

Digital Transformation and Operational Agility: Love Story or Conceptual Mismatch

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Abstract. The Digital Transformation (DT) refers to the ongoing process organizations go through in order to integrate digital technologies in all areas of the business, particularly the ones related to delivering high added value to the customer and stakeholders. As such, the DT can be apprehended in different ways. One can simply adopt new digital technologies on the fly when made available on the market or carefully study each new IT development at the light of a set-up of a carefully defined business, IT and/or DT strategy. Moreover, within the context of a structured approach of the DT, innovations can be adopted in a top-down fashion; nevertheless, leaving some space within development for co-creation involving the user/customer is also important to favor innovation leading to competitive advantages. The framework developed in this paper extends a previously built model-driven framework for supporting strategic agility (called StratAMoDrIGo) to allow the evaluation of the added value to the DT of functional elements contained in user stories written by or with the help of the end-user. These user stories depict concrete system behavior associated to more abstract *Features* themselves being part of strategic opportunities identified at governance level. The approach is thus part of a more comprehensive approach to reconcile operational developments with strategic concerns.

Keywords: Digital Transformation, Strategic Agility, Operational Agility, User Stories, i* framework.

1 Introduction

The Digital Transformation (DT) is an important present-day concern for many organizations especially within the context of the Covid-19 pandemic. On the one hand, the DT needs to be driven by strategic concerns meaning that the organization has to approach it in a *top-down* fashion to ensure a competitive position in the long run thanks to the acquisition of relevant digital technologies. On the other hand, the DT is essentially focused on delivering value to the customer and other stakeholders, therefore, value streams are often uncovered through an agile software (or digital technology) delivery approach which is *bottom-up* by nature. The problem can be approached then in terms

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of finding the adequate alignment between which functions to adopt for the delivered technology and the overall DT strategy. Likewise, organizations also deal with classic Business and IT strategies that IT acquisitions need to align to or comply with.

Tsilionis & Wautelet [13] propose *StratAMoDrIGo*, a conceptual modeling-driven approach aimed at supporting organizations to achieve a state of strategic agility; the latter refers to an organization's capacity to fully enable three main types of dynamic capabilities, i.e., the capacity to sense and shape opportunities (sensing), the capacity to seize opportunities (seizing), and the capacity to maintain competitiveness through reconfiguring the enterprise's assets (shifting) [3]. The inclusion of *StratAMoDrIGo* in the organization's practices is intended to enhance i) its *sensing capability* by creating an opportunity-aware culture, ii) its *seizing capability* by offering a concrete way to evaluate the organizational impact of opportunities' adoption, and iii) its *shifting capability* by highlighting how organizational resources and structures can be reconfigured for the adoption of the opportunities. Overall, the key idea of *StratAMoDrIGo* is to identify so-called *Strategic Opportunities*; these are technologies having a structural impact on the organization's finances as well as the way it conducts its business. The impact brought by these strategic opportunities in terms of strategic, stakeholder and user value is studied by the application of the framework. The main drawback of the approach is that it focuses on agility on a strategic (and tactical) level but essentially views the user value in terms of coarse-grained features that are set-up in a top-down fashion. Agility at strategic level can be indeed achieved by the swift and 'rough' outline of the systems, approaches, techniques that can be adopted and the delineation of their core features. Nevertheless, *StratAMoDrIGo* leaves aspects adhering to operational agility (i.e., the determination of fine-grained functions/elements highly valuable for the end-users) to be identified later in collaboration with customers. However, these fine-grained functions are conditioning the system behavior, thusly delivering value not only on the user but also on other stakeholders and to the entire organization. These fine-grained elements, captured into user stories within agile methods like Scrum, deserve a more thorough analysis into a DT context. A bottom-up approach can then be followed in order to study this impact.

This paper starts by studying theoretically how we can link the user stories within *StratAMoDrIGo* and how these low-level functions typically capturing customer value can impact the business, IT and DT strategies. In this regard, the main research question of the paper is "*How can we refine the StratAMoDrIGo framework to support the conjunct use of strategic and operational agility in a DT context?*". The main contribution to this question is the framework enhancing *StratAMoDrIGo* by incorporating user stories and the DT strategy directly within the ontology. The proposal is illustrated on a case study describing an Enterprise Resource Planning (ERP) system enhancement (upgrade of a formerly deployed SAP system to the SAP S/4HANA one) in the domain of medical device manufacturing and distribution.

The rest of the paper is structured as follows: Section 2 portrays how the *StratAMoDrIGo*'s strategic agility ontology has been enhanced to make the link with operational agility; it also demonstrates a path for the applicability of the approach via a process fragment. Section 3 depicts the application of the framework on a case for evaluation/validation. Section 4 presents some insights that rise from the applicability of the

approach to the case study. Section 5 discusses some threats to validity while Section 6 compares the approach with other relevant contributions in the domain. Finally, Section 7 concludes the paper.

2 Enhancing the StratAMoDrIGo Ontology to Link Strategic with Operational Agility and Supporting the Digital Transformation Strategy

2.1 Research Paradigm

Our study follows the design science paradigm [5] in terms of delivering generic solutions (i.e., artifacts, methods, tools etc.) for known (or not yet considered) problems. In accordance with the cycles for design science research defined by Hevner [4], we point our contribution to cover the following:

- The *Relevance Cycle* concerns the identification of opportunities/problems in the application domain. Presently, we identify the problem referring to the lack of a framework being able to conciliate a governance-level IT adoption approach based on business, IT and DT-related strategic objectives with operational agility;
- The *Rigor Cycle* refers to the theories/methods used to ground the construction and evaluation of our framework. The latter is built upon an existing strategic agility framework validated in previous research. To support the contribution of this paper, we have created a so-called 'pseudo-ontology' [9] (i.e., not a fully-fledged ontological construction but the creation of an informal user-friendly ontology). We indeed use a restricted and structured form of natural language to state and clarify the definition of its concepts. A UML class diagram is used to formalize the concepts of our ontology as well as the links between these concepts. The ontology and its application, through the use of existing models, constitute a contribution to the knowledge base of agility;
- The *Design Cycle* refers to the construction and the evaluation of the artifact; it has been constructed from existing approaches that have evolved to become more focused on the attainment of operational agility when an organization has already set in motion the processes to exploit rapidly any internal/external changes in its business environment. The evaluation is done on a case study within an organization seeking high added value out of new IT adoptions.

2.2 Evolution and Expansion of StratAMoDrIGo's Ontology

The framework developed in [13] essentially treated the issue of supporting strategic agility through models. In the original framework, solutions depicted as strategic opportunities have been seen as broader than software-based only; we nevertheless focus here on software developments (from scratch or off-the shelf). In that case, 'traditional' agile development delivers an interesting way of developing the software. Indeed, in a moving business context, we are seeking for short development cycles, value-based sprint prioritization as well as a maximum of user input. The strategic agility framework, as depicted in [13], makes a round trip between the top and the middle-level

uation described under the classic StratAMoDrIGo approach) or the value 'true'; the latter case (i.e., one *Feature* aligns perfectly with one *Epic User Story*, and one *Epic User Story* is then associated to lower-level user-negotiated specificities) describes the situation where *Features* do not act merely as the demarcation of the characteristics of strategic opportunities but essentially become the departure point for a full-scope analysis of operational aspects such as the quality/reliability of the software or the usability of the technologies brought by these strategic opportunities. This way, the extended version of the StratAMoDrIGo framework can conciliate a high-level strategic approach founded on strategic agility and stakeholder-based governance with a pure operational-level agile development of the identified sources of user value (the *Features*). Figure 1 refines the ontology model of [13] to represent this refinement in the framework's ontology. *User Stories* are expressed by Users under the scope of a specific *Feature* itself being an *Epic User Story*; a backlog of *User Stories* is thus created and managed using an agile method's life cycle like the one of Scrum.

The implementation and the management of the implementation of *User Stories* can be done on a custom fashion, i.e., using any agile development method based on user stories. This is generally the responsibility of the *Product Owner*. For illustrative purposes we have enriched the process fragment found in [13] into Figure 2 to cover the edition of *User Stories*. The *Product Owner* Role has been included and represented as an *i* Actor*; it is responsible of the *Structure Requirements* Phase realized by the *Map Epic User Stories with User Stories* Activity, depicted as an *i* Task*. Further refinements depend on the agile process that is used each time. In Figure 2, for illustration purposes, the refining process activities make the use of the Rationale Tree technique depicted in [16,17,15] for this special context. The Rationale Tree is a conceptual model aimed to decompose and link together a set of user stories.

To reiterate, the StratAMoDrIGo framework has primarily been designed to support strategic agility and extended here to match operational agile development. It does not focus on supporting a DT path as a strategic concern even if implicitly, within strategic agility, the support of suitable digital technologies is essential. The meta-model of Figure 1 has been extended to incorporate specific DT objectives forming altogether a DT strategy. The latter is perceived within the meta-model as a collection of strategic objectives and should be envisaged independently of the classic business and IT strategies. It can also be found in Figure 2 under the scope of the *Board of Directors* Role under the Task *Determine Digital Transformation Objectives* that specific DT objectives need to be set-up. These will thus later be used for evaluating compliance of new user story-driven functions.

3 Illustrative Example

3.1 Background on the Case

Our illustrative example has been recreated at a private medical device manufacturer operating in Europe. MedicalDev Europe & MedicalDev General¹ are umbrella companies under the MedicalDev Group headquartered in Asia. To leverage shared IT in-

¹ The names have been changed for confidentiality reasons.

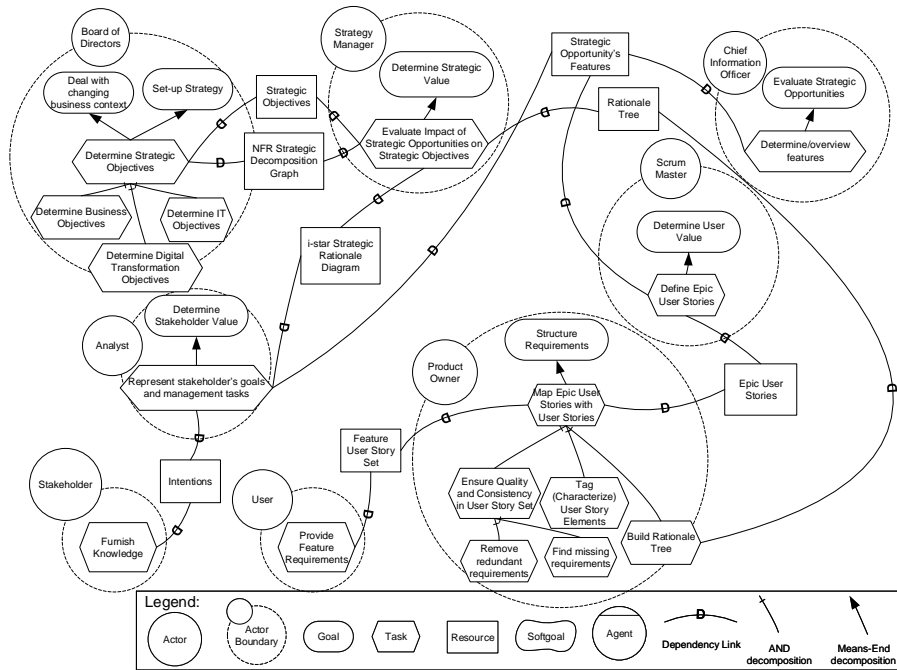


Fig. 2. StratAMoDrIGO's Updated Process Fragment to Support Operational Agility.

infrastructure services for these umbrella companies, SAP² was implemented as the ERP system in 2015, however, a next-level upgrade was proposed in 2019. The project has been planned in two phases; Phase 1 describes the *Move* stage, where the infrastructure is to be moved towards S/4HANA, an upgrade to the existing system. Phase 2 concerns the *Transformation* stage, where new services are to be embedded within the organization's existing processes.

Overall, the upgrade of the existing ERP system is aimed at increasing compliance and enabling integration capabilities for several processes within the service areas of finance, logistics, and manufacturing. The upgrade decision has been documented at governance level and it is considered as an efficiency improvement project to better align with the current business context and user needs, rather than a full-scale development project. Since it goes further than a mere technical update and is aimed at leveraging on high added value streams, the use of agile methods has been proposed for its development, utilizing user stories for requirements elicitation. The IT department has already been executing small projects in agile fashion; however, the current ERP implementation was started in 2015 in a non-agile way. A next-level upgrade was proposed in 2019 but the Covid-19 pandemic gave a radical switch in the business context which resulted in an opportunity to redefine business processes more aggressively. Indeed, the new business context led governance members to profoundly rethink the financial processes

² More information can be given at: <https://www.sap.com/index.html>

in collaboration with end-users and focus on automation, integration and the delivery of performance indicators. Overall, the organization aims to become more agile-driven (one of its core business objectives) not only in its IT developments but also in the way it conducts its business and pursues its DT. Our proposed approach is destined to bring a support for reasoning and relevant knowledge on the alignment of the improved ERP developments with respect to the business strategy and general DT objectives.

3.2 Credit Management as a Strategic Opportunity and the Determination of its Features

Overall, we conducted semi-structured interviews to elicit the business strategy (it is depicted in Figure 3) and identify impending strategic opportunities within the company. Our sample source consisted of members of the executive board and department/business units' directors. Likewise, the IT and DT strategy was elicited from members of the ICT governance committee as well as the collection of related documents (the DT strategy is depicted in Figure 4). We were more interested in the illustration of the company's DT strategy and how the recognition of strategic opportunities aligns with it; for this reason and due to the lack of space, the IT strategy will not be depicted in this paper but a similar alignment evaluation process between the strategic opportunities and the IT strategy can be assumed following the paradigm of the business strategy.

The data gathered during the interviews identified specific finance and controlling activities linked to Record to Report (RTR) processes (SAP **Credit Management** FIN-FSCM-CR - SAP Help Portal, n.d.) as a significant strategic opportunity source within the upgrade of the new version of the ERP. The importance of adequate credit and cash management in terms of integrating/centralizing the company's financial management for different departments/units/regions was listed as one of the CFO's top priorities.

As we aim to apply our proposed framework to the aforementioned strategic opportunity intending to focus mainly on linking strategic with operational agility, we do not document the entire strategic opportunity's top-down evaluation that led to the identification of the Features and would be realized using i* [20] and NFR diagrams [1]; instead, we focus immediately on the lowest-level functional elements provided by the StratAMoDrIGo framework, i.e., the *Features*. Overall, three Features have been recognized in a top-down fashion by the members of the governance during the application of the framework; these are mapped to the following epic user stories:

- **Feature Delivery Management** becomes the **Epic User Story** *As a customer I need to have consistent delivery from my suppliers*. This epic is to describe customers' accessibility to consistent and reliable product delivery;
- **Feature Payment Management** becomes the **Epic User Story** *As a Tax and treasury user I need to reduce delays in payments, non-payments and process costs*. The second epic describes coarse grained credit management functionalities;
- **Feature Cash Management** becomes the **Epic User Story** *As a manager I need to make sure the cash status is up-to-date*. This epic is linked to the record-setting functionality within the cash management process; a constantly up-to-date cash management record is valuable for strategic managers planning for future investments.

The rest of this paper will exclusively be devoted on the study of the impact of the user stories falling under the scope of **Feature 2** (so the system behavior that will be adopted for fulfilling the Feature at operational level). This particular Feature was found to be of primary strategic importance (i.e., the VP and CFO have both recognized the strategic value attributed by the ability of the new system to provide instantaneous cash/-credit settlements) while the process owners and operations' managers have emphasized on the need of the system to accommodate the automation of cash/credit transactions as a recurrent request of their employees/users (bottom-up specified functionality).

3.3 User Stories' Support on the Business Strategy under the Specification of the Second Feature

A set of requirements has been collected from users/stakeholders and the mapping game led to 5 main user stories under the scope of the Epic User Story corresponding to the second Feature. A rationale tree has thus been built to show the decomposition from the Strategic Opportunity to the Epic User Story and the (fine-grained) user stories. The alignment study has then been performed and validated by internal employees. Figure 3 shows the support of the individual user stories on the overall business strategy. The study gives a more in depth and accurate identification of the strategic value brought by the system in terms of effective behavior under the umbrella of the Feature. So this gives a slightly more in depth study and accurate results when compared to an immediate alignment study of the Feature with the business strategy earlier when the Feature remains for some parts a black box. Finer-grained and user-delivered sources of value are indeed identified.

3.4 User Stories' Support on the DT Strategy under the Specification of the Second Feature

To focus on the DT strategy, an alignment study has also been performed between the DT strategic objectives and the user stories under the scope of the Epic User Story corresponding to the second Feature. This alignment study also uses the rationale tree built previously. The alignment study has here been done on a generic set of DT objectives found in an informal source³. A custom set of DT objectives has also been built but for confidentiality reasons we do not want to publish them here and the alignment study to the generic set. The custom alignment study remains nevertheless very similar. Figure 4 shows the support of the individual user stories on the DT strategy. The study gives here an in depth complementary identification of the DT-related strategic value brought under the umbrella of the Feature.

4 Discussion

The recent Covid-19 pandemic (new business context) has created momentum for re-thinking the credit and cash management processes support leading to a (strategic) opportunity to change the operational tasks of employees through the digitalization of

³ <https://ungoti.com/blog/objectives-of-digital-transformation/>

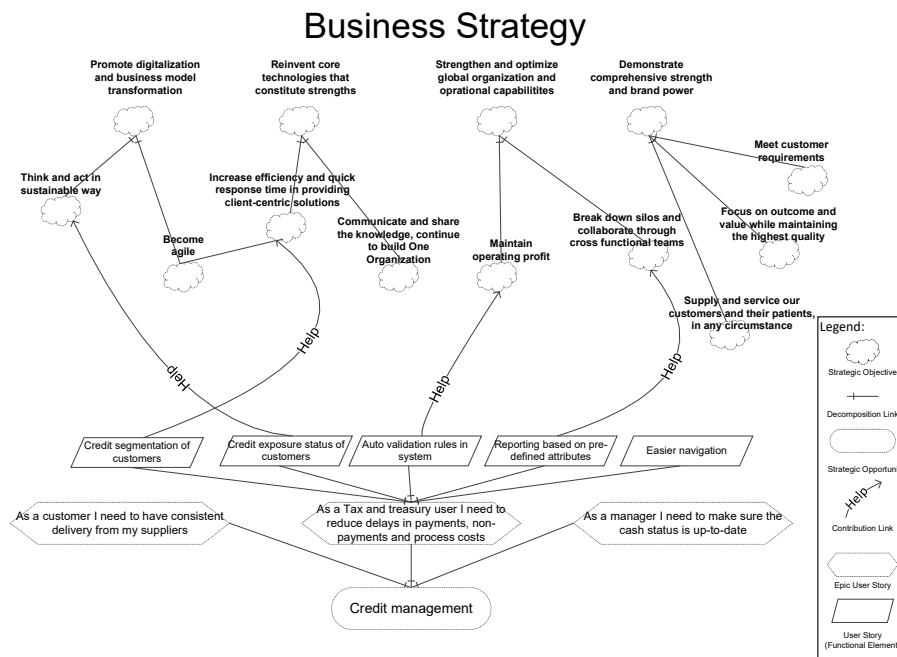


Fig. 3. Alignment of Low Level Functional Elements with the Business Strategy.

supporting services in the case company. The main Features of the credit management service were conceptualized in a top-down fashion by the company’s executives. These have been mapped onto Epic User Stories so that users (and other stakeholders such as the department heads, process owners, and IT managers contributing to further providing insights on the necessary functions expected in the system) could be involved to define exactly required, expected or wished system behavior related to the fulfillment of the epic. The operational elements are expected to ensure that the users are effectively and efficiently managing their respective tasks. Their critical functions like auto-validation rules, reporting, customer status, etc., provide the necessary behavior when approving sales orders from customers. The functions help the realization of organization’s (strategic) business or DT objectives and provide the necessary agility to change the course of actions if and when required. In most cases, the management-level goals are demarcated in the user stories. However, softgoals were not mentioned as they were implicit for the stakeholders.

The study of the alignment of the (concrete, low-level) user stories with the strategic business objectives and generic DT objectives provided evidence on an overall satisfying alignment of the strategic opportunity’s Feature *Payment Management* through its expected system behavior. The alignment goes further than the alignment study that could be performed with MoDrIGo [14] and StratAMoDrIGo in the sense that we study here the system behavior itself in terms of fine grained functions and not coarse-grained Features of which the internals are not (yet) defined to keep agility and openness to

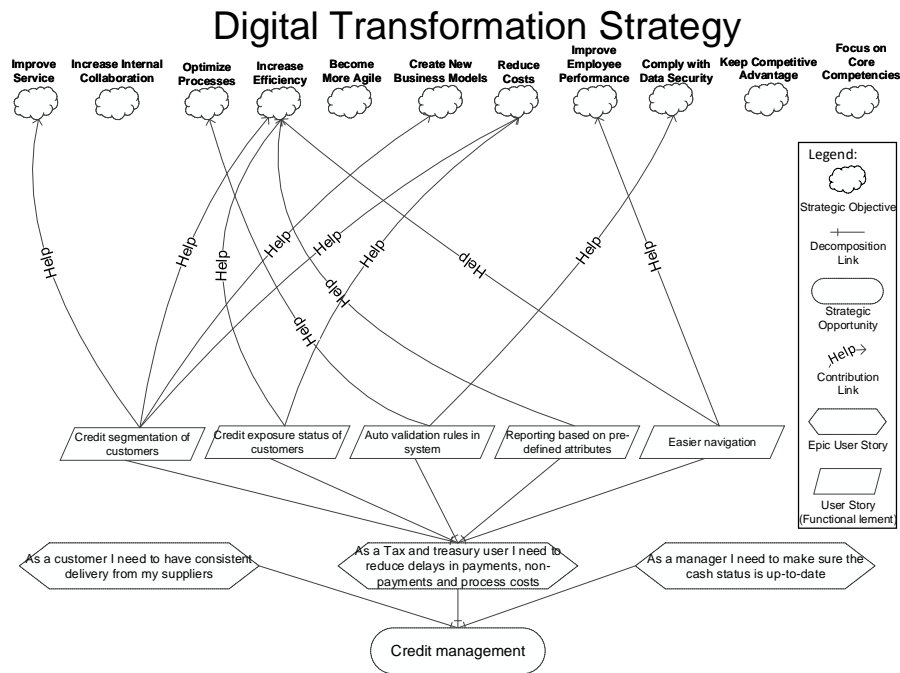


Fig. 4. Alignment of Low Level Functional Elements with the Digital Transformation Strategy.

innovation during development. Alternative scenarios can also be considered when different user stories can support the fulfillment of the Feature. The different user stories can then be selected on the basis of the identified value yet fulfilling the Feature.

5 Threats to Validity

As with any other approach within the design science domain, a threat to the *construct validity* is derived from the risk of misappropriation of the modeling constructs of the framework by various stakeholders, which may lead to misaligned/inconclusive strategic insights. This issue was addressed by having the authors of the paper organize a joint meeting with various members of the company whose case study is depicted in Section 3 in order to review, discuss and elaborate on each modeling representation and individual element of the framework.

The *internal validity* concerns the question of objectivity of the views gathered by the subjects during the data acquisition process. Indeed, subjects may report on their personal view (as opposed to a collective consensus) when giving information on strategic-, tactical-, or operational-level aspects. This would lead to inconsistent modeling representations. This risk can be mitigated by the conduct of a considerable number of interviews and systematic comparison of the views of these actors for knowledge validation. In our case, the representations of the strategic-/operational-level configura-

tions within the case study were determined based on a rigorous interview process and an overall cross-reference of the subjects' individual opinions.

A threat to the *external validity* can come from the lack of knowledge and/or experience with software modeling notations that act as prerequisites for the extended usability of the framework by a diverse set of roles within the organizational sphere (from C-level IT executives to domain analysts etc). Therefore, a lack of formation in specific software modeling techniques may jeopardize the generalized use of the framework by the corresponding information systems' community (our population). Until now, the framework has been applied by the authors of this paper, members of the research group, and a few consultants all being familiar with conceptual modeling, goal-based requirements engineering, and i*. Their experience certainly has an impact on the ability to apply such a framework correctly so not many valuable insights could be drawn in terms of its generalization. For this reason, the ability of novice modelers to apply goal-based conceptual modeling has been tested in [19,11] with other kind of formalisms. The latter did not reveal any major inconsistencies during the modeling phase, therefore applying goal-based frameworks with some guidance on real life problems can be done rather easily allowing the generalization of such frameworks to other requirements elicitation problems.

6 Related Work

Tsilionis & Wautelet [12] detail a modeling approach that aims to help organizations imprint – and reconcile the attainment of – their strategic (business and IT) objectives within their (operational) agile-driven software development processes. Their approach lies on the alignment evaluation of top-down abstract in-nature services aiming to fulfill the strategic business needs through the use of IT capabilities (they are called *business IT services*, (see [18,14]) with bottom-up specified user stories meaning to display operational insights to a pending IT development. Such business IT services are decomposed into one or many (also top-down defined) Epic user stories, in the effort to link a low-level function to a more aggregate one, contributing to its fulfillment. The main benefit of the present framework when compared to [12] is its orientation towards the DT meaning that it is not only driven by business process support/improvement as [12]. More broadly stated, the present framework is driven by IT innovations in general essentially centered on the end user and the customer rather than internal functions.

At this point, a comparison with other approaches offering strategic value propositions to agile-operated development cycles –with Scaled Agile Framework (SAFe) being the most prominent– is justified. SAFe 5.1 [8] is a method allowing to use agile software development on huge projects so to scale and diffuse across many teams the benefits of operational agility. SAFe also covers some elements of organizational strategy; it distinguishes indeed value streams at a very high level of abstraction that need to be supported by operational developments as well as *Epics* as functional high-level **scope elements**; Epics are considered in SAFe – not comparable to the ones distinguished in Scrum (and our approach) because they are even more abstract – as functional elements that are by nature so large that they can be developed in a fully autonomous manner. SAFe also considers strategic alignment on the basis of portfolio

management and does not focus on single software development projects. In that sense, there is partial alignment between SAFe and the framework explained in this paper since the latter is also not project-directed but targets the evaluation/funding/evolution of strategic opportunities encompassing new major functions that need to be supplied by the IT ecosystem. However, our current approach is fully conceptual modeling-driven while SAFe not only does not support the use of conceptual models but acts more or less as the transcript or documentation of directions on how to build-up of a culture of communication/coordination between the software development teams responsible for large (agile) product deliveries and the rest of the business function representatives in the organization.

7 Conclusion

By linking long-term objectives with system behavioral aspects, this paper offers an informal and user-friendly ontology that acts as a mechanism allowing for switching gears from strategic to operational agility according to the interests of the stakeholders. This ontology supports a method that can be used top-down for the evaluation of the value added by the adoption of strategic opportunities. More precisely it can be aligned with the business, IT or DT strategic objectives at the level of the Feature composing this opportunity. Also, it can be used in a bottom-up fashion to evaluate the alignment of the low-level functions depicted in (classical) user stories with the business, IT or DT strategic objectives. The agile development team can thus use it within the context of a Scrum (or any other user stories-driven) cycle to chart/implement the operational aspects of the development, allowing simultaneously to envisage value outside of the traditional 'user-value-only' perspective. This gives complementary strategic information useful notably for the planning game when the priority of user stories' implementation needs to be determined.

At this stage, we can get back to the stated RQ (*How can we refine the StratAMoDrIGo framework to support the conjunct use of strategic and operational agility in a DT context?*). To answer this question, we have extended the StratAMoDrIGo framework in three distinctive ways: *first*, we have proceed in a refinement of the StratAMoDrIGo ontology to include a more detailed analysis for the evolution of individual user stories and their attachment to larger pieces of declared functionality allowing for their fulfillment; we also show the linkage between such user-driven elements to the overall DT Strategy and how the evaluation of the alignment of these two should be done dynamically due to the ever-changing nature of the latter. *Second*, we have gone through a refinement of the StratAMoDrIGo process fragment to merge Strategic with Operational agility and distinguished strategic elements related to the DT, i.e. the DT objectives; we have also accentuated the roles and their corresponding functionalities/duties in this new layout as a means to increase the applicability of our approach. *Third*, we have presented an application on a specific case study for validation; we have depicted the overall business strategy of an international organization, its DT strategy as a subset of the company's pool of strategic objectives and how the creation of a new credit management system could be mapped as a strategic opportunity. The latter is analyzed/evaluated when it comes to its value-attributing characteristics and its overall contribution to the organi-

zation's business and DT strategy is studied. *Finally*, we have compared our approach with other relevant contributions in the related work section. Even if our approach's expressiveness and details may suffer in the process, we aim to provide something as simple as possible to organizations to ease the IT adoption on the largest possible scale and how the latter can be evaluated with its evolving DT strategy. Accordingly, future work also involves simplifying the framework so that models hold on a structured sheet like for the Business Model Canvas [7].

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