Exploring Operational Business Intelligence Acceptance

Finding factors that determine acceptance of Operational Business Intelligence in organisations.

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Abstract
Operational Business Intelligence systems have a great potential for organisations make use of to differentiate themselves. This research aims to find factors that influence the acceptance of such a system in an organisational context. Special attention is given to the several perspectives of the involved stakeholders. Through a literature research, a framework has been set up exploring OpBI acceptance. The framework shows a required context that should be created in order to achieve acceptance. This framework provides a starting point for a discussion about acceptance of OpBI systems in a complex organisational context.

Keywords:
Technology Acceptance, Operational Business Intelligence, Organisational Design, Contextual requirements, Acceptance forces

1. INTRODUCTION
The world generates 1.7 million billion bytes of data every day (European Commission, 2013). Research by McKinsey & Company (2011), BCG (2013) and many others shows that being able to perform Business Intelligence on this data is going to be key differentiator in every sector, for every company.

Business Intelligence is usually defined as "The process of turning data into information and then into knowledge to enable effective decision making" (Golfarelli, Rizzi, & Cella, 2004). As Business Intelligence (BI) is currently mostly data-centric and used for reporting in Decision Support Systems (Jourdan, Rainer, & Marshall, 2008; Marjanovic, 2007), its main use lies in supporting decision making for company strategies. Great potential has also been identified for its value on operational levels of organisations (White, 2006). This requires BI to become more process-centric instead of data-centric. The value of the operational use of BI is however both underestimated and little researched (Marjanovic, 2007).

Using Business Intelligence in an operational context is however very different from strategic use. The requirements for functionality are different for BI systems used in an operational context. In addition, the environment they will be used in is different. Given these implications, analysing these differences in environment and their impact is desirable.

As with their more strategic counterparts, it is important for Operational Business Intelligence (OpBI) systems to gain acceptance from their environment (Elbashir, Collier, & Davern, 2008). Research into acceptance of OpBI is however lacking. Additional research in this field is thus necessary to be able to understand which factors drive the acceptance of OpBI. The fact that OpBI systems affect several organisational parts that have different perspectives on the system makes it subjective for each of the involved stakeholders. This added complexity shows the need to look at acceptance from several perspectives.
In this article acceptance of OpBI systems in organisations will be explored. The subjectivity of the several related perspectives and explorative nature of this research calls for a more qualitative research approach, which is unusual and unique in this data-driven field.

Based on the presented information, the following scientific research question and sub-questions will be answered in this article:

**SQ1.** What does current literature state about acceptance of OpBI in organisations?

**SQ2.** What does a framework that describes acceptance of OpBI in organisations look like?

In order to answer these questions, this paper is structured as follows. Section 2 will describe the theoretical foundation needed to develop the framework. Based on the theoretical foundation, section 3 describes the development of the framework, which was done using a qualitative case study. Section 4 will verify and evaluate the framework, and section 5 will present the conclusions and a discussion on the findings of the article.

2. **THEORETICAL FOUNDATION**

2.1 Operational Business Intelligence

Business Intelligence (BI), like Big Data or ‘the Cloud’ have increasingly become buzz or hype words, which has the consequence that many different definitions are available.

BI is usually defined from a technical or managerial point of view. Those with a technical view use concepts like ‘data gathering’, ‘data integration’, ‘data storage’, ‘knowledge management’ (Negash, 2004; Power, 2008; Reinschmidt & Francoise, 2000). Managerial views give concepts like ‘system with historical information’, ‘enable effective decision making’, ‘management support’ and ‘reporting’ (Işık, Jones, & Sidorova, 2013; Lönnqvist & Prittimäki, 2006; Williams & Williams, 2010). For now, the following definition will be chosen for Business Intelligence: ‘The process of turning data into information and then into knowledge to enable effective decision making’ (Golfarelli, Rizzi, & Cella, 2004). This already shows that BI is mainly focussed on decision making and reporting, which is different from OpBI.

The main difference between BI and OpBI is its use. OpBI provides optimization for daily business operations (White, 2006; Rouse, 2010). A great potential has been identified for this analytical and real time operational use of business intelligence (Burns, 2013). Simply put, use of BI is predominantly strategic, where the use of OpBI is mostly operational.

These differences in use make it so that the requirements for such systems are also different to those of typical reporting BI systems. OpBI requires more timely and current data. Operational BI has most potential in so called line of business or front-line workers, like call centre operators (Rouse, 2010). This requirement for timeliness has the effect that OpBI systems should be fully integrated with the business process they are used by (Melchert, Winter, & Klesse, 2004).

2.2 Technology Acceptance

In current literature a wide range of theories exist on the acceptance of technology. A common notion in these theories is the link between a set of factors that influence the acceptance of technology and the intention to accept or use technology.

Issues that arise when having several different acceptance models were identified by Venkatesh et al. (2003). This lead to the development of the Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis, & Davis, 2003). UTAUT is a combination of a total of eight theories: Technology Acceptance Model (Davis F., 1989), Theory of Reasoned Action (Fishbein & Ajzen, 1975), Motivational Model (Vallerand, 1997), Theory of Planned Behavior (Ajzen, 1985) and others (AlAbdulkarim, Acceptance-by-Design, 2013).
The UTAUT model (Figure 1) is the synthesis of these theories. It has been set up to contain three classes: technology acceptance determinants, moderators and the anticipated outcome. Behavioural Intention and Use Behaviour depict an individual’s acceptance of technology and the actual use of this technology (Venkatesh, Morris, Davis, & Davis, 2003).

Like in most technology acceptance theories, ‘behavioural intention’ showing the acceptance of technology and ‘use behaviour’ showing the actual use of technology are the resulting constructs of the model. Furthermore, the UTAUT model of Venkatesh consists of four acceptance determinants and four acceptance moderators, this is also shown in Figure 1. Of the four determinants, three directly influence the intention and one influences the use behaviour. All of these effects are moderated by four different moderators.

2.4. Acceptance of OpBI in organisations

Orlikowski (1992) suggests early research that assumes technology is objective and has a deterministic impact on organisations is short sighted. Initial theory focuses purely on the ‘hardware’ side of technology by defining technology as “the substitution of equipment for human labor” (Blau, McHugh-Falbe, McKinley, & Phelps, 1976). While this definition is made broader by Thompson (1967), it still does not take into account any interaction between technology and its user. In addition, Orlikowski states that later research that focuses on social aspects and strategy regarding technology, rather than a deterministic approach is valuable but incomplete (Orlikowski, 1992).

Reflecting on the “Technological Imperative Model” (Giddens, 1976), the “Strategic Choice Model” (Davis & Taylor, 1986) and the “Model of Technology-Triggered Structural Change” (Barley, 1990), Orlikowski (1993) has set up a new model, which adheres to two important premises:

- The Duality of Technology, adoption is about the interplay between user and hardware and defines how technology is fits within an organisation.
- The Interpretive Flexibility of Technology, technology is interpreted differently across different parts of an organisation. (Mackay, 1988).

These premises are highly relevant for OpBI systems, as they are developed, used and managed from several different parts within organisations. Adhering to these premises, Orlikowski proposes a new “Structurational Model of Technology”, which has three components:

- **Human agents:** Technology designers, users and decision makers.
- **Technology:** Artefact that (helps) executing tasks.
- **Institutional properties:** Organisational characteristics.
These three components are shown in the Structurational Model of Technology, as it is presented in Figure 2. The human agents can be linked to three of the structural elements of organisations, as described by Mintzberg (1993). Technology designers fall within the technostructure, the users of OpBI are within the operating core and decision makers are at the level of the middle managers.

This research by Orlikowski shows the importance of linking technology with the organisation it is placed in. It does however still assume that the technology is actually accepted and used by the intended users within the organisation. Therefore, combining these insights with how acceptance of a technology works will provide an even more complete picture of technology adoption at organisations. This also shows the significance of this theory. The fact that it does see the discrepancy between the interpretation of different parts of an organisation justifies the fact that all stakeholders can have a relevant and meaningful interpretation of what the technology should do or what a system should look like.

2.3 Organisational Design

For Organisational Design, the generally accepted structure as proposed by Mintzberg (1993) is used. He suggests that every organisation has five parts. These five parts vary in importance and size, depending the characteristics of an organisation. The five parts he defines are the operational core, the technostructure, the support staff, the top management and the middle management.

OpBI has most effect on the Operational core, Technostructure and Middle management. It is thus relevant to look at acceptance of OpBI from several perspectives in this multi-actor setting. Within any organisation, the five parts of an organisation, are constantly moving and defining their position (Mintzberg, 1993). They all have the tendency to ‘pull’ the organisation in a specific direction, as that is favourable for their position or for the organisation from their point of view as shown in Figure 3.

1. **Pull to Professionalise**: The operational core wants to work as independent as possible and as such professionalise their way of working.
2. **Pull to Standardise**: The technostructure tries to plan the organisation as much as they can and wants the organisation to work in a uniform way.

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- **Pull to Collaborate**: Serving the organisation, the support staff promotes collaboration, both inwards and outwards.
- **Pull to Centralise**: The top management has a wish to control the organisation and impose the strategy it wants to pursue on the organisation.
- **Pull to Balkanise**: The middle managers and their departments want to protect their independence and stimulate rivalry with other departments.

What is important to note with these forces, it that they have to balance each other, as each of them individually poses a destructive forces to the stability of the organisation.

3. **DEVELOPING A FRAMEWORK FOR OPBI ACCEPTANCE IN ORGANISATIONS**

3.1 Propositions

*Operational Business Intelligence*

Rouse (2010) states that the timeliness of data is important. Furthermore, for OpBI to be successful, literature states that both the integration between technological systems itself and the integration between the systems and the actual process should be developed and mature (Melchert, Winter, & Klesse, 2004). As there is limited literature that combines OpBI with acceptance, it is assumed that an OpBI system that complies with these notions has a higher acceptance. In short, this means the OpBI literature provides three propositions:

1. An OpBI system that is **transparent** positively influences the acceptance.
2. An OpBI system that is **timely** positively influences the acceptance.
3. When the OpBI system is **integrated** with other systems and the business process, this positively influences the acceptance.

*Technology Acceptance*

The UTAUT model by Venkatesh (2003) is relevant, as it splits the intention to use from the actual use. This is also fits with the theory of interpretive flexibility, as different (perceptions of) intention creates different actual use. The direct determinants of use behaviour mentioned in UTAUT (intention to use and facilitating conditions) can be used to define propositions of acceptance. The indirect measures are used through these.

4. When a user has the **intention** to use the OpBI system, it positively influences the acceptance.
5. When facilitating **conditions** are available, it positively influences the acceptance of the OpBI system.

*Organisational Design*

As each of the three involved stakeholders exert their own forces, each have their own proposition, in which it is assumed that the stakeholders will accept an OpBI system, as long as it fits this proposition.

6. When the technostructure can **standardise** the organisation using the OpBI system, it positively influences the acceptance.
7. When the operational core can **professionalize** their work using the OpBI system, it positively influences the acceptance.
8. When the middle management can **balkanize** within the organisation using the OpBI system, it positively influences the acceptance.

Using these propositions, a case study was performed by Maxim Oei (2014). The results from this case study will now be summarized.

3.2 Case study results

A case study to evaluate the eight propositions was conducted at a financial institution in the Netherlands. This case study entailed a qualitative research in which use of one OpBI system was evaluated, by interviewing the three involved organisational parts (Oei, 2014); The Operational core, Middle management and the Technostructure. Interviewing all three groups made it possible to look at their acceptance of the OpBI system from three different perspectives, which was seen as relevant, due to the interpretative flexibility and duality of technology (Oei, 2014; Orlikowski, 1992).

First intake interviews were conducted, then a four week period of intensively monitored usage started, after which evaluation interviews were held. The intensive monitoring provided quantitative data to support the qualitative interviews (Oei, 2014).
The insights from the interviews show that all propositions had an effect on the acceptance of the OpBI system during the case study.

1. **Transparency**: the operational core needs transparency to be able to value and use the OpBI system effectively. This transparency should therefore be provided by the OpBI system in some way.

2. **Timeliness**: the relevance of the OpBI system is highly dependent on its timeliness. The necessary manual actions obstructed timeliness of the system during the case study.

3. **Integration**: The ease of use and transparency of the system was hampered due to the little integration of the systems. In addition, expectations of the Middle management and Operational core did not match the capabilities of the Technostructure.

4. **Intention**: Middle management was not able to create enough intention to use, as the operational core was not convinced by the added value of the system.

5. **Conditions**: the facilities were all in working order, which made sure that the conditions were not hampering the intention to use for all organisational parts.

6. **Standardisation**: the Technostructure had the wish to provide a standardised solution, following their strategy, but this caused the Middle management to feel out of control.

7. **Professionalization**: the Operational core had a strong opinion of what the expected of the OpBI system, but were not convinced by its performance. They used their freedom to decide not to use the system as much as was asked them to do.

8. **Balkanization**: Middle management struggled to define their position, as they had little influence on the functioning of the system and were not able to convince the Operational core to use the system.

The insights from the case study were combined with the literature study. This lead to a Framework for Acceptance of OpBI in Organisations (FAOpBIO).

### Table 1: Propositions and Contextual requirements and Forces of acceptance which are used in the Framework

<table>
<thead>
<tr>
<th>Propositions</th>
<th>Contextual requirements</th>
<th>Force of acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. An OpBI system that is <strong>transparent</strong> positively influences the acceptance.</td>
<td>Systems integration (flexibility)</td>
<td>Transparency</td>
</tr>
<tr>
<td>2. An OpBI system that is <strong>timely</strong> positively influences the acceptance.</td>
<td>Systems integration (back end)</td>
<td>Performance feedback</td>
</tr>
<tr>
<td>3. When the OpBI system is <strong>integrated</strong> with other systems and the business process, this positively influences the acceptance.</td>
<td>Systems integration (front end)</td>
<td>Performance feedback</td>
</tr>
<tr>
<td>4. When a user has the <strong>intention</strong> to use the OpBI system, it positively influences the acceptance.</td>
<td>Business process integration (job embedding)</td>
<td>Intention</td>
</tr>
<tr>
<td>5. When facilitating <strong>conditions</strong> are available, it positively influences the acceptance of the OpBI system.</td>
<td>Business process integration (usability)</td>
<td>Help requests</td>
</tr>
<tr>
<td>6. When the Technostructure has the ability to <strong>standardise</strong> with the OpBI system, it positively influences the acceptance.</td>
<td>Expectation alignment (capabilities)</td>
<td>Information requirements</td>
</tr>
<tr>
<td>7. When the Operational core has the ability to <strong>professionalise</strong> with the OpBI system, it positively influences the acceptance.</td>
<td>Business process integration (culture/autonomy)</td>
<td>Usage insights</td>
</tr>
<tr>
<td>8. When the Middle management has the ability to <strong>balkanise</strong> with the OpBI system, it positively influences the acceptance.</td>
<td>Expectation alignment (influence)</td>
<td>Management data</td>
</tr>
</tbody>
</table>
3.3 Framework for Acceptance of OpBI in Organisations

The case study showed that to create acceptance of OpBI in organisations, a minimal context of requirements has to be established, before acceptance can be realized (Oei, 2014). Then, the several organisational parts that are involved with the provisioning and use of the OpBI system will start to exert their pulling and pushing forces onto this system, to make it fitting to their wishes and expectations (Oei, 2014).

The way the propositions were linked to contextual requirements and the forces at work is shown in Table 1. The resulting Framework for Acceptance of Operational Business Intelligence in Organisations is presented in Figure 4.

Minimal context for Acceptance

For acceptance of the OpBI system to be achieved, a context has to be in place. These requirements are related to the three organisational parts and are systems integration, business process integration and expectation alignment. Systems integration, derived from Propositions 1, 2 and 3 should ensure that both the timeliness and integration with other systems used by the end users is taken care of. Business process integration, derived from Propositions 4, 5 and 7 is important to show the Operational core the relevance of using the system and make it to be part of their job. Finally, expectations alignment is crucial, as was seen in relation to Propositions 6 and 8. These showed the need to achieve a common understanding of the capabilities and the expected performance of the OpBI system.
Forces of Acceptance in Organisations.

The forces of acceptance act within the minimal context and provide ways to further ensure acceptance, as acceptance rises when they are fulfilled. Transparency is necessary for the Operational core to accept the OpBI system, as they need to know how and why it does what it does to be able to use it effectively. On the other hand, they should be stimulated in their intention to use by their middle management. In return, the Operational core should provide the Middle management with insights about their usage and should request help. For complete overview of system use, the Middle management needs management data from the OpBI system. Therefore, especially when multiple departments use an OpBI system that is managed by the Technostructure, they should pay close attention to the exact information requirements and performance expectations of the involved Middle management(s). Finally, the Technostructure should retrieve feedback from the Operational core to improve the system, especially when multiple departments use it in different ways.

3.4. Starting points for using the framework

The presented framework has a main function of showing what an environment in which acceptance of OpBI systems can be achieved looks like. A starting point to move towards such a situation will be described for both the minimal context and the forces of acceptance.

Minimal context for Acceptance

To realize the Minimal Context for Acceptance, the implementer of an OpBI system must first realize that only realizing a part of the context will hamper the acceptance of such a system. This underlines the subjectivity of acceptance, as all organisational parts have their own interpretation of the technology. Therefore, there should be a split focus on all three of the contextual requirements.

Forces of Acceptance in Organisations.

The insights of the FAOpBIO are in line with the theory of duality of technology and interpretive flexibility of technology as described by Orlikowski (1993). All of the organisational parts have their own interpretation of what is important and what the OpBI system should be able to do. Each of them should position themselves in such a way that it is beneficial for acceptance of the OpBI system as a whole.

As the technostructure is likely to provide the OpBI system to multiple departments within the organisation, it is critical that effective communication with these departments is set up to align expectations. They should be open to feedback and information request and provide the necessary transparency and management data. Systems integration and expectation alignment are thus key to make these forces possible.

The Operational core has a pull for transparency of the system and provides feedback towards Technostructure. Furthermore, they should be able to request help from their managers, which in return should provide them with the Intention to use.

The Middle management themselves is not a main user of the system, but does need its management data to monitor the use and results of that use.

4. VALIDATION OF THE FRAMEWORK

Due to the structure and qualitative nature of the case study, there are some inherent issues with validity and generalizability of the framework Oei (2014) presents. To take a look at some of these issues an expert interview was performed (AlAbdulkarim, 2014).

4.1 Methodological validity

The one-on-one character of the qualitative interviews of the single case study, was the main limitation of internal validity of this research. In addition, a limited number of people (16) were interviewed. The possible negative effects of qualitative research like cognitive dissonance were however mitigated as much as possible in the case study by using quantitative usage data to make the evaluation interviews more effective.

The period between the intake and evaluation interviews was only four weeks. This meant that the results of usage of the OpBI system might been skewed by learning or other start up effects. Their impact was considered limited though, as the interviewees were familiar with similar activities.
To increase the external validity of this research more case studies have to be performed, preferably in non-financial sectors, in organisations of various sizes.

4.2 Expert validation

Three main issues were identified in the expert interview with AlAbdulkarim (2014).

In the framework it is stated that expectation alignment is of importance between the Technostructure and the Middle management. In the work of AlAbdulkarim (2013) it is stated that in societal technology infrastructures requirements need to be elicited from the end users as well, which requires involving them in this communication. In her opinion, this also the case for technology infrastructures developed and deployed in organisations to a certain extent, which would mean specific communication with the Organisational Core is important as well.

The description framework states the minimally required context should be established first, after which the forces of acceptance start to work between the involved organisational parts. AlAbdulkarim noted the timeliness of these forces. In her opinion, requirements elicitation of the Operational core should start directly at the start of the development and not appear after development, for example through forces like performance feedback and help requests.

As identified by Oei (2013) as well, the Framework shows a situation wherein acceptance can be achieved, but it does not provide the actions and processes needed to get to this situation. This is however, in line with the research question, which is focussed on the factors of acceptance, not the way move towards them or to act upon them. Therefore, this was mentioned by AlAbdulkarim (2014) as one of the important recommendations for future research.

5. CONCLUSIONS AND DISCUSSION

This paper had as an aim to explore acceptance of Operational Business Intelligence system in organisations. To do this, a research question was posed to find factors that determine this acceptance. The literature in three fields, namely Operational Business Intelligence, Technology Acceptance and Organisational Design was explored. Combined with a case study by Oei (2014) this lead to the insight that three organisational parts are involved most in these systems: the technostructure, the operational core and the middle management.

To gain acceptance of an OpBI system, a context has to be set up, which at minimum has to comply with the requirements for Systems integration, Business process integration and Expectation alignment. Within this context, the three mentioned stakeholder exert their forces of acceptance, that influence the acceptance of the OpBI system. This was summarized in the Framework for Acceptance of Operational Business Intelligence Systems.

To effectively apply this framework when developing an OpBI system, a process is needed to further define the requirements of the context and the way that will be acted upon the forces of acceptance. This was out of scope for this article and is a recommendation for future work.

This article is mainly based on a literature review and a case study by Oei (2014). Therefore, generalizability of this framework and the contents hereof are limited. To enhance this, further research is suggested into different organisations, sectors and situations.

Validation with an expert of this framework suggested closer involvement of the end users at earlier stages. This should also be addressed in future research.
REFERENCES


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