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# BITInLine: A Serious Game to Enhance Business Information Technology and Strategy Alignment

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**Abstract:** For organizations that use IT systems in their primary business or as support of their business processes, optimal alignment between the business strategy and their business information technology (BIT) is critical. However, achieving business information technology alignment remains challenging due to the vast number of choices one has to make. Firstly, one has to choose from a large number of potential BIT practices. Secondly, one has to choose BIT practices that align with the business strategy. Thirdly, one has to understand the dynamics of combining multiple BIT practices. And, finally, as business strategy and BIT practices evolve, one needs to consider the long-term alignment as this has significant consequences for both the business strategy and the overall enterprise architecture. These intricacies of alignment mirror the challenges apparent in other business strategy-practice alignment domains. An example is human resource management and strategy alignment for which a simulation model and serious game has been developed in prior research. Here, we build upon this prior research. In BITInLine players have to select a set of BIT practices with the best strategy fit from a list of 48 different BIT practices. The challenge is to select a combination of practices over multiple consecutive simulated years (rounds within the game) that align to the organisations' strategic profile, and adapt to the outcomes of the choices made in previous years. Practices in the game are clustered around six key BIT topics emerging from the strategic alignment and enterprise architecture disciplines: (1) service strategy, (2) information & data strategy, (3) platform & application strategy, (4) Infrastructure strategy, (5) security strategy, and (6) operations and performance. In BITInLine feedback on the BITA and the deviation from the desired strategic profile is presented after each round (representing a year of using the selected practices). Using BITInLine, players can experiment with, and in doing so learn from, selecting multiple combinations of BIT practices and experience the outcome of their choices in terms of BITA over multiple simulated years, while adapting their choice of practices to the situation at hand. In the current paper the serious game (re)design to create BITInLine and an initial trial run will be presented.

**Keywords:** Business information technology, business strategy, serious game, competing values model, game-based research method

## 1. Introduction

While the importance of alignment between business information technology (BIT) and business strategy (BITA) is well recognized (Reich & Benbasat, 1996, Melville, 2004) attaining that alignment is challenging (Reich & Benbasat, 2000, Aversano, Grasso, & Torterella, 2012). The field of Enterprise Architecture has emerged from this important classical problem and some tools have been developed to aid IT professionals to attain BITA (see for example Luftman, Lewis and Oldhach (1993)). The enterprise architecture mission is to provide the formal modelling, methodological, and analytical instruments to achieve BITA. Although research addressing BITA is rich and has matured over the last three decades, the communication and transfer to the practice of BITA is still an issue, as many organisations experience difficulties on how to address BITA related problems. BIT-professionals remain struggling with the attainment of BITA. The potential of serious games to help professionals attain BITA, and in doing so, provide a valuable learning tool seems unexplored. To attain BITA, IT professionals must select BIT practices from many options and consider their long-term alignment on business strategies. A tool that enables IT professionals to experiment with BIT practice choices and their consequences in terms of BITA, without incurring the costs and possible downsides of their choices in real life, has the potential to both increase quality of the selection of BIT practices, and be a valuable learning tool for IT professionals. The IT professionals potentially learn, by playing the game, how to attain BITA and subsequently can apply their newly attained skills to their own organizations making that organization more effective trough BITA. Using design science methodology (Peffers et al., 2007), we set out to create a BITA serious game. Thus, the main novel contribution of this paper is the design and initial demonstration of BITInLine, a serious game addressing the challenge of aligning BIT with the business strategy. First, we will elaborate upon the theoretical intricacies of BITA that need to be included in BITInLine (Section 2). Secondly, we present the operationalisation of these intricacies (Section 3.1. and 3.2). Lastly, we will elaborate upon our first game demonstration and evaluation

after playing BITInLine during workshops with IT-professionals (Section 3.3). Section 4 concludes the paper with a discussion and pointer to future work.

## 2. Theoretical embedding of BITInLine

According to Aversano et. al., (2012) an approach to attain alignment should at least entail (1) modelling, (2) alignment evaluation, and (3) evolution execution. Modelling refers to the inclusion of business (strategy) and technical (BIT) details that are mapped on a common framework to foster comparison. This is essential for the evaluation of alignment. Finally, misalignment can be addressed by the adaptation of business, or technical aspects to increase alignment. Hence, to create a serious game that aids IT professionals in their quest for BITA there is a need to specify business strategy and BIT practices using a common framework. In addition, as misalignment needs to be addressed for IT professionals to learn, there is a need for an organizational change model that informs how and where misalignment occurs and changes over multiple years.

There are different ways to operationalize business strategy (see Mintzberg (1983) or Porter (1980)). Building on previous work that addressed similar game-based alignment operationalisation (Collou, Bruinsma, van Riemsdijk, 2019; Collou, 2020) the BITA game described here incorporates the competing values model from Cameron and Quinn (2006). The competing value model provides a framework to map organizations based on the extent to which an organization focuses on flexibility vs. stability and integration vs. differentiation (figure 1).

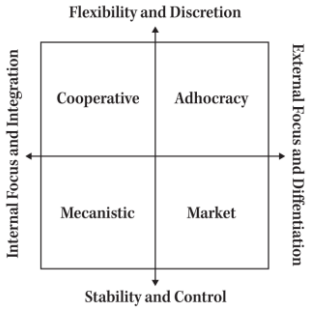


**Figure 1:** Competing value model (Cameron and Quinn (2006) to map business strategy.

Using the competing values model, four ideal type strategies emerge: cooperative, adhocratic, mechanistic and market. Cooperative organizations focus on quality enhancement, openness, participation and employee development. Adhocratic organizations focus on innovation, acquiring new resources, embracing new challenges and prospecting for opportunities. Mechanistic organizations focus on low costs efficiency, stability and an emphasis on permanence. Market organizations focus on market share, competition, hitting stretched targets and a focus on winning in the marketplace. In practice organizations commonly combine elements out of these ideal-types and in doing so apply a 'hybrid' strategy (Collou, 2020; Knol, 2013). An organization can for example combine the quality enhancement elements of a cooperative strategy with the stability focus of a mechanistic strategy, becoming a hybrid cooperative mechanistic organization.

In addition to specifying business strategy, there is a need to specify BIT practices, and make explicit the focus of IT business value (Tallon, 2007). By combining Tallon (2007), University of Sussex (2015) (which identified 6 IT strategy components that drive IT business processes and practices), seminal work on business performance management and its impact on business strategy (Kaplan and Norton, 1996), and our own work on quantitative and model-based analysis of enterprise performance (Iacob, & Jonkers, 2006) we devised the IT strategy framework shown in Table 1. This framework represents the foundation, and justificatory knowledge (Gregor and Jones, 2007) for the design of and mapping in BITinLine.

**Table 1:** IT Strategy components (University of Sussex, 2015, Tallon, 2007)

| | |
|---|---|
| **Service Strategy** | Deliver better and cost-effective services to the business and customers |
| **Information/Data Strategy** | Maintain integrity, availability and accuracy of business data across business processes |
| **Platform/Application Strategy** | Deliver the required business functionality with lower TCO, easy maintainability, and reduced delivery time |
| **Infrastructure Strategy** | Provide a high performing, reliable, energy and cost-efficient environment to run IT services |
| **Security Strategy** | Protect confidentiality, integrity and availability of information by establishing physical and logical controls |
| **Operations and performance** | KPI driven execution of IT components |

The manner in which these components are transformed into practical BIT practices is highly dependent on the strategy of the organization (i.e., an innovative and flexible organization tends to demand the same innovation and flexibility from its IT infrastructure).

The competing values model enables the specification of business strategy. In order to assess BIT alignment, BIT practices ought to be assessed using those same competing values (i.e., common framework). Hence, in order to facilitate the second element of Aversano et al., (2012) the BIT practices have to be 'scored' on the extent to which they map onto the competing values. Figure 2a depicts the theoretical model used for BITInLine in which the business strategy is dependent upon the flexibility vs. stability and integration vs. differentiation focus, and in which these choices concerning strategy influence the design of the BIT practices in the six BIT components.

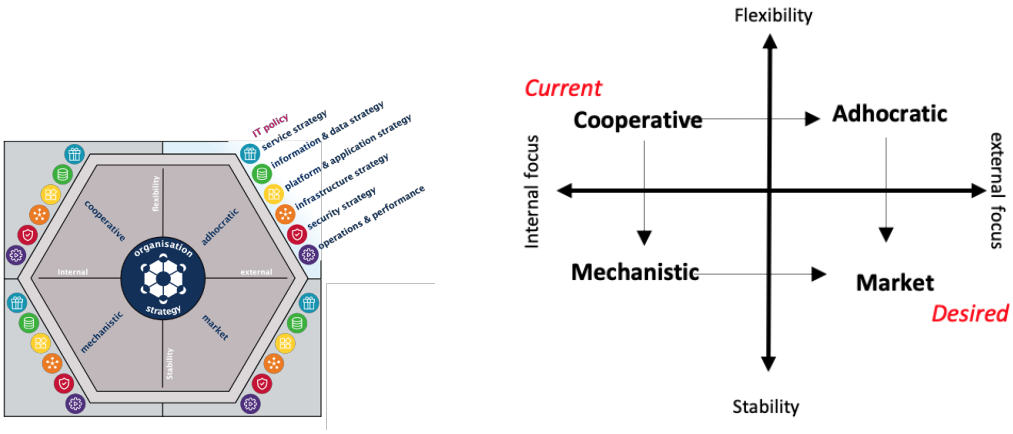


**Figure 2(a). Theoretical model 2(b):** Organisational change through neighbouring quadrants in the competing values model

In addition to having a common framework upon which both business strategy and BIT practices can be mapped, there is a need for a rationale on how alignment changes over time as BIT practices are combined over multiple years. Cameron and Quinn (2006) provide insight on how organizational change comes about in terms of the competing values model. Addressing the third factor of Aversano et al., (2012), the process of organizational change proposed by Cameron and Quinn (2006) suggests a gradual shift from one quadrant to neighbouring quadrants. Organizational change is an incremental process, when changing 'sideways' as opposed to 'diagonally', the organization can retain one competing value. Moving diagonally, both competing values must be switched simultaneously, requiring complete and potentially chaotic change. One example of this pathway of organizational change is the way in which organizations mature according to Cameron and Quinn (2006); from an adhocracy to a cooperative, from a cooperative to a mechanistic, and finally from a mechanistic to a market emphasis (p.55), see figure 2(b).

Several criteria emerge for a serious game to facilitate the navigation through the complex BITA domain. First, both business strategy and an exhaustive list of BIT practices ought to be operationalised using a common framework so that alignment scores between strategy and BIT can be calculated (BITA). Second, as we strive to enable players to experience the effects of BIT practice selection on BITA, changes in BITA over multiple years needs to be specified. In addition, from a serious gaming perspective, the game needs to provide easy to grasp

in-game feedback, which can be used by players to alter (improve) decisions. In doing so the game enables players to learn how to tailor BIT practices to business strategy. Furthermore, the game should foster discussion amongst IT professionals considering the BIT practices selected given a particular strategy, enabling a more thorough and systematic approach to the selection of BIT. Finally, as serious games use the element of engagement to increase learning (Wouters, van Nimwegen, van der Spek, 2013), motivational aspects should be part of the game. In order to get an overview of BITInLine we now first present the flow and gameplay of the game after which we elaborate on how BITInLine is designed to meet the earlier mentioned criteria, and on the initial test runs.

## 3. BITInLine design

BITInLine was designed taking into consideration varying business strategies, a comprehensive set of BIT practices and the multiyear considerations of BITA. Based on the competing values model (Cameron & Quinn, 2006) four ideal-type business strategies, and the opportunity to combine elements from these ideal-types, are included in the game. During a game session players follow 9 sequential steps which will be elaborated upon now.

### 3.1 BITInline flow and gameplay

Before the start of a BITInLine game session, players are divided into teams and are introduced to the 9 sequential steps that make up the serious game session. These steps revolve around the selection and prioritization (step 1, 4, and 7) specification (step 2, 5 and 8), and evaluation (step 3, 6 and 9) of those BIT interventions that will increase BIT alignment. Using a graphical representation of the nine steps to be taken (3 steps per round, 3 rounds) a multiyear perspective to BIT is encouraged as players are reminded of the years ahead and how the outcomes of year 3 build upon the decisions taken in prior years (figure 3).

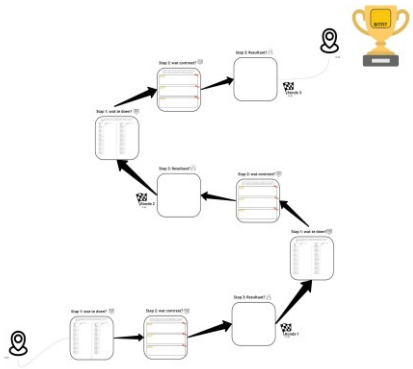

**Figure 3**: Online game navigation (language: Dutch, step 1, 4, 7= “what to do”, step 2, 5, 8= “specify”, step 3, 6, 9= “results”)

Subsequently, players are introduced to the organization for which they are challenged to improve BITA. The business strategy and current BIT score of the organization is presented in terms of the competing values model. The importance of BITA, and competition between teams in terms of BITA is emphasized. After this introduction players are asked to take step 1 of year 1: select and prioritize a set of BIT practices that increase BITA. Players do so by using cards that depict 48 BIT practices, these cards can be found here (http://www.gamelab20.nl/BIT/), see figure 4 for a sample of 8 BIT practices cards.

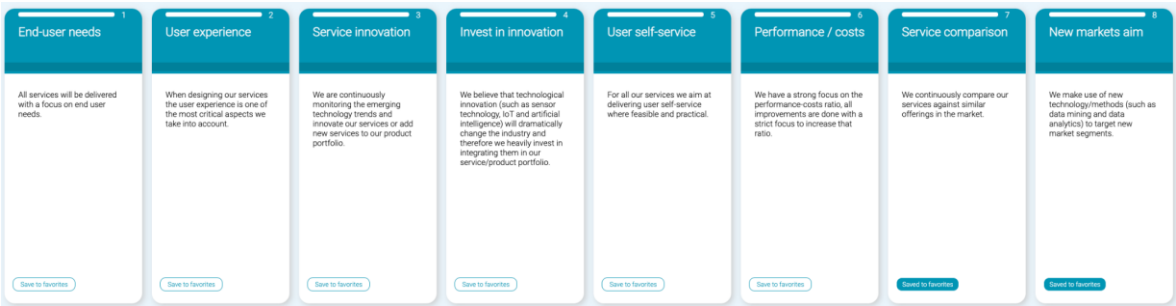


**Figure 4:** BITInLine practice cards

After making a selection and prioritization, players are encouraged to share their selection and foster group discussion. Subsequently, players are asked to specify the three most highly prioritized BIT practices (step 2, year 1): *what ought to be done specifically for those BIT practices to come to fruition?* This level of detail will encourage players to be critical and increase the usability of the selected practices in the respective organizations of the players. The BIT intervention practices that players selected during step 1 are entered into the simulation model which calculates how the BIT score and consequently BITA changes (section 2.1). Once the players are done specifying the highly prioritized BIT practices they are once again encouraged to share their outcomes with the whole group. Subsequently, the outcomes of their BIT intervention in terms of BITA is provided by the simulation model (see figure 5). Teams are encouraged to discuss these outcomes (step 3, year 1).


**Figure 5:** Performance feedback dashboard

The team with the highest fit score attained the highest BITA (ranging from 0 to 100). After discussing these results players are challenged to redesign their BIT by selecting a new set of BIT practices (BIT intervention) to increase BITA (step 1, year 2). This process of selecting and prioritizing, specifying, and discussing the outcomes is repeated for a total of three years. By simulating multiple years, BITInLine challenges the players to design and redesign BIT of an organization, while making explicit the degree of alignment and enabling players to learn and compete.

### 3.2 Operationalisation of strategy, BIT practices, alignment & change

During a game session, players are presented with the business strategy (t1), current BIT score (t1) and the consequential current BITA (t1). Subsequently players are challenged to select those BIT practices that they think will increase BITA. This selection of BIT practices to be implemented is labelled the BIT intervention. This BIT intervention affects the current BIT score (t1) and results in a new BIT score (t2) which in turn results in a different BITA (t2). Players are then, once again, challenged to select those BIT practices that they think will change the BIT score (t2) in such a way as to further increase BITA (t3). See figure 6.

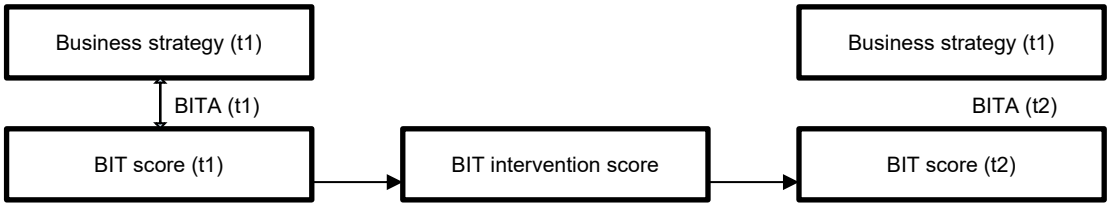


**Figure 6.** Functional steps and operationalization BITInLine

The following subsections will specify the individual concepts and their interrelationships of figure 6.

*3.2.1 Business strategy*

Within BITInLine business strategy is operationalised allocating of 100 points over four underlying variables representing the four strategic quadrants. In table 2 an example is provided in which the organization upholds a hybrid strategy: 80 percent focus on cooperative elements and a 20 percent focus on adhocratic elements.

**Table 2:** Business strategy score

| | **Cooperative** | **Adhocratic** | **Market** | **Mechanistic** |
|---|---|---|---|---|
| **Business strategy** | 80 | 20 | 0 | 0 |

Within the gaming session these strategic focus scores can be based on mock data or based on the organizational culture assessment instrument (Cameron & Quinn, 2006) filled out by management of an organization. Within regular game sessions, the strategy score remains stable, although BITInLine provides the possibility to change the business strategy during the game. This enables BITInLine to incorporate business strategy changes.

*3.2.2 BIT practices: BIT score & BIT intervention score*

In addition to the business strategy, a BIT score, and a BIT intervention score are used in BITinline. The BIT score refers to the current BIT classification, expressed in the same quadrants as the business strategy. The BIT intervention score refers to the impact of the BIT practices players selected, expressed as the impact on the elements in the strategic quadrants.

To determine the BIT intervention score we need an exhaustive set of BIT practices the BITInLine players can choose from. We use the competing values framework to enable a common framework. To capture the diversity of the four business strategies and 6 BIT components, 48 BIT practices were defined (4 [strategies]*6 [BIT components] *2 [design options per practice per strategy]). Table 3 presents an example of the BIT component service strategy and the 8 design options related to the four different strategies. The initial set of practices is based on business performance management, strategic management and alignment, enterprise architecture and organisational science literature, and will be continuously evaluated, validated, and extended.

**Table 3**: BIT practices

| **Cooperative** | **Adhocratic** |
|---|---|
| -All services will be delivered with a focus on end user needs.<br>-When designing our services, the user experience is one of the most critical aspects we take into account. | -We are continuously monitoring the emerging technology trends and innovating our services or adding new services to our product portfolio.<br>-We believe that technological innovation (such as sensor technology, IoT and artificial intelligence) will dramatically change the industry and therefore we heavily invest in integrating them in our service/product portfolio. |
| **Market** | **Mechanistic** |
| -For all our services we aim at delivering user self-service where feasible and practical.<br>-We have a strong focus on the performance-costs ratio, all improvements are done with a strict focus to increase that ratio. | -We continuously compare our services against similar offerings in the market.<br>-We make use of new technology/methods (such as data mining and data analytics) to target new market segments. |

Every individual BIT practice is assigned four initial scores reflecting the extent to which it aligns to the four business strategies. These scores were assigned in such a way that every BIT practice aligns best to one quadrant, aligns somewhat to the neighbouring quadrants of that first quadrant and aligns the least to the diagonally opposite quadrant (see table 4).

**Table 4:** BIT practice scores

| | **Cooperative** | **Adhocratic** | **Market** | **Mechanistic** |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| All services will be delivered with a focus on end user needs. | 60 | 15 | 10 | 15 |
| We are continuously monitoring the emerging technology trends and innovating our services or adding new services to our product portfolio. | 15 | 60 | 15 | 10 |
| We continuously compare our services against similar offerings in the market. | 10 | 15 | 60 | 15 |
| For all our services we aim at delivering user self-service where feasible and practical. | 15 | 10 | 15 | 60 |
| **BIT (intervention) score**<br>***Average of individual practice scores*** | **25** | **25** | **25** | **25** |

Using these individual BIT practice scores, both a BIT score and a BIT intervention score can be calculated. The initial BIT score (t1) can be defined by using mock data, or by using an assessment of the current applicable BIT practices at an organization. If a set of BIT practices is found at the organization, the BIT score can be calculated by averaging the scores on the four strategic quadrants of those BIT practices (see table 4). Similarly, a BIT intervention score can be calculated by averaging the scores of those BIT practices selected by players. In every round (i.e., year) players select those BIT practices that according to them will increase BITA. The average scores on all four strategic quadrants of those selected BIT practices equal the BIT intervention scores for that particular round.

***BITA***

During the game, players are provided with actionable feedback by means of the BITA score. This BITA score is calculated based on the strategy score and the BIT score. The BITA score (measure of fit) is calculated by taking the absolute cumulative difference between the strategy scores and BIT scores normalized to a 0 to 100 scale. An example is given in table 5: the business strategy is made up of an 80 percent focus on the cooperative strategy; a 20 percent focus on the adhocratic strategy, and no focus on the mechanistic and market strategy. The BIT focus is made up by a 60 percent focus on cooperative elements; a 15 percent focus on adhocratic elements; a 17,5 percent focus on market elements and a 7,5 percent focus on mechanistic elements.

**Table 5:** Business strategy, BIT practice focus and vertical alignment

| | **Cooperative** | **Adhocratic** | **Market** | **Mechanistic** |
|---|---|---|---|---|
| **Business strategy** | 80 | 20 | 0 | 0 |
| **BIT score** | 60 | 15 | 17,5 | 7,5 |
| **(Absolute) differences** | 20 | 5 | 17,5 | 7,5 |
| **BITA score** | *200-((20+5+17,5+7,5)*/2) = **75** | | | |

By calculating the BITA scores, BITInLine makes the extent of alignment between BIT and the strategic focus of an organization explicit. This enables reflection and redesign of the BIT practices over multiple rounds. Hence, players are challenged to select a set of BIT practices (i.e., the BIT intervention score) that affects the current BITA score and consequently increases BITA each round. In the remainder of this section, we explain *how* the BIT intervention score affects the current BIT score.

### *3.2.3 Changes in BITA*

As players are challenged to select BIT practices that alter the BIT score and consequently BITA, there is a need to calculate how BIT changes throughout the multiple rounds. The method with which changes in the BIT score occurs during the game adheres to the organizational change process implied by the competing values model. A simulation model developed in a prior study (Collou, 2020) was applied to calculate these changes.

Based on the strategy score, the current BIT score (t1), and the BIT intervention score, the model calculates how BIT changes, and recalculates BITA (t2). Changing the BIT score occurs by changing the individual BIT quadrant

scores through the neighbouring quadrants that share one competing value. Specifically, the simulation model calculates the extent to which every BIT quadrant score needs to change based on the opposing quadrants BIT intervention score; if the BIT intervention scores high on the cooperation quadrant, the model first calculates a small decrease in the market quadrant. Subsequently, the model calculates a large decrease of the neighbouring quadrants and adds those scores to the BIT intervention quadrant; the cooperation quadrant takes in a large chunk of both the adhocratic and mechanistic quadrants. See figure 7a and 7b where a BIT intervention with a score on the cooperative quadrant is applied to a current BIT score that is equally distributed over the four quadrants.

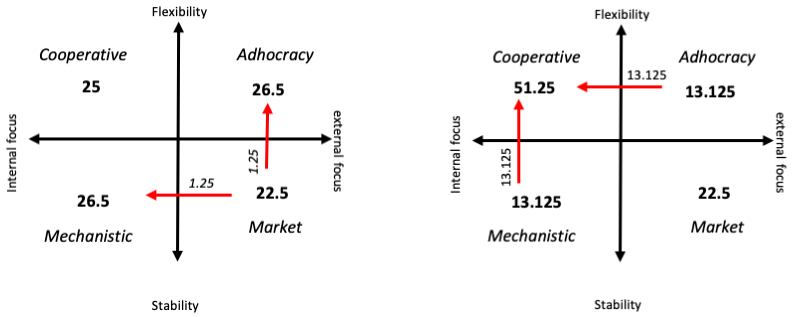


**Figure 7(a):** Changes in BIT score step 1 and (b) Changes in BIT score step 2

The purpose of these calculations is to reflect the directions of the change process inherent to the competing values model. In this example, the BIT intervention provides a score for the cooperative quadrant only. However, BIT intervention scores always provide scores on all four quadrants. Due to the interdependency of the calculations (a score on the cooperative quadrant affects all other quadrants), the starting point of the calculation affects its outcomes. If the simulation model starts calculating from the cooperative quadrant, it will change the scores in all other quadrants and thereby change the start values by subsequently calculating the effects starting from the adhocratic quadrant. To filter out this bias of starting order the model calculates the final outcomes of all possible orders of calculations (Q1, Q2, Q3, Q4 – Q1, Q3, Q2, Q4 – etc.) and takes the average to be the final outcome.

BITInLine meets the priory listed requirements as it enables a specified assessment of business strategy and an exhaustive set of BIT practices using a common framework. BITA can be calculated over multiple years as BIT intervention scores affect BIT, and consequently, BITA. In addition, BITA provides an easy-to-understand feedback measure for players to assess the quality of their selection.

### 3.3 Initial demonstration and evaluation

In accordance with the demonstration phases of design research methodology (Peffers, et al., 2007) we set out to demonstrate and test the functionalities of BITInLine during two game workshops in which a total of 51 IT professionals participated. We explicitly set out to test the flow and functionalities of the game during these two sessions. More specifically we assessed the extent to which players experienced the sequency of the 9 steps as logical and engaging (flow), and assessed the extent to which the selections of BIT-practices and their outcomes in terms of BITA enabled us to distinguish between groups over multiple years (functionality). We did not explicitly ask questions on flow and functionality during the game sessions (as to not disturb players) but did observe the in-game discussions. After the game session we did ask players for feedback, first in general and second more explicitly in terms of flow and functionality.

BITInLine proved to be able to distinguish between the quality of BIT practice choices made by the different teams (4 to 5 players) as varying fit scores were attained. Moreover, these fit scores fluctuated during the different rounds demonstrating that, while fit scores did build upon prior fit scores, some teams increased the quality of their selection, and attained higher BITA. No critique was formulated regarding the outcomes of the simulation model suggesting that BITA scores provided are in line with expectations and/or reality as experienced by the IT professionals in this (limited) sample.

Feedback was overwhelmingly positive, players stated that they were reminded of the multiyear strategic nature of selecting BIT practices when playing BITInLine and appreciated the discussion of BIT content that, according

to them, did not always happen during day-to-day tasks. Lively discussion emerged on why BIT practices were selected and how those practices could be specified. The level of detail in specifying BIT practices varied with some groups being able to be very detailed and others learning from these groups how to specify BIT. Moreover, the players labelled the game as being fun in multiple comments.

## 4. Conclusion & discussion

The current paper described the design and initial run of a serious game with the goal of challenging players (students and professionals) to select a combination of BIT practices over multiple consecutive simulated years that align with the business strategy and adapt to the outcomes of the previous choices. Players had to select a set of BIT practices from a comprehensive list of 48 different BIT practices. The selected practices were entered in a simulation model to provide feedback on BITA. Feedback from the simulation model, and in addition team performance on the practical implementation of BIT practices, were discussed in groups of players that competed against each other to achieve the best fit. In an engaging manner, players can experiment with, and in doing so learn from, selecting multiple combinations of BIT practices and experience the outcome of their choices in terms of BITA over multiple simulated years.

Results from the initial test runs show promising results. Lively discussions within and between groups of players on how to achieve BITA are the result of playing BITInLine. The simulation model that calculates the impact of the BITA intervention showed plausible results and was no topic of discussion during the test runs. However, challenges remain. First, validating the weighting factors of the individual BIT practices is a high priority for future research. Secondly, further research should focus on the weighting of a combination of practices. The impact of the intervention is determined by calculating the mean scores of all selected practices. In this initial design mutually exclusive practices, or combinations of practices that boost each-others' impact, were not accounted for. Thirdly, although BITInline accounts for organizational change dynamics based on the direct outcomes of the selected practices in a certain year, between year impact of practices is not included in the change model, leaving out the possibility to "build up" practices over multiple years. Fourthly, while first impressions are positive, a more systematic approach to validating the learning effects of BITInLine is needed.

Due to restrictions COVID-19 restrictions, BITInline was played online. Nevertheless, the flow of the game, the guidance in the online game navigation and rapid feedback from the simulation model engaged players throughout the game session. Future comparison with an offline version of the game, that uses the same principles, but expands the discussion possibilities, could improve the learning experience and impact of the game.

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