will design the different VM boards. Our initial data is stored into the in-house business software, in the transactional database. The required data is integrated into the BA environment, further processed in order to develop de data model. Finally, the VM board is designed (Figure 1).

Based on the general BA framework introduced in Figure 1, we have designed the approach for developing VM boards (Table 1). All activity outputs in Table 1 are information artifacts.

Table 1
DSR PHASES AND ACTIVITIES FROM DATA TO VM BOARD

Phase	Activity	Output
Ph0: Initial phase	A01: Problem Identification and Motivation	O01: Objectives of the Solution O02: Requirements for the VM board
	A02: Defining the objectives of the solution	
Ph1: Phase 1	A11: Design and Development of the initial artifacts:	O11: Preprocessed data
	- Data Source Identification	
	- Selection of the necessary data	
	- Preprocessing of data (data cleaning, data transformation)	
	A12: Validation of the initial artifacts	
	A13: Communication of the results	

Ph2: Phase 2	A21: Designing and developing of the intermediate artifacts	O21: Initial data model O22: Enriched data model
	Data Integration in the BA framework	
	Data Modeling in the BA framework (defining calculated columns, measures, KPIs using DAX)	
	A22: Validation of the intermediate artifacts	
	A23: Communication of the results	
Ph3: Phase 3	A31: Designing and developing of the final artifacts	O31:Final data model O32:VM board
	- Establishing the final data model in the BA framework	
	- Designing the data visualizations and the VM board	
	- Using different modeling algorithms in the BA framework (implementation with Python scripts)	
	A32: Validation of the final artifacts	
	- Testing the VM board (VM board checklist)	
	A33: Communication of the results	

ANALYSIS AND RESULTS APPLICABILITY IN E-COMMERCE

VM boards are useful tools for conducting Visual Management in the field of Ecommerce. Ecommerce activity imply the interaction of the in-house business software, usually an Enterprise Resource Planning system, with the ecommerce website/system and the courier service/software. The process flow (Figure 2) covers following stages:

- Receiving orders from the ecommerce system;
- Processing order information;
- Shipping products;
- Delivering products to the customers.

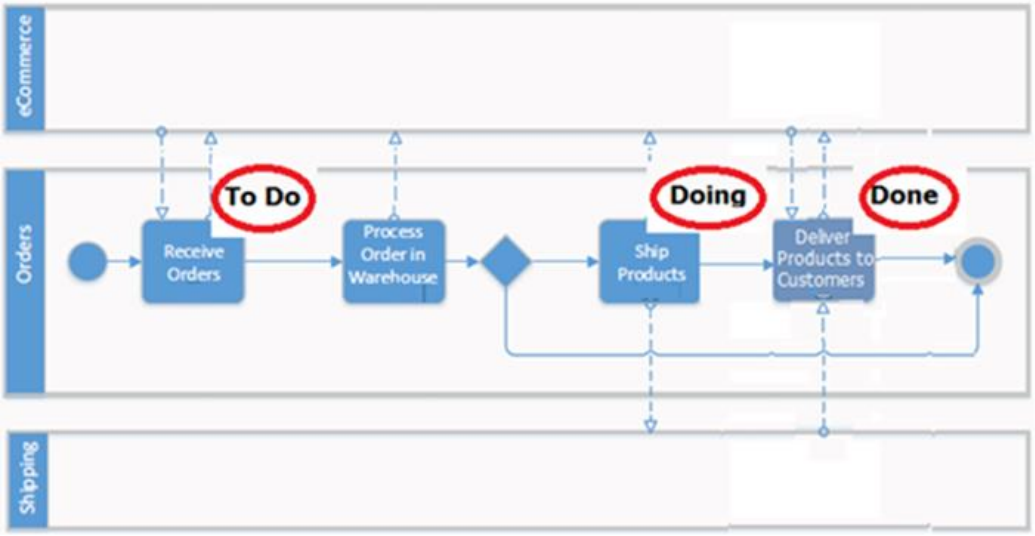

FIGURE 2
ECOMMERCE PROCESS (ADAPTED FROM ORBIS SOFTWARE, 2017)

To integrate Visual Management (VM) into the work process we have established the three work stages ”To Do”, ”Doing” and ”Done” that the Ecommerce process goes through. A 10-day time slot is set, which is automatically updated as time passes. The VM board displays the followings:

- To Do list: contains new received orders that have to be processed;
- Doing list: contains orders whose products have been shipped;
- Done list: contains orders whose products have been delivered to the customers.
- The daily progress of new, shipped and delivered orders in the considered time interval.

For the current state, we propose a set of indicators, like total_customers, total_orders, total_quantity, total_discount,total_sales_income and total_net_ profit. These indicators are calculated for To Do, Doing and Done orders (Figure 3). Also, the SMART (Specific Measurable Achievable Relevant Time-bound) indicators are highlighted.

The data model has a relational schema based on associated tables. Necessary data processing is implemented using DAX syntax in defining calculated columns and measures, e.g. with formula (1) a new table with the data recorded in the last 10 day is created.

Table tblOrders last 10days
tblorders last 10days = FILTER(tblOrders,[Order Date].[Date] >
(1)
(TODAY()-10)||tblOrders[Status]=”To Do” || tblOrders[Status]=”Doing” || tblOrders[Status]=”Done”)

The content of table “tblOrders last 10days” is automatically updated according to the timeline. Additional, Python scripts consolidate the analysis and the data visualizations (see script (2)). It defines the BAR visualization in Figure 3.

clrs = [’red’ if (x ==”To Do”) else ’yellow’ if (x==”Doing”) else ’green’ for x in values]
sns.barplot(x, y,data=dataset,order=[”To Do”, ”Doing”,”Done”],palette=clrs)
plt.show()

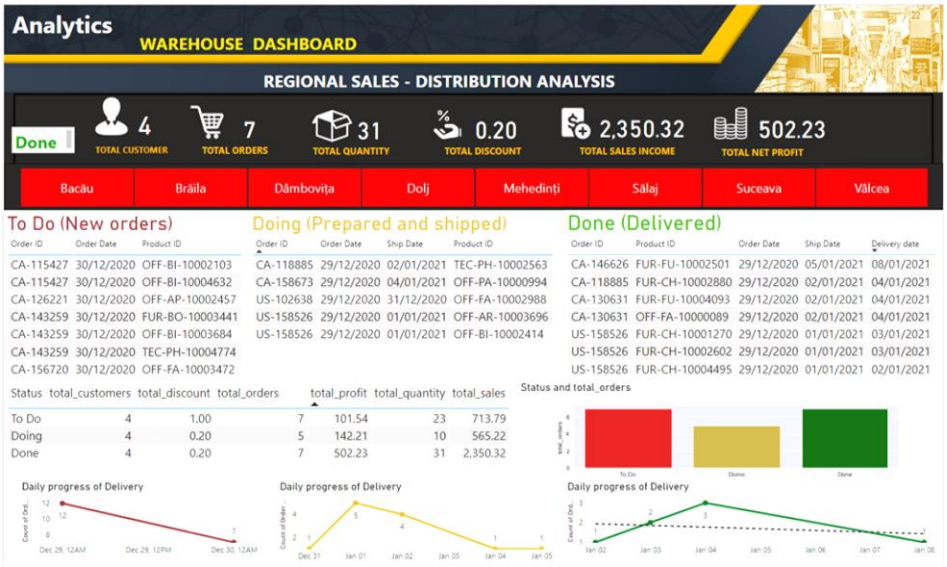

FIGURE 3
VM BOARD FOR MONITORING E-COMMERCE PROCESSES

The dashboard in Figure 3 is a representative example of a VM board used in the field of Ecommerce. Based on Kanban “To Do”, Doing” and “Done” tasks, the VM board displays in real-time the orders according to their status: ’New orders’, ’Prepared and shipped’ and ’Delivered’.

DISCUSSION

Relevant theoretical and empirical studies on Visual Management are exposed in (Bell & Davison, 2013). The proliferation of visual practices and artifacts combined with the increased prevalence and complexity of visual technologies in organizational life have influenced management research (Eriksson & Funding, 2018). Visual Management is used within operations management practice, particularly in association with process improvement initiatives in diverse areas such as production (Beynon-Davies & Lederman, 2017).

Focusing on the information resource, VM can be defined as follows: Visual Management is "an information management strategy that relies on the effectiveness of information integrated into process elements, close to where information needs might occur" (Tezel et al., 2015). Based on the earlier considerations of Greif (1991), the information displayed by visual representations has the following characteristics:

- the information is presented into a self-service manner;
- the information is "entirely determined ahead of time";
- the information relies little or none on spoken words

In addition, because of its direct impact on processes, the information displayed by the visual controls contributes to the better monitoring of the processes (Formoso et al., 2002).

Visual Management is conducted using proper boards, dashboards. It is important that these boards are designed "to track measures that drive results". An "acceptable" timeframe is established to read the status of the key measures and to constantly monitor the process.

Business Analytics (BA) refers to "skills, technologies, and practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning" (Bartlett, 2013). Business Analytics projects are data-centric: data from different data sources is integrated into a data model. The data model is configured to meet the requirements. Data is processed generating new information. Key Performance Indicators (KPI) is defined. Finally, the KPIs and their associated information are included in visualizations, business analysis is performed.

CONCLUSION

Three areas of current interest are addressed in this paper, namely Visual Management, Business Analytics and E-commerce. The research approach implies a literature review on visual management, the use of Design Science Research for establishing the methodological approach and the use of a case study for conducting the practical demarche.

The e-commerce market has registered a rapid evolution in the last years, trading large volumes of products and services. The challenges stem from the need to fully automate processes, to rapidly process large volumes of data specific to these transactions.

Visual Management is a business management technique successfully used in the lean systems. It aims to increase process transparency by providing information in an intuitive visual way that requires no further explanation.

Business Analytics solutions are used to build analysis models and simulations to create scenarios, to understand realities and predict future evolution.

Both Visual Management and Business Analytics are operating with information artifacts, starting with various data sources, continuing with processed data, and finally with

different data visualizations. BA uses a combination of practices, techniques, applications, skills, and technologies to generate business value from data, and therefore we propose to use Business Analytics tools for supporting Visual Management. Going further, we propose to extend the use of Visual Management from production systems to E-commerce processes.

Visual Management approaches and implementations are reinforced by the use of Business Analytics to optimize operations and decisions.

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