Constantin Brancoveanu
prince of Wallachia
(1688–1714)

About C. Brancovsanu

Constantin Brancoveanu was a skillful politician who secured during a peace and elevated Wallachia's economy and culture. As a patron, he also laid the foundations of a style of architecture and art.

1688 - 1714

Multi-Criteria Analysis in Choosing IT&C Platforms for Creative Digital Works

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Abstract: The paper presents several methodological aspects related to choosing the best IT&C (Information Technology and Communications) platform for creative digital works, with particular reference to the development of virtual exhibitions for mobile devices. The creative digital domain is presented and a review of several existing IT&C platforms and tools is made. The paper highlights several aspects and associated decision situations which may be met in the process of designing and building IT&C platforms for creative digital works, such as: selecting the IT&C tools, integrating the system into the enterprise, and evaluating the final project. A particular emphasis is made on evaluation criteria to be used in solving the various decision problems.

1. Creative Digital Domain

Creative digital is a new field of human activity that contains the creation and publication of multimedia elements delivered in digital format. In other words, it includes those activities meant for the creation and publication of informational and experiential multimedia elements that are currently being or will be produced and delivered in digital or virtual way. The definition of the digital creative domain covers also the software applications and services that enable or assist the activities of production, management, publication, and consumption of multimedia elements (Hearn *et al*, 2014).

A creative digital work is a manifestation of creative effort using facilities offered by digital technologies. This new concept is related to *creative industries* and *creative economy* which refer to a range of economic activities concerned with the generation or exploitation of knowledge and information (Adorno, 1991; Towse & Hanke, 2013). Many of the activities involved in the creative digital domain are related to traditional and analogue segments and sectors, such as movie-making and television that are evolving rapidly into complete digital production and delivery chains. The largest market share belongs to the computer game industry (Raessens & Goldstein, 2011). As mentioned in (Panourgias et al, 2014), the sector of computer games is considered very relevant to the exploration of human creativity in relation to digital technologies, because the development of computer games involves combining the cultural features with the highly sophisticated digital technologies that support them. Other activities are at the beginning, such as the *born digital* sectors that have recently emerged as broadband and mobile content and they do not include analogue media to manage or process through the value chain. Some other sectors, for example libraries and museums, provide a preservation and selective access and re-use not only for born digital media, but also for physical media and even three dimensional artefacts that are digitized, so that they can be preserved, discovered, accessed and viewed in different ways in digital format (Hearn et al, 2014; Filip et al, 2015). The native digital or digital copies of the cultural objects of museums and libraries can be possibly used as ingredients in various creative digital products in advertising, design, architecture, e-publishing, and so on.

In the cultural heritage area, the digitization process is very important when discussing digital representations of cultural elements. The advantages of turning physical objects into digital objects are very relevant. It prevents them from destruction and also provides opportunities that have not existed before for new extended usages. Furthermore, the collections of different cultural institutions can be aggregated in large centralized archives and databases that allow collaborative access and more efficient working (Ciurea & Filip, 2015).

2. A Review of IT&C Platforms for Creating Digital Exhibitions

At the moment, there are several IT&C platforms and tools available on the market to produce creative digital works, including virtual exhibitions that will be very attractive for the visitors. Some of these tools were created with the support of research projects funding. Others were created by different IT&C companies. Among the most interesting IT platforms and tools, the following examples can be mentioned:

- *MOVIO*, an open source content management system designed for creating online virtual exhibitions (Minelli et al, 2014; Natale et al, 2014), which is largely utilized in the Athena Plus project (www.athenaplus.eu).
- *Prezi Digital Storytelling* (https://prezi.com/oqlnwmqutroa/digital-storytelling), an online tool to create attractive virtual presentations;
- *Omeka* (http://omeka.org), an open source web publishing platform which enables creating interpretive exhibitions.

MOVIO is a tool developed by GruppoMeta in Italy and allows cultural institutions to edit digital exhibitions as well as to tell digital stories. The platform supports multilingualism in the back end and also in the front end. The curator of the virtual exhibition may edit the contents using different tools integrated in the platform: media archive, ontology builder, storyteller, different types of image galleries, maps, timeline, and so on.

Prezi is a software for creating interactive presentations, but also is a storytelling tool, which is cloud-based. The product is designed for presenting information on a virtual canvas and is using a user interface that allows users to zoom in and out of their presentations and to display and navigate through the information from the presentation.

Omeka is an open source software, completely free, used for content management and online digital collections. The platform is developed as a web application that allows users to publish and exhibit different cultural heritage elements.

Figure 1 below presents an example of a virtual exhibition created by using MOVIO in the Romanian Academy Library (www.biblacad.ro). It is about Constantin Brancoveanu, the prince of Wallachia (1688–1714). The whole exhibition can be visualized at http://54.247.69.120/build/movio/movioTraining10.

Virtual exhibition created with MOVIO

Figure 2 below shows the same virtual exhibition, created with the Prezi software.

Virtual exhibition created with Prezi

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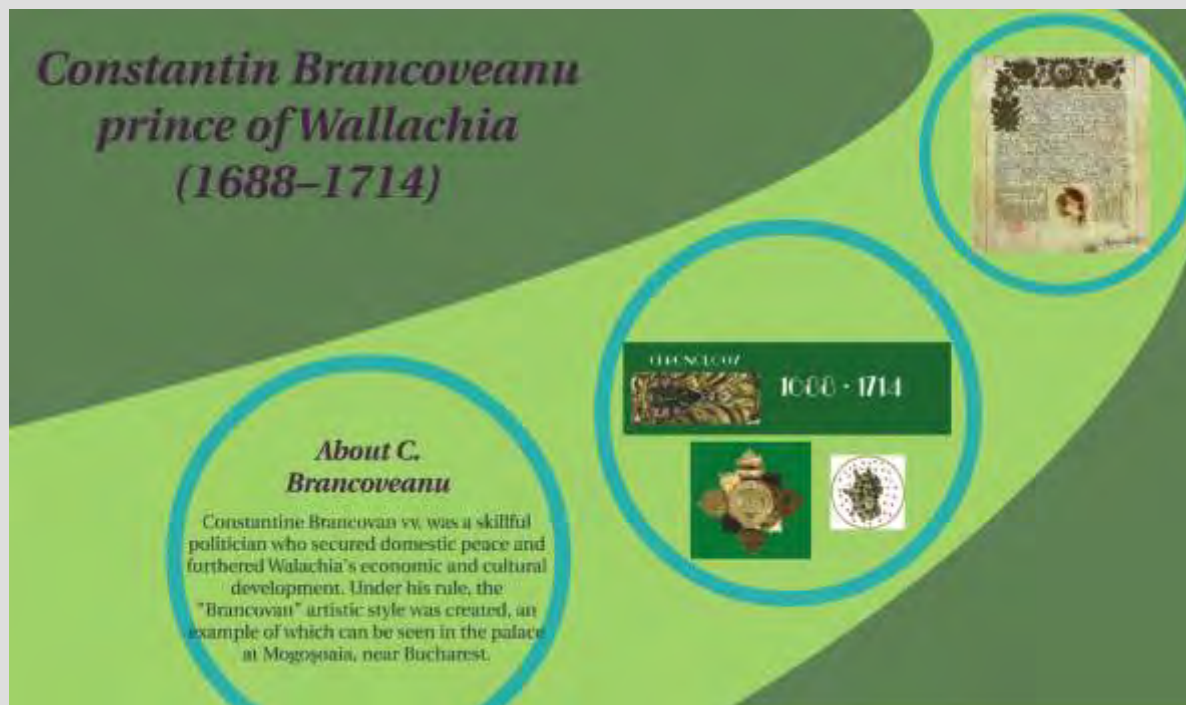
There are several factors which can influence the process of designing and implementing a virtual exhibition on mobile devices, such as the people involved, the orientation and the purpose of the mobile application, the organizational settings, standards used and so on.

These influence factors should be taken into consideration by the management of the target organization and by the designer of the virtual exhibition as well, when a decision on introducing and creating a mobile application for virtual exhibitions is to be made (Filip, 2012).

The mobile application for virtual exhibitions may be oriented to serve a certain generic class of users ("roles") or to help a specific group of persons with names, identities and specific IT&C skills ("actors"). Nowadays, virtual exhibitions are not considered as passing fads, but a representative extension to physical exhibitions. By using such tools or by implementing native mobile applications for Android, Windows Phone, or iOS platforms, very attractive virtual exhibitions can be created for mobile devices.

3 Methodology

In implementing a mobile application for virtual exhibitions, a major initial decision is making a choice between the alternatives of buying or leasing IT&C products. In recent years, the approach of using cloud services, such as the *SaaS (Software as a Service)* model, has attracted attention. The SaaS business model means that software vendors host on their servers the applications to be accessed, via Internet, by client organizations only when it is necessary. The pricing scheme is based on a *pay per use* one or a monthly lease fee, instead of initial license price and annual maintenance fee. The *SaaS* scheme can be of particular interest for smaller companies that have limited IT infrastructure and limited qualified personnel. On the other hand, when a decision is to be made, one should take into consideration long-term running costs and security issues. Availability of necessary IT&C infrastructure, ease of usage are the main evaluation criteria when a decision is to be made (Filip, 2012).

The decision of choosing the best platform does not belong only to the people involved in building and using the system, but also to other people with authority in the organization.
In decision theory, the *subjects of interest* are those characteristics of the assessed object which are taken into consideration at the moment of choosing the best platform. When a metric is associated to a subject of interest, we obtain an *evaluation criterion*.

The main evaluation criteria for selecting the best IT&C platform can be grouped into three subsets as follows (Filip, 2012; Filip, 2007):
- the *adequacy of the method*;
- the *quality of the informatics implementation*;
- the *acquisition and usage aspects*;
Table 1 presents the evaluation criteria used for selecting the best IT&C platforms for developing virtual exhibitions and other creative digital works where ⬆ indicates that the highest value is preferred and ⬇ indicates the lowest value is desired.

Subset	Evaluation criteria	Obj
adequacy of the method	- accuracy of results;	⬆
	- response time	⬇
quality of informatics implementation	- scalability;	⬆
	- functional transparency;	⬆
	- flexibility;	⬆
	- code compactness;	⬆
	- variety of available options;	⬆
	- reliability, robustness, security and data integrity;	⬆
	- completeness and quality of documentation.	⬆
way of acquisition and usage	- quality and completeness of delivery;	⬆
	- delivery time;	⬇
	- warranty and post supply assistance offered;	⬆
	- acquisition price;	⬇
	- general reputation of the supplier;	⬆
	- dependency on technical support;	⬇

Evaluation criteria for choosing IT&C platforms (Filip, 2007)

The values of measuring the quality of a certain possible solution with respect to evaluation criteria above presented are introduced in MADM (*multi–attribute decision making*) models, to be solved by using the available algorithms to obtain a ranking (Filip, 2002; Shi et al, 2012, Stefanoiu et al, 2014: chapters 4 and 5; Zavadskas *et al*, 2014).

In case more persons are involved in selecting the platform in order to aggregate individual preferences through the weighted average method (Stefanescu *et al*, 2014), the following rules (Nitzan & Parush, 1983) are suggested to be used:

- the *rule of simple majority*, where the importance of each participant's opinion is equal and weights are expressed by the vector , $w = [1,1, ... , 1]'$, where T indicates the transpose of the vector;
- the *rule of restricted simple majority*, where the opinion of a single person is higher than others, $w = [2,1, ... , 1]'$;
- the *rule of simple quasi-majority*, where the preferences of some people have bigger weights, $w = [3,2,,1, ... , 1]'$;
- the *rule of almost unilateral decision*, where the project sponsor's opinion is imposed, $w = [10,1,1, ... ,1]'$.

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4. Example

Today a lot of IT&C platforms and tools for developing a virtual exhibition are on the market, and the offer is growing from one moment to the next.

We consider the following example for choosing the best IT&C platform for developing virtual exhibitions. We are taking into consideration the platforms and tools mentioned above in the paper, namely MOVIO, Prezi, and Omeka.

In Table 2, we are considering the following results obtained from an expert in the domain of virtual exhibitions with respect to evaluation criteria of selected IT&C platforms.

Subset	Evaluation criteria		Obj	MOVIO	Prezi	Omeka
adequacy of the method	-	accuracy of results;	⬆	0.9	0.8	0.6
	-	response time	⬇	0.5	0.7	0.8
quality of informatics implementation	-	scalability;	⬆	1	0.8	0.9
	-	functional transparency;	⬆	0.8	0.8	0.7
	-	flexibility;	⬆	0.8	0.9	0.8
	-	code compactness;	⬆	0.9	0.7	0.7
	-	variety of available options;	⬆	0.9	0.8	0.5
	-	reliability, robustness, security and data integrity;	⬆	1	0.8	0.9
	-	completeness and quality of documentation.	⬆	0.8	0.8	0.7
way of acquisition and usage	-	quality and completeness of delivery;	⬆	0.8	0.8	0.7
	-	delivery time;	⬇	0.3	0.7	0.6
	-	warranty and post supply assistance offered;	⬆	0.9	0.8	0.8
	-	acquisition price;	⬇	0.3	0.4	0.5
	-	general reputation of the supplier;	⬆	0.9	0.7	0.7
	-	dependency on technical support;	⬇	0.2	0.5	0.3

Table 2. Experimental results of evaluation criteria for selected IT&C platforms

As presented in Table 2, most of the best scores are obtained for the MOVIO platform, which means that MOVIO is considered the best IT&C platform, compared with Prezi and Omeka, for developing virtual exhibitions.

5. Concluding Remarks

The activities of designing and implementing virtual exhibitions, by using different IT&C platforms and tools, compose a process which may include many decisions to be made at different stages. There are several critical aspects, both of technical and non-technical nature, which should be taken into account. Among the main aspects which might cause problems are the evolution of the technical constituents together with increased client requirements for solution quality. Multi-attribute decision criteria and models could be effectively utilized to solve the decision situations encountered.

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