INTEGRATED APPROACH TO THE EVALUATION OF DIGITAL LIBRARIES: AN EMERGING STRATEGY FOR MANAGING RESOURCES, CAPABILITIES AND RESULTS

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ABSTRACT
The growing importance of the networked environment and the consequent change in users’ information behaviour has challenged the library academia and professionals’ skills to find new and more adequate strategies and methods to assess the performance of traditional, hybrid or digital information services. This paper aims to detail the strategy and methodology used by a research team to evaluate the performance of the Portuguese Digital Library consortium.

Using a holistic user/stakeholder-centred approach, the researchers designed a Digital Library Integrated Evaluation Model. The five key-component of this model are presented: (a) Diagnosis; (b) Strategical groups and performance information needs; (c) Perspectives on performance evaluation; (d) Evaluation criteria and methods; (e) Evaluation points of view.

The evaluation methods, techniques and tools developed under two of the Model components – (c) Perspectives on performance evaluation and (d) Evaluation criteria and methods – are particularly discussed:
• the Digital Library Balanced Scorecard;
• the Matrix of Perspectives and Strategical Measurement Areas and the related performance measures and indicators;
• the Digital Library Service Quality Model and the multiple-item scale used in the assessment process.

The case study is also used to explore potential interactions between evaluation cultures/environments and learning professional skills, with emphasis on benchmarking and other interesting perspectives for research.

1. EVALUATING THE NETWORKED ENVIRONMENT

For more than four decades, performance evaluation of library and information services has been captivating the attention of professionals and researchers of the Information Science area. The models used in the evaluation of these services have been categorized by Hernon and Altman (1996) in the following way:
• **Extension** (amount): models that implement measures to find out ‘how much’ inputs (financial resources, staff, documents, etc.) or outputs (activities, services’ use, etc).

• **Efficiency**: models centred in the establishment of ratios between inputs and outputs, most frequently per capita ratios.

• **Cost**: models focused on the average cost per input/output; when combined with extension and efficiency measures, they generate cost-effectiveness indicators;

• **Quality**: models developed to evaluate results (outputs) in terms of quality (reliability, relevance, etc. of a given service and user satisfaction with that service);

• **Effectiveness**: models that evaluate how an information service is attaining its goals and its alignment with the parent organization, as well as the organisation’s capacity to fulfil users’ needs.

As R. Cullen (2003) points out, cost-effectiveness analysis, RoI (Return on Investment) or impact and value assessment are other important approaches that have been used in the evaluation of information services.

The advent of a new networked environment in the beginning of the 90s of the 20th century brought increased complexity to this library and information services’ diverse evaluation context: traditional, hybrid and digital libraries coexist in the same geographical space and, sometimes, within the same organisation.

Among many existing definitions of the Digital Library (DL), we can pick one provided by Leiner (1998):

‘The Digital Library is:
- The collection of services
- And the collection of information objects
- That support users in dealing with information objects
- And the organization and presentation of those objects
- Available directly or indirectly
- Via electronic/digital means.’

According to T. Saracevic (2004), the main problem in evaluating DL derives from the difficulty in establishing evaluation borderlines. Based on a literature review on DL evaluation, this author identified seven possible approaches to this subject (Table 1).

Despite these multiple approaches and the existence of several possible levels of analysis, in 2000, Saracevic pointed that ‘As yet, digital libraries are not evaluated on more than one level. This isolation of levels of evaluation could be considered a further and greater challenge for all digital libraries evaluations. In addition, as a rule, many systems are used in ways that their designers never intended’

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1 Saracevic (2000) identifies seven levels of analysis integrated in three perspectives or approaches: the user, the interface and the system.
### Table 1: Context of digital libraries evaluation (Saracevic, 2004, p. 5)

<table>
<thead>
<tr>
<th>Context of evaluation</th>
<th>Description</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems-centered approach</td>
<td>Implies the study of efficiency/effectiveness</td>
<td>Used frequently.</td>
</tr>
<tr>
<td>Human-centered approach</td>
<td>Implies the study of behaviour about informational needs ('information seeking, browsing, searching).</td>
<td>Very much used.</td>
</tr>
<tr>
<td>Usability centered approach</td>
<td>Implies evaluation by users</td>
<td>This approach is a bridge between systems approaches and human centered approaches.</td>
</tr>
<tr>
<td>Ethnographic approach</td>
<td>Implies the realization of studies about life styles in digital libraries and the study of impacts</td>
<td>Applied with success.</td>
</tr>
<tr>
<td>Anthropological approach</td>
<td>Implies the study of different stakeholders and their cultures related to digital libraries</td>
<td>Applied in one study with interesting results.</td>
</tr>
<tr>
<td>Sociological approach</td>
<td>Implies evaluation of situational actions in user communities</td>
<td>Applied in only one study.</td>
</tr>
<tr>
<td>Economic approach</td>
<td>Implies cost studies, cost-benefit, value and economic impact.</td>
<td>Applied in the beginning of digital libraries (PEAK Project)</td>
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</tbody>
</table>

(p. 364). In 2004, he added: ‘Digital libraries are complex social, institutional and technical systems. No evaluation can possibly address all these aspects together’ (p. 5).

This tension between the need for complete knowledge of an information system and the impossibility of reaching that absolute knowledge suggests the adoption of a holistic cumulative approach to evaluation where ‘… individual components can be combined to produce something beyond the sum of those components …’ (Nicholson, 2004). ‘In the context of measurement and evaluation’, as Nicholson points out, ‘it means that a more thorough knowledge and understanding of a system can be gained from combining different measures than can be de-
rived than taking those measures separately’ (2004). This sort of approach to evaluation was considered adequate for evaluating the Portuguese Digital Library consortium. From 2006 to 2007, the research team in charge of this DL evaluation initiative developed and implemented an Integrated Evaluation Programme.

2. A HOLISTIC USER/STAKEHOLDER-CENTRED APPROACH: THE DIGITAL LIBRARY INTEGRATED EVALUATION MODEL

Using a holistic user/stakeholder-centred approach, the researchers designed a Digital Library Integrated Evaluation Model (Figure 1).

This model is formed by five key-components:

a) Diagnosis;

b) Strategic groups and performance information needs

c) Perspectives on performance evaluation

d) Evaluation criteria and methods

e) Evaluation points of view.

a. Diagnosis

As mentioned by Bertot (2004), ‘Evaluative approaches are developed to answer the questions of what libraries need or want to know regarding their resources and services’, so he speaks about ‘needs driven evaluation strategies’ [p. 5] In this sense, pre-orientation towards stakeholders’ performance information needs is an important factor: ‘... stakeholders typically have diverse and often competing interests’ (Patton, 2002, p. 42). It is, therefore, essential to clarify and study the primary and secondary stakeholders (Reeves, Apedoe and Woo, 2003). On the other side, the ‘Resource dependence theory’ talks about organizational open systems in which environment transactions are very important because of their interdependence networks (Baron, 2003).

In the case of the Portuguese DL, the researchers identified two types of stakeholders:

- **Primary stakeholders**, directly interested or affected by the evaluation: DL consortium top managers, DL operational teams, libraries teams and end-users.

- **Secondary stakeholders**, envolving all persons/institutions interested on the evaluation and its results: suppliers, associations, visitors (national and international), scientific research community, digital libraries professionals, Information and Documentation Sector, Information Management market and citizens in general.

\(^1\) Created in 2004, this DL Consortium has clients in all sectors of society. More information is available at: www.b-on.pt
Based on the performance information needs of these two groups of stakeholders and also on an extensive literature review, a diagnosis of the DL environment was carried out.

**b. Strategical groups and performance information needs**

After concluding the diagnosis, the next step was the identification of the DL’s strategical groups and segments. The research team concluded that they equal the primary stakeholders that previously had been pinpointed.

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2 Concept introduced by Hunt (1972) to emphasize the strategical key-dimensions related to organizational performance and group performance.
The analysis of the DL strategical groups’ performance information needs led to the identification of five Strategical Perspectives.

c. Perspectives on performance evaluation

The inadequacy of traditional evaluation methods for the requirements of the emergent Knowledge Society led to the development of innovative evaluation methodologies like Kaplan and Norton’s Balanced Scorecard – BSC (1992, 1996). It was mainly the strategical dimension of this methodology that pushed the research team to adapt and integrate it into the DL Evaluation Model. The DL BSC is composed of five strategical Perspectives (see Figure 2).

- **Resources and partnerships** Perspective – it is concerned with the way internal resources (financial, information, technology, materials) and partnerships (supplier-buyer, cooperation, consortium) are managed to fulfill the DL strategy.
- **Clients** Perspective – this perspective covers all performance results related to the satisfaction of needs and expectations of clients and other DL stakeholders.
- **Results** Perspective – it is focused on the DL key-performance results, as well on its effects on users and other stakeholders.
- **Learning and development** Perspective – it covers leadership and staff management areas dealing with performance aspects like satisfaction, motivation, involvement and competencies development.
- **Internal Processes** Perspective – it is focused on the way processes are conceived, managed and improved in order to support organizational strategy, satisfy clients and generate value to all stakeholders.
Once the Perspectives were settled, the research team proceeded to the identification of the DL’s **Strategical Performance measurement areas**. In the **Matrix of Perspectives and Strategical Measurement Areas** the DL measurement areas are presented and related to the Perspectives (Figure 3).

<table>
<thead>
<tr>
<th>Perspectives</th>
<th>Resources and partnerships</th>
<th>Clients</th>
<th>Results</th>
<th>Learning and development</th>
<th>Internal processes</th>
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</thead>
<tbody>
<tr>
<td>Areas</td>
<td>DL collection</td>
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<td>Libraries electronic</td>
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<td>collection</td>
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<td>Libraries electronic</td>
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<td>services</td>
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<td>DL services</td>
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<td>Technological</td>
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<td>infrastructure</td>
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<td></td>
<td>Partnerships</td>
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<td>DL collection</td>
<td>Libraries electronic</td>
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<td>DL collection</td>
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<td>DL collection</td>
<td>services</td>
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<td>DL collection</td>
<td>Technological</td>
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<td>DL collection</td>
<td>infrastructure</td>
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<tr>
<td>DL collection</td>
<td>Partnerships</td>
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</table>

**Perspective: Resources and partnerships**

<table>
<thead>
<tr>
<th>Areas</th>
<th>ID</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL collection (contents)</td>
<td>iR-c1</td>
<td>DL collection growing rate</td>
</tr>
<tr>
<td></td>
<td>iR-c2</td>
<td>Percentage of databases in DL collection</td>
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<tr>
<td></td>
<td>iR-c3</td>
<td>Percentage of serials in DL collection</td>
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<td></td>
<td>iR-c6</td>
<td>Cost per serial</td>
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<td></td>
<td>iR-c7</td>
<td>Cost per content unit downloaded</td>
</tr>
<tr>
<td></td>
<td>iR-c8</td>
<td>Cost per FTE</td>
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<td></td>
<td>iR-c15</td>
<td>Percentage of serials with Impact Factor</td>
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</tbody>
</table>

Figure 3 – Digital Library’s Matrix of Perspectives and Strategical Measurement Areas

Table 2 gives an example of some the performance indicators used in the evaluation of the DL collection.

**Table 2 – Some performance indicators used in the DL evaluation**
d. Evaluation criteria and methods


In this case study, the information needs on performance determined the identification of six criteria in the Integrated Model:

- **Effectiveness** – Strategic management implies the focus on objectives in each BSC perspectives of evaluation defined, aligned with the organizational vision.
- **Extension** – gives information about resources (inputs) or results (outputs), being the basis for the development of ratios, like for example cost-benefit indicators.
- **Efficiency** – the relation between products and services and resources used in this process. This criterion measures the productivity in key-areas of performance.
- **Cost** – measures global costs of functioning. Combined with the criteria of efficacy generate cost-efficacy indicators.
- **Quality** – the concept of perceived quality based on gaps on perceptions and expectations of users (Berry e Parasuraman, 1991). In this perspective, service quality (SQ) always exists when users perceptions are greater than expectations
- **Impact** – the impact or outcome on skills, attitudes and behaviour of clients.

The application of the quality criterion to the evaluation of the Portuguese DL was based on the development of a tailor-made *Service Quality Model*.

e. The Digital Library Service Quality Model

It can be generically considered that underlying to the use of a product or service is the satisfaction of one given necessity of the user/client. Consequently, to reach superior levels of quality it is necessary to perceive which are the users’ expectations and requirements, how they perceive the delivered service, what the relevant dimensions of this service are and how users will evaluate these dimensions.

The use of a service involves a multiplicity of tangible and intangible aspects that makes the adoption of instruments that allow its measurement and evaluation particularly critical.

As Parasuraman, Zeithaml and Malhotra (2005) pointed out, despite the great profusion of studies on service quality, over all the last three decades, only one limited academic article dealt with e-service quality or web services quality evaluation. Because of their specificity, these services evaluation required the adoption of convenient instruments and scales adequate to their characteristics and users’ relevant evaluating aspects.
Based on empirical studies, several academic researchers have been using different e-service quality scales with relevant dimensions for this type of services. For example, Zeithaml, Parasuraman e Malhota (2000, 2002) developed e-SERVQUAL, which included seven dimensions: efficiency, reliability, fulfilment, privacy, responsiveness, compensation and contact. The scale developed by Loiacono, Watson and Goodhue (2002) – WEBQUAL – has twelve dimensions: informational fit-to-task, interaction, trust, response time, design, intuitiveness, visual appeal, innovativeness, flow, integrated communication, business processes, substitutability (better than alternative services).

Based on the conceptual model suggested by Zeithaml, Parasuraman and Malhotra (2002), the research team developed a Digital Library Service Quality Model to evaluate the quality of service delivered by the Portuguese DL (Figure 4).

This model is centred on users and assumes that service quality provided through digital library services involves different levels and a set of critical points that determines SQ. These critical points or Gaps are related to organizational deficiencies. If these gaps are monitored, it is possible to implement adequate measures to correct these critical points and improve service quality.
The model identifies some linkage between the identified strategical groups in this digital library evaluation process. These linkages have some critical points that can be identified as gaps:

- Digital libraries services intend to answer to the expectations of its users. The difference between the perceptions of the delivered service and the expectations generates service quality (fulfilment gap).
- **Knowledge gap** – it refers to libraries teams and libraries managers’ deficient knowledge on users’ needs and expectations.
- **Perception gap** is the difference between users’ perceptions and libraries teams and libraries managers’ perceptions on users.
- **Communication gap** reflects misunderstandings between different operational teams and institutions.

This model also assumes that a digital library is a multidimensional construct that includes three dimensions: (1) Efficiency, (2) Competitive advantage and (3) Adequacy of information.

**f. Evaluation points of view**

The (re)introduction of the stakeholders’ points of view on the DL evaluation corresponds to the final step in the construction of the Integrated Evaluation Model and guarantees the multidimensional, integrated and holistic structure of this model. As Nicholson points out, quoting Brophy and Couling (1996), ‘The same evaluation criteria will be judged in different ways by different participants in the process. In order to gain a holistic understanding of the evaluation, the viewpoints from different groups must be taken into perspective. (…) Therefore, it is important to be aware of the viewpoint of the group doing the evaluation and ensure different groups who might be affected through decisions made from the evaluation can participate in the process’ (2004).

**3. POTENTIAL INTERACTIONS BETWEEN EVALUATION CULTURES/ENVIRONMENTS AND LEARNING PROFESSIONAL SKILLS**

A number of Portuguese researchers and practitioners have argued that LIS competencies management, more than ever before, experiences new notions of professional culture in changing evaluation environments and professional work (Ochôa and Pinto, 2007). Professional communities are supported by change agendas and opportunities, one of them being the potential interactions between evaluation culture and professional skills.

The components of professional competence in an evaluation environment link professional learning skills to librarians’ clients highlighting the importance of practice based on knowledge management and quality dimensions of service. De-
spite disciplinary variations, it seems evident that evaluation cultures emphasize the importance of expert knowledge in order to become a professional actor in information society dilemmas. This focus may also be seen as a factor that challenges the position of quality services within digital libraries strategic priorities and thereby creates a discursive practice with explicit reference to professional skills relevance.

This case provides a basis for discussions about the competence dimension in evaluation cultures, articulating the aim of skills management as part of a professional responsibility.

Two major concepts influence this case: Management Skills Charter and Skills Map, a combination of theories of knowledge management concepts and Quality Management, assumed by all the staff and publicised by various media. It implies that digital libraries are perceived as objective representatives for both professional skills evidences and quality services levels. In this marketing process what is associated with collective competences activities is often perceived as the highest valued.

This approach allows a better evaluation of the library strategical process, identifying the principal attributes of a digital library, namely:

- The use of common procedures to evaluate;
- The engagement of all the participants in results, discussing strong and weak points and designing improvement actions;
- The use of an integrated system of evaluation where levels of key-skills are particular important for the effectiveness. A coordinated combination of service, just-in-time answers, a new personalised way of looking at users needs and expectations in each library may help to create informational skills with strategic value in the information market;
- Skills models must be aligned with strategic maps accordingly with changes within information sector.

The key-factor to success in this experience is the individual professional role identification with a new professionalism model.

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Conclusions