

Business Intelligence Agility, Informing Agility and Organizational Agility: Research Agenda

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Abstract. In assuring organizational agility, informing activities play a key role by sensing the environment for important changes. A special part has to be assigned to business intelligence (BI) activities, since their exact task is to monitor the environment and detect important issues to provide ground for well-informed responses. In turbulent business environment, BI function has to adjust dynamically to maintain the quality of produced insights. A survey on published research has shown that many sources stress the importance of agile BI on organizational agility in general. However, the importance of managerial and especially cultural factors for the role of informing in building up agility competencies is under-researched. The technology factors of agile informing that create preconditions for organizational agility are much better researched and evaluated than their human and managerial counterparts. There appears to be a need for consistent research approach in favor of the less researched human and managerial factors. The goal of this paper is to define research framework by addressing agility issues at three levels: organizational, information and BI agility. This framework is going to serve as a foundation for planned research on the factors of BI agility.

Keywords: organizational agility, informing agility, BI agility, BI culture

Verslo analitikos judrumas, informavimo judrumas ir organizacinis judrumas: tyrimų gairės

Santrauka. Siekiant organizacijų judrumo (angl. *agility*), kuris suprantamas kaip gebėjimas greitai ir adekvačiai reaguoti į permainas, svarbus vaidmuo tenka informacinei veiklai, kurios pagalba veiklos aplinkoje siekiama aptikti svarbių permainų požymius. Ypatingas vaidmuo tenka verslo analitikos (angl. *Business intelligence*) veikloms, kadangi jų tiesioginė užduotis yra stebėti aplinką ir atpažinti svarbius reikšmingus siekiant pagrįstų atsakomųjų veiksmų. Turbulentiškose verslo aplinkose verslo analitika turi dinamiškai prisitaikyti, siekiant išlaikyti sudaromų įžvalgų kokybę. Paskelbtų tyrimų apžvalga parodė, kad daugelis šaltinių pabrėžia judrios verslo analitikos svarbą visos organizacijos judrumui. Tačiau vadybinių ir ypač kultūrinių veiksmų įtaka stiprinant informavimo vaidmenį judrumo kompetencijų plėtrai yra nepakankamai ištirta. Iš veiksmų, sąlygojančių organizacinį judrumą, technologiniai veiksniai yra žymiai geriau išnagrinėti ir įvertinti nei žmogiškieji ir vadybiniai veiksniai, ir galima konstatuoti, kad egzistuoja nuoseklių tyrimų poreikis pastarųjų veiksmų

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atžvilgiu. Šio straipsnio tikslas yra apibrėžti būsimųjų tyrimų karkasą, nagrinėjant judrumo klausimus trimis lygiais – organizaciniu, informaciniu ir verslo analitikos. Šis karkasas turi tarnauti pagrindu planuojamiems verslo analitikos judrumo tyrimams.

Reikšminiai žodžiai: organizacinis judrumas, informavimo judrumas, verslo analitikos judrumas, verslo analitikos kultūra.

1. The Concept of Agility in General

Although the term of “agility” has been actively talked about in business context for the last decade, agility has always been an essential feature for businesses operating in a dynamic environment. Agility is seen not only as an ability to swiftly leverage business opportunities, but also (and even more so) to survive emerging threats and handle inevitable changes with possibly minimal losses (Goldman et al., 1995; Amos, 1998; Dove, 2001; Prahalad, 2009; Sull, 2009). The ability to respond is recognized as essential to survive (Kuilboer, Ashrafi and Lee, 2016). In order to maintain and improve performance, organizations need to be able to adjust their processes, products and behaviors along with the constantly alternating business environment to remain competitive and relevant on the market (Smith, 2002). Agility is not necessarily related to direct creation of value, but it is expected to create necessary resilience for future threats, and can be seen as a form of insurance against future changes in the environment.

Organizational agility is selected as the focus point of the intended research presented in this paper. Although many definitions of organizational agility exist, in this paper we understand it according to the definition provided by Seo and LaPaz: organizational agility can be defined as a set of processes that allows an organization to sense changes in the internal and external environment, respond efficiently and effectively in a timely and cost-effective manner, and learn from the experience to improve the competencies of the organization (Seo and La Paz, 2008).

The notion of organizational agility is closely related to the notion of dynamic capabilities (Teece et al., 1997). Teece’s concept of dynamic capabilities essentially says that what matters for business is corporate agility: the capacity to sense and shape opportunities and threats, seize opportunities, and maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise’s intangible and tangible assets. According to Knabke and Olbrich (2016), the dynamic aspect refers to “the ability to renew competences according to changing environments”, reflecting reactive position to be able to adapt to changes. However, agility, in our understanding, encompasses the proactive side as well, and includes the built-in strengths that provide for easier adaptability in future changes.

Several examples of situations requiring agility:

- A key supplier is suddenly out of business;
- An ERP system goes down for a day;
- A business opportunity requires to drastically rearrange resources;
- An innovation by competitor renders your product obsolete.

All such situations cannot be neglected because they imply serious changes and will require important decisions to minimize losses or maximize gains. They also indicate a need

for an adequate level of preparedness to cope with inevitable and significant shakeup of resources and activities. This brings agility issues close to the area of change management.

The demand for agility is originating from the need to change. The organizations must recognize the signals and indications from internal and external environments in order to respond quickly and adequately (Seo and La Paz, 2008). The internal forces driving organizational change refer to events, factors, people, systems, structures, and conditions inside the organization that are generally under the control of the company (Mullins and Christy, 2013; Senior, 2002). The external forces such as social, cultural, political and economic factors, technological advances, competition, globalization, customers' expectations are those factors that occur outside of the company but cause change inside organization and are, for the most part, beyond the control of the company (Mullins and Christy, 2013; Senior, 2002; Dawson, 2003; Fallik, 2013).

The nature and dynamics of organizational change have been examined by researchers from a number of different perspectives including extent, origin, timing, intensiveness, level (Verstraete, 2004; Dove, 2001; Benn, Dunphy & Griffiths, 2014; Ackerman, 1986; Burnes, 2014). Burke (2002) suggests to use the contrast principle in order to better understand the different dynamics that organization change can take such as:

- Revolutionary vs. Evolutionary;
- Discontinuous vs. Continuous;
- Episodic vs. Continuous flow;
- Transformational vs. Transactional;
- Strategic vs. Operational;
- Total system vs. Local option.

Despite the dynamics of change, there are four broad areas where organizations can decide to implement change – strategy, structure, technology and people (Robbins, 2011). In order to respond promptly organizations should ensure required level of agility in mentioned areas. The change of organizational culture, which falls in the area named as people, is one of the most difficult to undertake.

Organizational agility is largely ensured by information agility or informing agility (Gill, 2010). Information systems are expected to enhance the agility of an organization. As early as 1997, Sambamurthy and Zmud defined IT capability as “a firm’s ability to acquire, deploy, combine, and reconfigure IT resources in support and enhancement”, thus strongly supporting the informing agility competence. Lu and Ramamurthy (2011) state that firms invest in information technology to pursue fast initiatives in response to constant changes in environment, and indicate a lack of understanding of contradictions between IT and agility in the general context of IT use. Bani Hani et al (2017) state that “... making organizations agile can be fairly challenging and costly due to different business models, organizational structures, IT systems, and investments to support the IT-organizational agility relationship. Therefore, it might be argued that the role that IT plays in supporting organizational agility is context sensitive (Teece et al., 2016)”. Park, El-Sawy and Fiss (2017) suggest a portfolio-like approach to balance technologies and their configurations to achieve greater agility.

In discussing agility issues, more and more sources relate informing functions and business intelligence in particular as a key factor in building up agility. The role of business

intelligence, to our opinion, is of prime importance here because it provides the required insights on own activities and their environment. Such insights reach beyond the role of traditional information systems, providing essential functions of monitoring, early warning and decision support. So the agility of BI systems and activities may be defined as the capacity to maintain and reconfigure the portfolio of important informing competencies that provides maximum resiliency or scalability for future trends or opportunities.

2. Supportive and restrictive factors of agility at different levels

One of the assumptions made in this initial research phase is that organizational agility, information agility and BI agility are tightly interconnected by the important role of informing activities, and factors important for one type of agility may be important for other types as well.

2.1. Organizational agility

Organizational agility focuses on and is manifested by supporting organizational-level strategic tasks of sensing and responding to internal and external business events of environmental changes. It should happen in a timely manner in order to seize opportunities and handle threats effectively and efficiently; and learn from the experience to improve the competencies of the organization (Lee et al., 2015; Overby et al., 2006; Roberts & Grover, 2012). Appelbaum et al (2017), researching the area of profound organizational changes, have achieved several controversial conclusions:

- Major organizational change programs (Business process reengineering etc.) were deemed responsible for bringing companies into decline.
- However, many firms that went out of business had not undertaken any transformations.
- Inaction is perceived as a larger threat to business survival than transformation and reinvention.

The above implies that inaction or inability to change is seen as a greater risk than ambitious organizational change programs. To our opinion, although for sure there are numerous cases substantiating this point, each case should be looked at individually – organizational change programs are rather complicated undertakings, sensitive to many context issues. One unifying feature for companies facing changes is their preparedness and awareness for possible gains and losses.

The search for organizational agility creates some controversies and may require complicated tradeoffs. Tallon et al (2019) have pointed out that balancing agility with streamlined performance of IT operations requires difficult decisions. The trade-off between organizational reliability and agility was researched by Keller et al (2019) with observation that in certain cases reliability can undermine agility and vice versa. The agility requirements can be effectively confined to certain activity areas more exposed to turbulence as long as the architecture is designed in a pertinent way – and if it is supported by suitable organizational measures (Zimmer, 2012). Verheyen (2019), comparing industrial paradigm to agile paradigm, concluded that industrial organization does not

allow much space for learning, error, and flux – features that are often mentioned in the context of organizational agility.

The earlier presented definition of organizational agility by Seo and La Paz (2008) points out the role of information and informing activities, and stresses the sensing of internal and external environment – a function that is mostly attributed to business intelligence. The importance of intelligence function is supported by Appelbaum et al (2017), who define one of the key aspects of organizational agility as the ability to sense environmental change and draw an appropriate response. Queiroz et al (2018) have stressed the importance of sensing of important changes in organization environment. Tallon et al (2019) supported this point, largely relating it to organizational culture.

Out of 16 components of agility, presented by Appelbaum et al (2017), 11 components deal with informing:

1. Wide-deep scanning.
2. Agile scoreboard.
3. Flexible assets and systems.
4. Rapid problem solving.
5. Rich information systems.
6. Agility benchmarking.
7. Deep customer insight.
8. Aligned suppliers.
9. Performing partnerships.
10. Rapid, able decision making.
11. Continuous learning.

This is not surprising, given that agility as a preparedness to respond properly and in a timely manner is impossible without adequate informing.

The dependence of organizational agility upon informing activities and information systems brings in its own risks. Seo and LaPaz (2008) have concentrated on what they have called the dark sides of information systems in their role of supporting organizational agility. Among the most prominent IS-related factors restricting organizational agility are: data overload; lack of integration between info sources and perception systems; overlaps and gaps; bad data quality; technology dependence; and rigid, inflexible IS infrastructure. The latter has been supported by Van Osterhout et al (2006) and Queiroz et al (2018).

Most of the above sources suggest that a set of core competencies as a base for organizational agility has to be identified, reinforced and extended. The summarized factors are presented in Table 1 further in this paragraph.

2.2. Information agility

The term “information agility” is much less often used, and while the role of information and informing is obvious in discussing agility issues, there are features of information management and information systems inside an organization that are the most important for agility. Tallon et al (2019), discussing the relations between organizational agility and information technology (and somehow circumventing the obvious component of

information systems in otherwise brilliant paper), have examined numerous IT-driven enablers of organizational agility. While demonstrating the generally accepted view of IT use positively influencing organizational agility, they also pointed out that numerous IT-based factors exist that restrict organizational agility – e.g., information overload, IT dependence, or selective data censoring.

Oetringher (2018) has named important tools for organizational agility that relate almost exclusively to information management:

- A. Lessons learned from the past 15 years
- B. Solutions and mechanisms for handling situations such as having an environment that changes more quickly than the documentation can be updated.
- C. Single central repository through which employees can find relevant strategies, standards, service descriptions, lessons learned.
- D. Simple mechanisms and policies for decision making at best level and within boundaries

Imhoff and Pettit (2004) have stressed information silos as one of the key factors impairing information agility: “(business) activity is a complex, human network of specialized interactions where valuable data resides in pockets around the organization, often disconnected and sometimes lost in the rush to a new campaign”. Seo and La Paz (2008), discussing the dark side of IS, have pointed out factors minimizing its risks, as well as the related tradeoffs:

- Standardization. Standardization of basic elements provides more flexibility at upper levels; too much standards bring rigidity. Component based design, modularity and SOA should help balance the standardization issue.
- Buying, leasing or outsourcing. Because of risks of losing capabilities it is hard to evaluate advantages and disadvantages before making the final decision.
- Management skills and individual agility. Hiring agile people might be not enough; proper organizational structure and culture are required.
- Organizational structure and culture. Certain types of culture encourage or suppress creativity, learning, re-aligning resources.

We have to note that regarding the above factors, the important principle in information agility and organizational agility might be simple processes that may be easily rearranged or relocated, and are hard to break. In addition, centralized solutions are often mentioned as less agile because of being more vulnerable and harder to recover.

Among other informing factors enabling organizational agility we can mention emergent coordination between business and IT executives (Liang et al., 2017); fast reaction and decisions (Appelbaum et al., 2017); smooth basic informing processes (Lee et al., 2015). Covering most of the issues listed above, Choo (2013) has proposed an umbrella term of “information culture”, embracing the entirety of issues of information use in an organization as a part of organizational culture. Pamela Meyer (2015) has presented a framework for agility based on human interaction and other human factors: “... The agility shift means creating networks, structures, systems, and processes that support human interactions, rather than simply designing and implementing a system that enables mechanistic transactions. ... Organizational agility depends on a strong culture.” Summarizing the above, we can note a growing interest in cultural factors regarding organizational agility and informing activities in particular.

2.3. BI agility

Informing agility is executed mostly through: (a) general-purpose IS, like ERP systems, and (b) BI applications that are more insight-oriented and provide the potential of higher returns, but at the same time we assume that they are subject to more often changes. Chen and Siau (2012) have suggested to examine BI impact in a context of organizational agility, and estimated the use of BI as a significant antecedent of organizational agility. Kuilboer et al (2016) have examined BI capabilities as facilitators for organizational agility in operational, portfolio and strategic levels, and grouped BI tools into four capability groups: organizational memory, information integration, insight creation, and presentation.

The importance of environmental scanning, accentuated in many works on organizational agility, directly points at the need for powerful and agile BI. Discovering insights and responding needs a “degree of nimbleness that can’t be achieved by hierarchical bureaucracies”. If agility requirements are ignored and BI environment becomes rigid and cumbersome, this leads to isolated BI culture where BI users are looking for workaround solutions that result in ‘shadow BI’ structures. Such structures emerge spontaneously and, if isolated, lead to inconsistency, loss of standards and damaged trust in BI as a result.

According to Appelbaum et al (2017), to work around the rigidity of hierarchical structures and centralized decision making, alternative (horizontal, networked) organizational structures are required. The network structure allows rapid, flexible access to critical resources, capabilities and information. This aspect is very much in line with BI community that is shown to be a part of BI culture in earlier research by one of the authors (Skyrius et al., 2018), and confirms the importance of BI culture based on sharing insights and important information, building and strengthening the BI community.

There are contradictions related to developing or maintaining agile BI:

- From flexibility and creativity to governed stability and reliability;
- From few standards to many standards;
- From opportunity-oriented to survival-oriented notion of agility;
- From efficient and strained to slack but flexible (just-in-time versus just-in-case).

From technical perspective, centralized and highly standardized BI implementations can be reliable, ensure stability, efficiency and be governed, but they not meet agility requirements. On the other hand, self-service BI and information silos that empower business users are way more flexible and responsive to changing environment, but in the long term it might compromise reliability and connectivity as it is hard to govern and control. A balance between discipline (in the sense of adhering to defined rules, standards, and processes) and agility needs to be found – and the line between discipline and agility varies from context to context.

2.4. Summarizing and relations between factors

In order to gain a better understanding of agile environment it is important to be aware of factors not only supporting agility but also the ones restricting it. The summary of factors supporting or restricting agility, detected in literature analysis, is presented in Table 1.

Table 1. Factors supporting or restricting agility

	Supporting factors	Restricting factors
Organizational agility	<p>Agile organizational culture – flexible, creative, error-tolerant (Linders, 2013; Bateman and Snell, 2012; Tallon et al., 2019)</p> <p>Timely detection of important events and cues (Lee et al., 2015; Overby et al., 2006; Roberts & Grover, 2012; Seo and LaPaz, 2008; Appelbaum et al., 2017; Tallon et al., 2019; Chen and Siau, 2012)</p> <p>Rapid learning (Appelbaum et al., 2017; Oetringer, 2018)</p> <p>Fast decisions (Appelbaum et al., 2017; Queiroz et al., 2018)</p> <p>The ability to renew competences according to changing environments (Knabke and Olbrich, 2016)</p> <p>Mature BI capabilities (Watson and Wixom, 2007)</p> <p>Identification of core competencies (Bateman and Snell, 2012)</p>	<p>Rigid, conservative organizational culture (Bateman and Snell, 2012)</p> <p>Industrial organization (Verheyen, 2019)</p> <p>Information overload for decision makers (Seo and LaPaz, 2008)</p> <p>Lack of integration between information sources and perception systems (Seo and LaPaz, 2008)</p> <p>Variety of IT systems (Bani Hani et al., 2017)</p> <p>Inflexible IT systems (Van Oosterhout et al., 2006; Queiroz et al., 2018)</p> <p>Large organization size (Daft, 2001)</p>
Informing or information agility	<p>Agile informing culture (Choo, 2013)</p> <p>Emergent coordination (Liang et al., 2017)</p> <p>Removal of departmental information silos (Imhoff and Pettit, 2004)</p> <p>Flexible IT infrastructure (Appelbaum et al., 2017)</p> <p>Clear, rational and well-defined basic informing processes – reporting, KPI (Lee et al., 2015; Oetringer, 2018)</p> <p>Enterprise-wide information sharing (Liang et al., 2017)</p> <p>Capability to reconfigure IT resources (Sambamurthy and Zmud, 1997)</p> <p>Dynamic nature of BI (Mayer and Schaper, 2010; Zimmer et al., 2012)</p>	<p>Messy, chaotic IS strategy (Lu and Ramamurthy, 2011; Seo and LaPaz, 2008)</p> <p>Bad data quality (Seo and LaPaz, 2008)</p> <p>Departmental information silos (Imhoff and Pettit, 2004; Tallon et al., 2019)</p>
BI agility	<p>Agile BI culture (Bateman and Snell, 2012)</p> <p>Network structure (Appelbaum et al., 2017)</p> <p>Information and insight sharing (Skyrius et al., 2018)</p> <p>Lessons and experience (Oetringer, 2018)</p> <p>Community of experts/analysts (Appelbaum et al., 2017)</p>	<p>Rigid standards (Seo and LaPaz, 2008; Tallon et al., 2019)</p> <p>Information overload (Tallon et al., 2019)</p>

Source: authors

From the data in the above table we can see that there is a significant set of information-related factors influencing organizational agility, both at the levels of general informing functions (information agility) and BI functions (BI agility). Some of the factors are recognized as technical or 'hard' qualities (e.g., solution architecture), and the others are human related or 'soft' ones (e.g., culture). In the terms of organizational preparedness for changes, BI activities are expected to support it by providing the required monitoring and sensing of the environment, so it is easy to assume that agile BI will maintain its key competencies for longer time with required levels of performance. We may also infer that organizations with flatter structures and less rigid hierarchies possess a type of climate that is more supportive for agility.

3. Influences between the levels of agility

As shown before, organizational agility is largely based on information and informing; information serves as a unifying medium that allows to follow and coordinate all activities in their entirety. Thus, a non-agile BI will impair organizational agility through non-agile informing. While part of the informing entities, e.g., ERP systems, carry permanent informing functions, it is the unexpected events and changes that test the preparedness of organization to react. As BI functions aim to serve this non-routine part of information needs, BI agility as preparedness to reconfigure its competencies and assets in changing situations is of prime importance. For BI agility, BI culture is important because of its role in supporting or restricting development of BI capabilities to match the changing environment and growing experience.

In the face of the organizational challenges brought by the digital revolution we are seeing the paradigm shift from organizations being treated as machines to organizations understood as living organisms (Bateman & Snell, 2012). This organic system is driven by human interactions and behaviors that are in their own turn conditioned by culture, which plays an important role in organizational agility.

3.1. Organizational agility through culture

Since organizational agility is being recognized as an important determinant of organization success, it is important to specify what factors enable agility. In an extensive literature review on organizational agility by Tallon et al. (2019), the antecedents or enablers of agility can be subdivided into four general categories: technological, behavioral, organizational / structural, and environmental.

The culture, which falls under behavior category, is one of the essential drivers for change and is core of every organization with linkages to leadership, behaviors, org structure, processes, policies. Together with information, culture plays important role in enabling organizational agility. Chiavenato (1999) addresses the importance of organizational culture by stating that it represents the perception of managers and workers and reflects the predominant mentality at the organization. To our opinion, one of the most accurate definitions of organizational culture comes from Schein (2016) who describes it as: the accumulated shared learning of the group as it solves its problems of external

adaptation and internal integration. This accumulated learning is a pattern or system of beliefs, values, and behavioral norms that come to be taken for granted as basic assumptions and eventually drop out of awareness.

The kinds of cultures that enable greater agility is being rooted in people focused attributes such as autonomy, empowerment, collaboration. It is about creating an environment that is underpinned by values, behaviours and practices which enable organisations, teams and individuals to be more adaptive, flexible, innovative and resilient when dealing with complexity, uncertainty and change (Gogate, 2017).

In various sources authors often stress that agile is more culture than process (Denning, 2010). Agile culture is often associated with the following characteristics (Kulak and Li, 2017; Hesselberg, 2019; Spayd, 2010; Appelo, 2010):

- Shared sense of purpose;
- Servant leadership;
- Self-organizing and empowered teams;
- Collaboration and communication;
- Rapid iteration and experimentation;
- Continuous improvement and learning;
- Learning from failure;
- Willingness to share knowledge;
- Trust and transparency;
- Value driven.

At the core of agile culture is acceptance that this kind of culture should always be learning, developing and evolving so an end goal should never be reached.

3.2. Relation of organizational and BI cultures

The organizational culture corresponds to the values and beliefs of the company's staff, and it guides their behavior. A simpler definition of organizational culture is given by Johnson (1999): 'the way we do things around here'. Hence, the organizational culture influences how the company operates, including the ways of work with information and informing processes – also identified by researchers as information culture. The information culture is a part of organizational culture that is concerned with the assumptions, values, and norms that people have about creating, sharing, using information (Choo, 2013). This is leading to BI culture which supports the complex part of information needs scale intended to satisfy the needs for insights and decision support that arise from important and possibly costly issues (Skyrius et al., 2018).

If an organization is characterized as agile, this culture will reflect in the way company works with information and use BI applications to gain better insights. While BI capabilities are associated with higher organizational agility, it is equally important that managers promote a culture of calculated risk taking in order that employees have a way to test their ideas without fear of failure or retribution from superiors.

From a different angle, there is a need to be aware of certain cultural norms to be avoided as those that limit the value of BI. An example would be the culture of caution

that might block the sharing of BI insights. In order to gain most value of BI, the culture of transparency and openness is required and in the organization where those values are discouraged, BI won't be working properly since BI implementation might discover difficult truths about the organization.

Bateman and Snell (2012), discussing features of agile organization that are related to IS, BI, or informing activities in general, have defined organic structure that is more agile than mechanistic organization structure, and defined some important cultural features of such structure:

1. Jobholders have broader responsibilities that change as need arises.
2. Communication occurs through advice & information rather than orders & instructions.
3. Decision making and influence are decentralized and informal.
4. Expertise highly valued.
5. Jobholders have to balance judgment and evidence based on hard data.
6. Obedience to authority less important than commitment to the organizational goals.
7. Employees more interdependent, relate more informally & personally

To sum up, BI culture is not isolated, it depends on / is part of organizational culture which drives informing standards and use of valuable insights.

3.3. BI culture impact on BI agility

The agility is recognized as one of the key success criteria for a BI solution. Baars and Zimmer (2013) suggest to define BI agility as the ability to efficiently and quickly react to changes in foreseen or unforeseen requirements based on structural and behavioral characteristics of the BI system as well as anticipating change proactively. Since the behavior characteristics are driven by culture, we can state that BI culture is expected to have impact on BI agility. BI agility is especially being fostered by the following culture related aspects:

Tolerance for experimentation and mistakes (Marchand and Peppard, 2013);

- The horizontal BI community of analysts and insight builders throughout the organization (Hallikainen et al., 2012);
- Communication and sharing of information (Davies, 2004; Kiron and Shockley, 2011);
- Availability of prior experience and lessons learned (Marchand et al., 2001);
- Balanced IT governance with the required level of essential common standards and self-service environments that support the agility and flexibility (Zimmer et al., 2012).

Discovering insights and responding needs a “degree of nimbleness that can't be achieved by hierarchical bureaucracies” (Appelbaum et al., 2017). To work around the rigidity of hierarchical structures and centralized decision making, alternative (horizontal, networked) organizational structures are required. Agile way of working promotes horizontal communities of subject matter experts - in BI context, the existence of intelligence community is one of the key factors to support agile BI culture.

3.4. Organizational agility through BI agility

Many sources directly relate organizational agility to sense and response capabilities that are the very focus of BI systems (Park et al., 2017; Lee et al., 2015; Chen et al., 2014; Overby et al., 2006). Although BI cannot make decisions or execute organizational changes itself, its role in sensing and decision support is indisputable. The sensing task includes such activities as acquiring a vast amount of data from various sources about events of environmental change and processing raw signals to turn data into information and knowledge, and eventually into actionable insights (El Sawy, 1985). This task initiates decision making and acting tasks – response. The response task often requires decision makers to access the history of previous decisions – BI can serve here as well. A cycle of these tasks is also an organizational learning process, which creates new knowledge of environmental change and commands organizations to adjust or replace extant knowledge and rules (Park et al., 2017).

Seo and LaPaz (2008) have structured the basic logic of organizational agility into several components:

- **Perception** senses changes in the environment. The role of IS here is to capture sufficient amounts of relevant data.
- **Processing** – filtering and processing raw signals to accurate information; intelligence and analytics functions belong here.
- **Responding** is an organizational pro- or re-action to the signals. Decision makers have to access the history of previous decisions.
- **Aligning** is related to changes in objectives and processes that affect the needs for sensing, processing and responding to the new signals. The new information needs clearly require changes in intelligence setup.
- **Learning** is an ability to build on experience.
- **Competency development** comprises knowledge and experience.

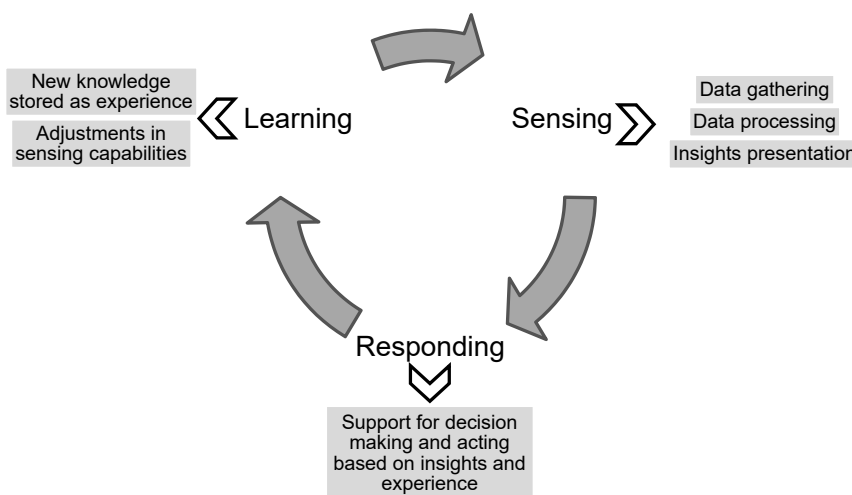


Figure 1. Agile organization process loop and supporting BI capabilities (source: authors)

The above process is clearly of a cyclical nature, and its functions are largely based on informing activities that remind other cyclical informing processes – decision making, business intelligence, organizational learning and others, usually attributed to the area of sophisticated informing activities. The changes in business objectives and processes affect the needs for sensing, processing and responding to the new signals. BI capabilities support not only organizational reactive responses to environmental changes, but also proactive enhancements to foresee opportunities or threats (Zimmer et al., 2012). The agile organization process loop with links to supporting BI capabilities is shown in Figure 1.

An analysis of published sources in AIS's "basket of eight" journals, performed by Knabke and Olbrich (2016), produced several main dynamic capabilities related to BI use: adoption of BI assets, market understanding and intimacy, and supporting business operations. The adoption of BI assets aims at effective use of BI technology potential supporting the other two capabilities: market understanding and intimacy leverages the information and insights about external environment, and supporting business operations is an inward-oriented capability focused on principal internal processes.

BI dynamics are largely determined by the dynamics of business needs (Mayer and Schaper, 2010). While similar conclusions might be drawn for other systems as well, the domain of BI is disproportionately affected because of its heavily data-centered nature and because subject to managerial decision making are not only factual changes but also potential ones. A consequence of this is the requirement that the BI systems, their design, and their development processes have to become agile too, as a change in the business environment will inevitably entail changes in the relevant data fallout (Zimmer et al., 2012). If BI is not adapting constantly, the support for organizational agility will be limited and even restricting.

As well, organizations differ in the extent to which their BI capabilities support agility based on maturity of BI usage (Watson & Wixom, 2007). The organizations with nonintegrated data, high data latency, Excel-based analytics, and little appreciation for information-based decision making are unlikely to be agile. In such cases, the principal BI function of developing an encompassing view of the environment and sensing important changes becomes rather complicated.

4. Assumptions

Having summarized the available research on organizational and BI agility issues, we may note the relative importance of cultural factors for the development of agile competencies. The possible research model could be of the following structure (Figure 2).

Several assumptions are reflected here regarding influences between the components. Firstly, organizational agility, as many sources indicate, largely depends upon organizational culture – rigid, conservative or complacent cultures contain significant inertia, whereas fluid, less formal cultures accept changes as a permanent part of their activities. Secondly, BI culture is part of the organizational culture, and leverages its potential accordingly, in the boundaries set by organizational culture. Thirdly, BI culture defines the potential of BI agility by supporting or restricting flexibility, network communities and

open-minded approaches that support necessary changes with less friction. And finally, to the extent that organizational agility is significantly influenced by informing functions, agile BI is an important precondition for agile organization. Functions like effective monitoring of internal and external environment, sensing important signals and minimizing the probability of missing important cues are of vital importance to organizational agility. The more detailed investigation of the above dependencies is the research task that the authors of this paper are to undertake.

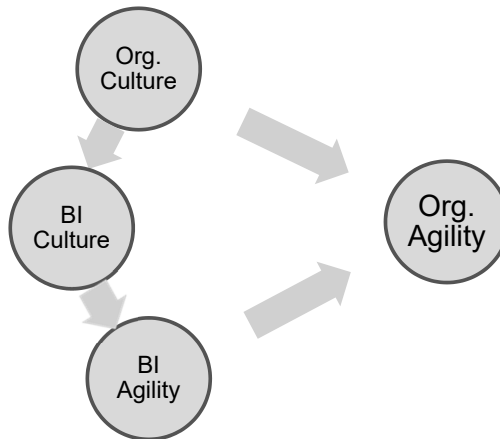


Figure 2. **Research model** (source: authors)

4. Conclusions

While the importance of agility in a business organization is obvious, the dominating informational nature of many factors affecting this agility raises important questions about the role of informing processes. One of the central roles in assuring organizational agility has to be assigned to BI activities, since their principal task is to monitor the environment and sense important issues with subsequent support for well-informed responses. The importance of managerial and especially cultural factors for the role of informing in building up agility competencies is evident, as well as their under-researched nature. The technology factors of agile informing that create preconditions for organizational agility, to our opinion, are much more researched and evaluated than their human and managerial counterparts. Consequently, there is a need for consistent research approach in favor of the less researched human and managerial factors. The upcoming research is going to account for increasingly dynamic nature of business activities, focus on the role of informing and intelligence functions and the factors of cultural environment in an organization that support or impair agility competencies. The principal research question would aim at the definition of a set of human and managerial factors influencing organizational agility, and the proposed initial research model should serve as a starting point to plan, guide and conduct the discovery process.

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