1 POSSIBLE REMEDIES TO IMPROVE BI ADOPTION

1.1 Solutions in literature

1.1.1 The end-users

Over the years several studies have been made revolving around the effectiveness and adaptation of business intelligence in various sectors and parts of the world. Most studies however, either if they are conducted in SMEs or large multinationals, all conclude the same topics where improvements can be made to increase BI adoption.

In the publication by Information Builders (2016) '5 ways to boost adoption of BI and analytics' five key areas were mentioned where improvements can be made in order to boost the adoption rate of BI in an organization.

The first and foremost area were the users. Know your users, know what they want and differentiate solutions according to their needs (Information Builders, 2018, pp. 2). Perez takes it a step further. He suggests mapping several user profiles and granting them different roles and access to functionalities. Among the roles he suggest are the admin, who can maintain the ecosystem, the BI developer who can create content, the Business analyst who can create content for his own personal use and a BI consumer who can view content and ask additional questions for new content. Having these well-defined roles means companies can create different levels of training in order to prevent end-users being overwhelmed by information they may not need in their daily job and lose interest in using BI (Perez, 2015, pp. 44).

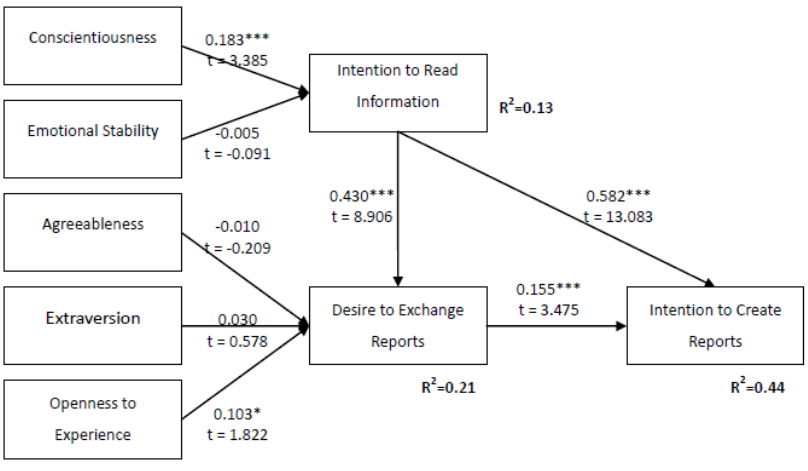

Figure 1-1: Structural modeling analysis of factors influencing BI behavior (Chang, 2015, pp.15)

Chang (2015) proposes that not only does the training influence the possibility of people adopting BI, but also their personality traits influence their usage of BI tools. In his research he uses two models to try and predict the usage intentions to read and exchange reports by end users.

Among others she proposes the Five Factor model which categorizes a number of human character traits in five groups.

- Openness to experience = imaginative, artistically sensible, intellectual people.
- Conscientiousness = responsible, dependable and achievement oriented people.
- Extraversion = sociable, talkative and assertive people.
- Agreeableness = good-natured, cooperative and trusting people.
- Emotional stability = calm, enthusiastic and secure people.

In her study she concluded that particularly the 'Openness to Experience' and 'Conscientiousness' groups contribute to people being inclined to read and share reports (Chang, 2015, pp. 24-30). This however doesn't mean the other groups should be discarded. Users strong in the two aforementioned groups are just more inclined to be early adopters as BI users.

Given this information, Protiviti suggests as one of their solutions to solve BI user adoption to work on advocacy (Protiviti, 2017, pp.3). Spreading interest about the tool, develop 'raving fans' and use them as evangelists to help people see the solution is foundationally sound, quick, responsive and relevant. Selecting the end-users to be these evangelists could be guided by the conclusion Chang made in her study, in order to maximize the adoption of the solution and create a firm userbase to ease further implementation.

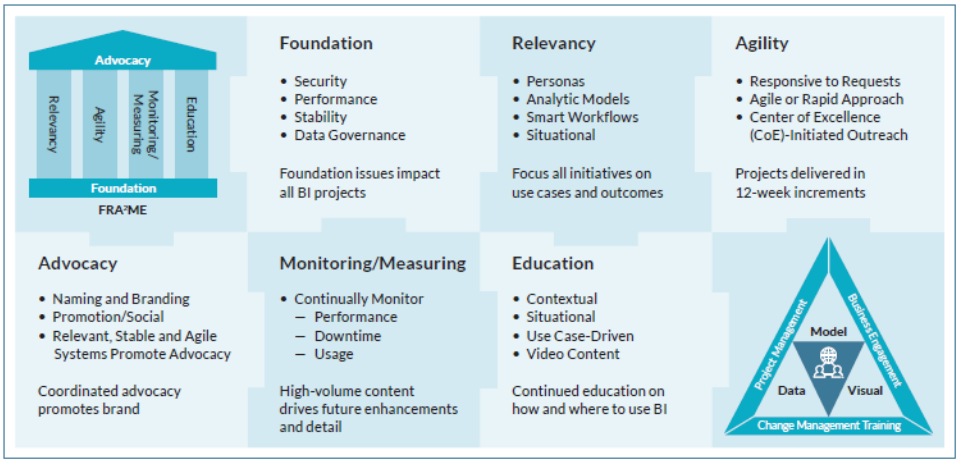

Figure 1-2: The Fra²me Methodology according to Protiviti (Protiviti, 2017, pp. 2)

This firm userbase is needed to convince other end-users to start using the tool. According to Skyrius, one of the main factors influencing BI culture is the sharing of information. This sharing can be motivated by the former reception of useful information, like for instance finished reports, and mutuality (Skyrius, 2016, pp. 180-181).

Functions provided by a BI system	Share, %
1. Data security and access management	93
2. Real-time analysis	86
3. Data collection from many sources and systems	84
4. Possibility to share created reports and insights	84
5. Ad-hoc analytics for self-serving users	77
6. Data drill-down	71
7. Predictive analytics	68
8. Intuitive and clear user interface, requiring no training	58
9. Use of mobile devices	55
10. Data mining options	46

Figure 1-3: Most often quoted BI functions, no. 4 is sharing of content. (Skyrius, 2016, pp. 180)

Having a firm userbase with evangelists convincing people to use BI also helps to overcome other roadblocks end-users experience. In her work de Mesquita Fetzner studies the implementation of BI and the perspective of individual change. She notes that several aspects can facilitate or hinder personal change. Amongst those factors are the interpretations of the effect of the change to the end-users work and the emotional reactions people have in the face of technical system changes (de Mesquita Fetzner, 2011, pp. 28).

These reactions often arise with the implementation or use of BI tools, since people are in fear of losing their job or don't want their work process being changed. This results in a reaction against the tool which may or may not have anything to do with the tool and its usefulness itself.

Besides personal inclination towards new tools, it's always difficult to change a well settled work process, even if it means less work. In IT these changes are often extra hindered by the age of the different end users or the level of stress and demand placed on the end users. It's commonly known that age is often a deciding factor for starting to use new technology. Also the, temporary, increased workload that comes with learning new tools (e.g. practicing, solving issues, experimenting, etc.) can mean users drop the new software in favor of the old established tools (de Mesquita Fetzner, 2011, pp. 35).

Having a good stable userbase can help ease these reactions and let end users experience that the new technology will be an improvement to their workflow.

1.1.2 Education and community

A next factor that can help solve BI user adoption in an organization is education according to Protiviti. Education should be situational, contextual and personal, which means using the kinds of training tools people relate to best. Having efficient education will in turn generate the buzz needed to sell new implementations across the organization and help build a good userbase (Protiviti, 2017, pp. 4).

Skyrius also suggests records should be kept of lessons and experience. These records not only include success stories, but also errors, failures, mistakes and surprises, thus reinforcing trust among the BI users and the members of the BI community (Skyrius, 2016, pp. 181). Also these records can serve as a good knowledgebase where power users can browse for answers or known errors on topics they are working on, thus shortening solution worktime or eliminating issues altogether.

Aiding the distribution of information among the BI users, a well-constructed community can act as a knowledge repository as well as a first line helpdesk. Bach proves in his study of the TAM for BI systems that knowledge sharing has a positive, but indirect, effect on the acceptance of business intelligence tools (Bach, 2017, pp. 16). According to Skyrius the BI-community should be sustainable and self-reinforcing with analysts and insight builders from key functional areas and with different analytical backgrounds. In a next phase the community can start and act as change agents, fueling improvements in collaboration with the business users. In order to avoid becoming a counter-culture however, this community should possess leadership and have the mandate of the management in order to drive the BI culture in the organization (Skyrius, 2016, pp. 181).

Having both good education and a thriving community can positively influence the anticipated behavior of end-users. Azjen mentioned that the intention to perform a certain behavior is influenced by the personal attitude of the subject towards that behavior in relation to the social pressure the user experiences to engage in the behavior. These influencers however have one antecedent each which forms at its most basic level an explanation for the behavior (Azjen, 1986, pp. 454).

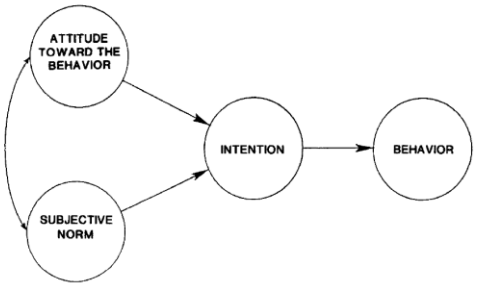

Figure 1-4: Schematic figure of the Theory of Reasoned Action (Azjen, 1986, pp. 454)

The behavioral belief is the antecedent that influences the attitude towards the behavior, the normative belief influences the social pressure. Behavioral belief links the behavior to an outcome or to some other attribute as the cost incurred. The outcome value contributes in direct proportion to the strength of the belief. Normative beliefs on the other hand, are concerned with the likelihood that important referent individuals or groups would approve or disapprove of performing the behavior. The strength of each normative belief is multiplied by the person's motivation to comply with the referent question (Azjen, 1986, pp. 455).

Given this information, having a strong community and good education can work on both influencing antecedents.

Good education will shape the perceived ease-of-use which is one of the two parameters suggested by Davis in the Technology Acceptance Model (TAM) (Davis, 1989) which boosts end-user self-efficacy. Having higher self-efficacy has a positive influence on decisions, which is a basic determinant of user behavior (Davis, 1989).

Since behavioral belief links behavior to a certain outcome and the outcome value contributes in direct proportion to the strength of the belief, having a better perceived ease of use due to training makes the outcomes of the behavior perceive more attainable and thus the behavior of using BI more probable to occur.

The same goes for normative beliefs. Users that are part of a dedicated community will feel social pressure to do the expected behavior. As mentioned above, having a good education will increase the perceived ease-of-use which in turn will aid in boosting the users motivation to succeed in the behavior. Since motivation is a multiplier for normative beliefs it is safe to say that education and community go well together and strengthen each other (Azjen, 1986, pp. 454-455).

Grublješič sums up the need for education and good community quite well in her study. She tries to summarize the existing general IT acceptance models and tries to build a 'business intelligence acceptance model'. While reviewing the reasons for high or low acceptance in the companies she used as a case study, she concluded: "It is also necessary to provide a system of administration and support for BIS. Further on, every day support, assistance and mentoring […] is necessary since without that only a few people would use the system" (Grublješič, 2015, pp. 307).

1.1.3 Measuring and monitoring

A third solution to increase user adoption of BI according to Protiviti is monitoring and measuring the use and efficiency of the BI solutions. Keeping an eye on user activity and data usage is essential to establishing a positive track record for reliable data. That, in turn, builds the trust of business users to use the BI solutions and trust the reporting. Determining which report is being used or which dashboard is regarded as the most reliable provides opportunity to continue to dig deeper into the

organization's needs, and to evolve and create more relevant solutions as the business grows (Protiviti, 2017, pp. 3).

Having measurable data can provide on the spot feedback to decision makers concerning the used tools or resources. Information Builders mentions in their white paper concerning the five ways to boost BI adoption that there has to be enough attention to performance. When the BI environment scales up, the amount of users, queries and data scales up as well, sometimes exponentially. Having wait times going up, means users are less inclined to use the solution any more (Information Builders, 2018, pp. 4).

As Eckerson points out, in the age of Google, casual users expect immediate response to on-screen clicks and gestures. The aim should be a response time less than 3 seconds per click. He also mentions this feat can become difficult for complex reports with a lot of queries per screen (Eckerson, 2015).

Monitoring not only applies to the users, but also to the data sources. As Eckerson mentions, if end users feel that the BI tools deliver inaccurate or incomplete data, they will stop using them (Eckerson, 2015). Besides good quality, it should also be able to combine multiple data sources in an easy way to generate new insights in questions posed by the business users.

Protiviti's FRA²ME concept summarizes the measuring/monitoring component in their Foundation section. Having a good query and source performance, a stable solution, enough security in place and good governance to ensure trustworthy data is the right foundation to start and build user adoption (Protiviti, 2017, pp. 3).

1.1.4 Management support

Puklavec used a survey based on the Technology, Organization & Environment (TOE) and Diffusion of Innovation (DOI) frameworks. As a reference group he used business intelligence experts and adopters. In a first stage he built a list of keywords applying to BI, which he gathered from numerous sources in literature. The next step was to ask the reference group what keywords influenced BI adoption the most.

In this survey 'management support' ranked as highest influencer for the adoption of BI solutions (Puklavec, 2014, pp. 204-205).

Bach sees Project Management Maturity (PMM) as a driving factor for user Perceived Ease of Use (PEU) and indirect for user Perceived Usefulness (PU). As referenced above, PEU and PU are the two main components of the TAM according to Davis (Davis, 1989, pp. 320) which to some extent influences the susceptibility of the end user to change and accept a new technology (Bach, 2017, pp. 15-16).

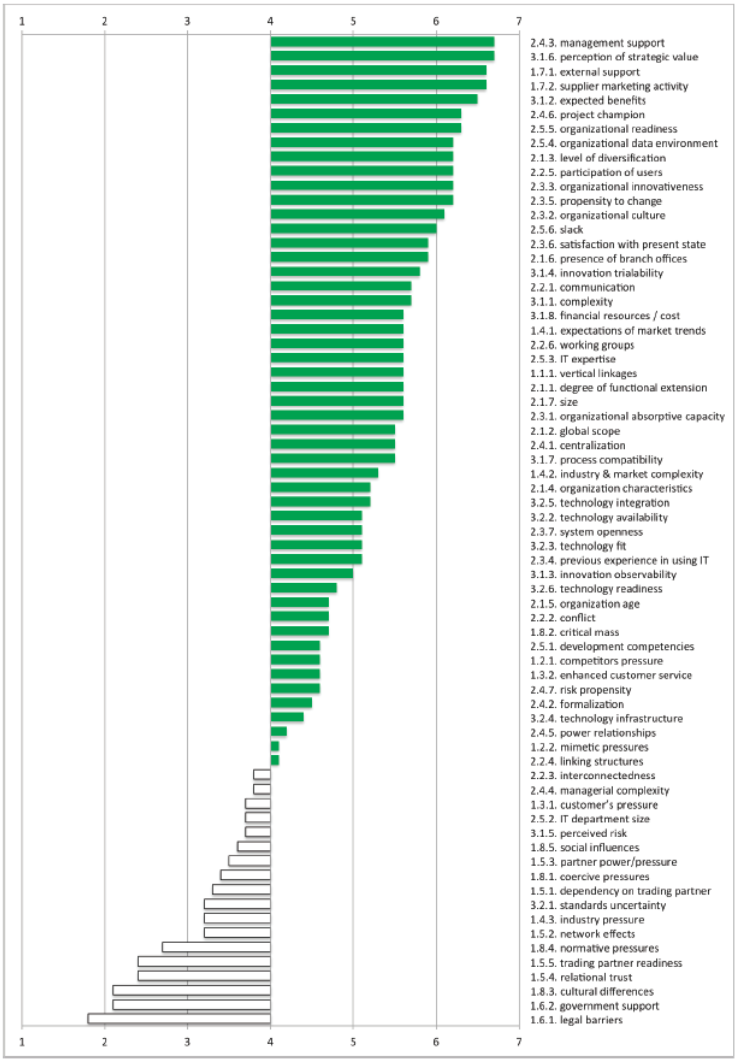

Figure 1-5: List of keywords and their ranking according to reference group responses (Puklavec, 2014, pp. 203)

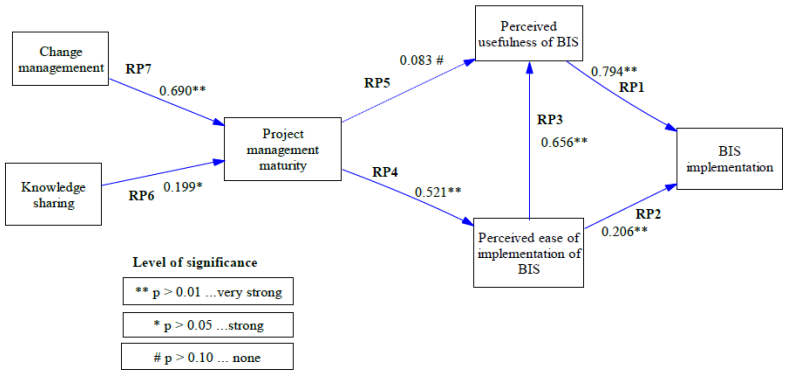

Figure 1-6: Path diagram of the research model made by Bach. (Bach, 2017, pp. 15)

Although PMM has no direct influence on PU, it influences PU indirectly through heavily influencing PEU. Having good management support is therefore vital to ensure the adoption of BI in an organization is successful.

Yoon and Hou also include questions about managerial support in their survey to test influences on the BI adoption rate (Yoon, 2014, pp. 3761 and Hou, 2014, pp. 587), signifying the importance of backing the decision to implement or use BI by the management team.

Finally Yeoh tried to understand in his study how large organizations address the critical success factors (CSF) of BI system implementation to a fully working platform. He concluded that organizational factors were the most critical in achieving implementation success. This involved a committed management support and sponsorship from the business side. He also studied one unsuccessful business case and concluded it did not succeed due to a primary focus on technology and neglected organizational requirements (Yeoh, 2016, pp. 145).

Case	
R1 ✓	*There was consistent support from the executives, especially through their involvement in the steering committee, and direct endorsement from the CEO. *Their endorsement of the BIS commanded respect and interest among others. *Sponsorship and budget described as generous
R2 ✓	*The initial BIS development was strongly supported by functional managers. *Now the silos BIS have gained the attention of top executives. *As a result, it involved some degree of organizational restructuring (i.e. an amalgamated BIS is in progress for its major network access and maintenance divisions). *Budget described as adequate *Existence of a high-level steering committee
E1 ✓	*Top management support was strong, MD is crucially aware * Sponsorship and budget described as generous *Top-down commitment was shown in defining the process of business needs and report requirements *Existence of a high-level steering committee
S1 *P*	*Initially, the executives focused more on the benefits of ERP than the BIS. *However, the BIS was gaining momentum as in supporting auditable business reporting and complying with the needs of its key client and strict regulation. *Budget described as adequate
W1 ✓	*Top management support was strong; the BI system was initiated by the CIO. *The CIO appointed a specific project manager to lead and co-ordinate the project. *The project manager was empowered at board project level and reported directly to the CIO. *Sponsorship and budget described as generous *Existence of a high-level steering committee
W2 ✓	*Top management, both the CEO and CIO, fully supported the BI initiative. *The project manager reported directly to the CIO and were empowered at the broad project level. * Sponsorship and budget described as adequate
W3 *X*	*Top management was not convinced about the usefulness of a BIS for the business. *The executives instead supported its ERP modules expansion projects.

Note. ✓ denotes a CSF that was fully addressed; P denotes a CSF that was partially addressed; X denotes a CSF that was ignored.

Figure 1-7: CSF's used by Yeoh to address management involvement. (Yeoh, 2016, pp. 145)

The CSFs addressed ranged from the endorsement of the project by project management generating respect among other users over support from executives to enough allotted resources for implementing and maintaining the solution (Yeoh, 2016, pp. 139).

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