

Management Challenges in Bimodal IT Organizations

Dimitrios Stamoulis^{1*}

¹Department of Informatics, University of Athens, Greece

*Corresponding Author: dstamoulis@yahoo.com

Citation: Dimitrios Stamoulis (2022). Management Challenges in Bimodal IT Organizations Analysis. *Journal of Information Systems Engineering and Management*, 7(2), 14084. <https://doi.org/10.55267/iadt.07.12014>

ARTICLE INFO

Received: 11 Dec. 2021

Accepted: 16 Mar. 2022

ABSTRACT

Most information technology (IT) organizations are experimenting on adoption of the dual mode of operation, involving traditional and agile methods of work. These two incompatible development worlds need to be in sync for IT to operate effectively. However, both types of operation map onto generic project management principles allowing the manageability of IT projects. Management issues and challenges are presented as points for paying particular attention when managing bimodal (both waterfall and agile practices) IT organizations in two stages: the transition from the traditional to the bimodal and after the adoption of bimodal. These issues and challenges belong to the management and organizational, people, process and technology categories. The management challenges presented in this study are important for the decisions to be made regarding the management and governance of projects into bimodal IT organizations.

Keywords: IT project management, agile development, bimodal IT

INTRODUCTION

The advent of agile methodologies in software engineering came as a response to the need for increased end-user involvement, tailorable information systems and deferred design decisions for the user interface level at the beginning (with rapid prototyping, extreme programming, iterative or spiral development etc.) and later for the entire software stack, covering front- and back-end implementations.

On the other hand, business process reengineering that was necessary for transposing physical world processes and procedures to new ones that were more pertinent to the digital world to exploit new features and capabilities of devices and the pervasiveness of web- and mobile-based end user applications, accelerated the use of methods and techniques that are more exploratory by nature and allow for experimentation, as opposed to the traditional software development lifecycle (SDLC) approach, since business innovation has been primarily IT-capabilities driven, more than anything else.

Such forces led IT to work at two difference modes, or setups: the SDLC and the agile ones. Thus, the term bimodal IT was coined by Gartner Group, to describe the two worlds in IT implementations. According to Gartner Group¹: "Bimodal is the practice of managing two separate but coherent styles of work: one focused on predictability; the other on exploration. Mode-1 is optimized for areas that are more

predictable and well-understood. It focuses on exploiting what is known, while renovating the legacy environment into a state that is fit for a digital world. Mode-2 is exploratory, experimenting to solve new problems and optimized for areas of uncertainty. These initiatives often begin with a hypothesis that is tested and adapted during a process involving short iterations, potentially adopting a minimum viable product (MVP) approach. Both modes are essential to create substantial value and drive significant organizational change, and neither is static. Marrying a more predictable evolution of products and technologies (Mode-1) with the new and innovative (Mode-2) is the essence of an enterprise bimodal capability. Both play an essential role in digital transformation."

Since there are significant differences between traditional (Mode-1) and agile (Mode-2) styles of working (Hoda et. al., 2008), management challenges arise when IT organizations attempt to work in a bimodal way. First of all, the transition from Mode-1 (SDLC) to Mode-2 (agile), pure or mixed, are far from easy and straightforward. For some organizations, the destination is pure agile (Mode-2 only), while for most of the others, a mix of SDLC and agile, a true bimodal way of work, is the desired situation. There are pros and cons to all approaches but managing transitions through the various steps from Mode-1 to Mode-2 and/or bimodal is an area where important and multi-dimensional decisions need to be made by IT management.

¹ <https://www.gartner.com/en/information-technology/glossary/bimodal>

Table 1. Mapping of Mode-1 and Mode-2 operations toward project management principles.

PM principles	Mode-1	Mode-2
1. Work organization	SDLC/V-Model phases	Sprints (usually biweekly, time boxed development of ready for production features)
2. Estimations	Effort estimation based on the Work Break-down Structure for each phase of the SDLC/V-Model phases	High level estimation and then spring planning using story points, a measure of complexity of the work to be accomplished. Also capacity based estimation sometimes used, instead of story points.
3. Prioritization of work	According to the SDLC/V-Model phases	According to perceived business value of use cases: higher value first, then the lower ones
4. Deliverables	Interfaces, reports, processing blocks and application modules	Implementation of user stories (functional analysis) that comprise use cases
5. Time	Is an element of the time plan (Gantt chart)	Is a box that contains implementation delivery targets
6. Staffing	People participate into phases and steps according to their roles & job profile.	Dedicated people that participate from inception to completion of the project and play potentially several roles within the team.
7. Progress reporting	Actuals vs. baseline <p>“The Earned Value Measurement System (EVMS) has become a mainstay in Commercial and Government groups to measure progress and success of a project. EVMS is espoused to be an effective (albeit subjective) measure, but it does not play well with agile development efforts, due to its requirement of static schedules and work plans. Here we introduce a new paradigm for EVMS that will accommodate and be effective in measuring progress and problems within agile development efforts.” (Crowder and Friess, 2015). A similar investigation has been previously examined by (M. Griffiths and A. Cabri, 2006).</p>	Burn down chart
8. Scope of work and peer deliverable	As defined in the SDLC/V-model phases.	Definition of “done” ² per sprint.
9. Work validation	Based on alignment of the V-model’s corresponding elements per phase.	Customer acceptance using Net Promoter Score (Grisaffe, 2007) or other marketing KPIs.
10. Learning	At the end of the project, usually documented at the project close-out report.	At the end of every sprint, a retrospective meeting calls for evaluation of success and failure points recognized by the team members themselves, for faster learning curves.
11. Documentation	Exhaustive descriptions, including data- and work-flows.	Minimal, however additional material such as high-level analysis trees/ ideas configuration etc. are needed. Wiki repositories are sometimes used, with references to use cases (business requirements) and user stories (functional analysis specifications)
12. Project manager	As defined in PMBOK – safeguards deliverables delivery on time and within budget, with the available resources at the best possible quality.	“The agile manager understands the effects of the mutual interactions among a project’s various parts and steers them in the direction of continuous learning and adaptation.” (Augustine et al., 2005)
13. Tools	Traditional project management and software development tools.	Commercial agile tools (Mihalache, 2017)

² <https://www.scrum.org/resources/blog/done-understanding-definition-done>

The next section discusses the differences in project management when running projects in Mode-1 and Mode-2 in an IT organization and how both approaches map onto the generic principles of project management, because, either way, organizations need to manage projects regardless of how they run them. Arguments are presented that lead to adopting a bimodal mode of operation, rather than choosing pure Mode-1 or Mode-2. Then, management challenges arising (a) in the transition of an IT organization from Mode-1 to bimodal and (b) while running the IT organization in a bimodal way of operation are presented. The identified management challenges represent the results of both literature review as well as field observations for a period of two years approximately made at banking and telecoms organizations in Greece that have decided to work bimodal. Most of them are using Scrum as the agile methodology for Mode-2 operation. (Schwaber, 2004) has found Scrum to be the most favorable flavor of an agile methodology used for IT applications. The management challenges presented in this study are important for the decisions to be made regarding the management and governance of projects into bimodal IT organizations.

IT PROJECT MANAGEMENT IN MODE-1 AND MODE-2

Both modes of operation, 1 and 2, require staffing, KPIs, methods such as project completion estimations, project progress reporting, tools, time and budget constraints etc. Although Mode-1 is geared towards productivity, efficiencies of cost and effort as several project are running in parallel at smaller speeds using all staff as a unique pool of resources, Mode-2 focuses on exploration and innovation, using time-boxing techniques to deliver the higher value element in the backlog first, using dedicated teams of people. However, there are no IT projects with unlimited time and budget constraints, nor running without control over deliverables and progress. So, both modes obey the same basic principles of the project management, nonetheless served in different manners. However, there are significant differences between traditional and agile approaches to project management (Wysocki, 2006).

There are opinions saying the agile methodologies underlying Mode-2 operation do not constitute well-defined project management methodologies, but rather a mindset and best practices in managing people's involvement in product design. (Cockburn, 2005) The Project Management Body of Knowledge (PMBOK) "is structured around five process groups (initiating, planning, execution, controlling and closure) and nine knowledge areas (integration management, scope management, time management, cost management, quality management, human resource management, communication management, risk management, procurement management). On the other hand, agile software project management is based on the following principles: embrace change, focus on customer value, deliver part of functionality incrementally, collaborate, reflect and learn continuously. [...] The result is that, agile project management methodologies cannot be considered complete, from the traditional project

management point of view, since a number of processes either are missing or not described explicitly." (Fitsilis, 2008)

If project management as defined by PMBOK is to be used in conjunction with agile methodologies to provide a methodological framework for running Mode-2 projects, then COBIT or ITIL (the underlying methods and toolset for ISO 20000) needs to be combined with an agile methodology, e.g. Scrum, to shape a solid basis for managing the Mode-2 projects. But is it possible to combine ITIL v.3 and agile methods, since ITIL implies a serial way of work in service design, while agile is based on iterations and small size deliveries of almost complete sub functionalities? (Verlaine et al., 2016) have identified and described "eight interfaces, i.e., information exchange channels, between ITIL v.3 and SCRUM, which can be put into action thanks to some described adaptations in the structure of the ITIL v.3 life cycle." Probably ITIL will evolve towards Mode-2 project management, in line with "the alignment between ITIL v.3 and the service implementation life cycle proposed by (Verlaine et al., 2015), to provide a mapping of "the life cycle of the ITSM procedural structure of an IT organization, of the service implementation life cycle in a service-oriented system, and of the agile management of software implementation projects."

To facilitate a common understanding of how traditional / Mode-1 and agile / Mode-2 working styles map onto the basic project management principles that are necessary in any IT governance framework, **Table 1** is presented, which is the result of both literature review as well as observations from real world organizations.

Table 1 has been tested through interviews to be a very useful educational tool for IT management to understand how the two modes of operation fit into the basic project management principles and the main differences between them in terms of methods, tools, etc.

MODE-1, MODE-2 OR BIMODAL?

Enthusiasm about adoption of Mode-2 by organizations, is evident in several research papers, such as the following:

- "Unlike TPM (Traditional Project Management), the aim of agile is to have a small scope and rapid delivery at a high rate. APM (Agile Project Management) emphasizes communication rather than processes or plans. APM yields impressive benefits; its benefits come from many factors, primary of which is increased productivity and quality. Productivity results from its streamlined nature, adaptability to change, collaborative nature, and focus on profits in the marketplace. Projects that have used APM were five times more effective than those using TPM in cost and quality; furthermore, APM projects had 11 times greater return on investment (Rico et al., 2009). In addition, APM has proven itself a practical way to manage high-risk, time-sensitive research-and-development projects due to its lightweight processes that lead to efficient decision making and productivity (Cui & Olsson, 2009). The frequent customer interaction and early concept testing results in outcomes that are

quick and sensitive to markets. These results, in turn, increase customer satisfaction, which improves customer trust, retention and loyalty, and translates into economic benefits such as improved sales, revenues, and overall profitability.” (Salameh, 2014)

- “It is concluded that scrum has the positive impact on the knowledge areas of software project management. Scrum has positive influence on the time, cost, scope, Quality, Risk and scope of the project. Some organization focus on the goal-oriented hiring of employees and some are not, so it has a great impact of scrum on H.R management as well. Survey shows that scrum reduces risk, control the cost, and developed quality product helps in timely completion of the project.”(F. Hayat et al., 2019)
- Mode-2 operations are considered to add higher value due to: “Rapid delivery of software products, highly tolerant of change requirements, reduce cost and time, early feedback from customer, documentation, focus on high quality product.”(Ahmad et al., 2016)
- Highly complex and unclear situations with time constraints can better be accommodated with agile approaches to project management (Williams, 2005)

However, there are criticisms to Mode-2, agile approach, too:

- “It is difficult to believe that the agile approach provides for the efficient execution of a project. We agree that it provides higher quality results and that the final products meet the desires (and not only the requirements) of the client significantly better, but we believe that projects are more expensive and last longer than they would if executed in the traditional way.” (Stare, 2013)
- “Despite the advantages of Agile, criticism on agile methodology states that it fails to pay attention to architectural and design issues and therefore is bound to produce small design-decisions.” (Kumar and Bhatia, 2012)
- “Here are some of the limitations and shortcomings of agile methodologies we got based on the literature.
 - a. Main emphasis is on development rather than design and user. It basically focuses on processes for getting requirements and developing code and does not focus on product design.
 - b. High testing lead times and low-test coverage.
 - c. Many teams requiring high coordination and communication from project managers.
 - d. Does not scale well to large projects, as numerous iterations are needed to complete the desired functionality.
 - e. Too much time may be devoted to any single, small

feature.

- f. On a large-scale project, opportunity cost to employ agile methods may be too high for a foregone production on more profitable and lean projects.
- g. Management Overhead is increased because a successful application of an agile methodology relies heavily on strong teamwork, the project manager must remain involved in the dynamics of the team.” [ibid.]

Given the pros and cons of Mode-2 operation, it is obvious that the combination of both modes, the bimodal IT organization, offers maximum value for IT organizations, since, organizations may benefit from the combination of order and structure with disorder and flexibility (Cunha and Gomes, 2003):

- “Based on our research we conclude that one development method does not fit all software development projects in the case of IBM center in Chicago. Both agile and traditional (modified waterfall) are in use. We also conclude that agile methods have not replaced traditional methods. One important deciding factor is the customers’ preference. Our data shows that more and more project managers in IBM are equipped to manage agile projects. Project managers in IBM do not follow any agile method as described in literature. They follow a hybrid model that they call Agile-with-Discipline. This hybrid-agile allows flexibility to have continuous changes to requirements throughout the project development process but at the same time ensures that proper tools, techniques and supporting documentation are done. While the literature downplays the need for documentation in agile projects our data shows that proper documentation is still needed especially on external / customer projects. Lastly, our data does not support the opinion that agile teams are completely self-organized and self-managed.” (Adelakun et al., 2017)
- “Mode-1 IT is really effective when it is operating according to a predefined plan. But digital business contains much uncertainty. As organizations innovate to seize opportunity in digital business, they’ll need to implement both the traditional and agile IT modes in their organizations, or bimodal IT. Mary Mesaglio, research vice president Gartner, said at Gartner Symposium/ITxpo 2015. ‘You need to become bimodal because one mode can’t answer the complex needs of the organization. It’s not nice to have. Gartner believes you must have both modes’.”³

It is therefore obvious that both modes are necessary depending on the type of project to be implemented. In (Thesing et al., 2021), 15 criteria for choosing the appropriate mode have been defined, belonging to these categories: “scope, time, costs, organization context, and project-team characteristics.” Bimodal IT operation, i.e. working in two

³ <https://www.gartner.com/smarterwithgartner/why-digital-business-needs-bimodal-it>

different modes simultaneously, poses a number of issues for managing IT projects and the entire IT organization.

MANAGEMENT CHALLENGES IN THE TRANSITION FROM MODE-1 TO BIMODAL

Introducing new methods of work in any organization creates instability, uncertainty, risk, anxiety and produces in inherent risk until the stakeholders climb the learning curve of the new method to either embrace or reject it. Agile approaches to IT implementations are no exception to this.

Typical project management teaches that in such occasions, the steps to be followed include a proof of concept (PoC) and a pilot project (PP), before any decision is taken. Afterwards, configuration and adaptation of the new method of work is taking place based on the lessons learnt through the PoC and the PP to prepare the deployment of the method. Some organizations are using this path to arrive at Mode-2, selecting innovative applications, R&D activities or similar goals to experiment with Mode-2. Pilot projects are either intended for 'friends and family' or go to the outer world to receive feedback (beta versions) before going full live.

Customer centricity, service orientation and the digital transformation of organizations require the redesign of new, digital customer journeys ("the series of interactions a customer has with a brand to complete a task" (Dias et al., 2016)) that, if implemented end-to-end, cause waves of new front-end applications and deep changes in back-end systems and processes. Take for example, digital customer on boarding as provided by banks. The lengthy, paper-based process of data collection has been substituted by a few photos taken by the smart phone (face, ID card, taxation papers, bill payment statement etc.), phone and e-mail verification and then the user is almost ready to open a bank account online and start using it online. Then, another such digital customer journey will enable the user to acquire a bank card, an e-banking subscription, an e-wallet and start transacting immediately. Such projects create a new breed of digital applications, significant improvements in back-end systems to provide existing functionality as services to the new front-ends and potentially integrations with third party or new internal applications. Re-engineering of business processes for devising new customer journeys calls for the collaboration of lawyers, compliance officers, user experience experts, product owners, technology consultants, analysts, developers, testers etc. to participate in teams that foster an open-ended, team-spirit, accountability- and participatory-driven culture and mentality, as well as zero-based design thinking to arrive at successful products or services. By replacing business processes one by one with the new digital customer journeys, the entire organization is revamped. However, time to market pressures require that these migrations towards digital customer journeys take place in parallel rather than sequentially, hence transition from Mode-1 to Mode-2 is unavoidably occurring as scaling up of the agile practice is a business demand. Reallocating resources from one mode to

another, co-location of the resources, continuous verification of decisions by customers, are some of the management challenges to be addressed when migrating to Mode-2 projects and ultimately to bimodal.

(Haffke et al., 2017) "identified four bimodal IT archetypes and the factors that drive an organization to adopt bimodal IT. We found that companies switch between different archetypes as they transform the IT function." These archetypes have to do with structural changes in the internal organization to accommodate Mode-1 and Mode-2. In Archetype A, the decision to run a project in either mode is made on a per project basis, inside IT. Decision rights are usually granted to a joint business-IT committee, or the digital transformation office, if such a unit exists with pertinent authority. In Archetype B, IT is internally divided into Mode-1 and Mode-2 departments to run separately the projects selected for either mode. In Archetype C, business owns the resources for the Mode-2 projects and establishes a structure outside IT, using, of course, IT resources. Archetype D reintegrates the two modes inside IT in a seamless way, which is obviously a very demanding exercise. One would argue that the ownership of the Mode-2 teams is a battle of power, since all business divisions would prefer to possess IT resources and capabilities on their own in order to make exclusive use of them, leaving the development and maintenance of back-end services that are consumed by their front-end applications to the Mode-1 IT. It is obvious that Mode-2 remains an IT field of practice which can't be detached from the core IT function, because IT standards, quality methods, documentation etc. would otherwise not be observed, creating technical debt and inadequate documentation that hardly helps the handover to other (Mode-1) IT staff. Sometimes, decisions have been observed where Mode-2 operations are staffed with mainly outsourced personnel; this is to ensure that the project's results are not hindered by people's attitudes or ignorance of the new methods, at least in the first steps of the Mode-2 adoption by the organization.

The transition to Mode-2 is not without failures. Main sources of failures when going to agile, include (Koi-Akrofi et al., 2019):

- Insufficient experience with agile methods
- Little understanding of the wider organizational change needed
- Philosophy or culture of the company in contradiction with agile principles

To minimize risks during the transition to bimodal, our observations have shown that the approach of selecting customer journeys to be implanted in Mode-2 is the less risky method and the one that allows the organization to adapt slowly but firmly. Digital customer journeys are obviously extrovert IT applications with strong user interface/ user experience components. These are easier to be developed with develops types of software management tools (Zhu et. al., 2016), while legacy back-end services are usually left outside agile development practice requiring effort to synchronize between Mode-1 and Mode-2 teams. It is recommended not to leave the legacy systems development teams outside these agile groups, especially if the IT organization has decided to go to real bimodal operation.

When organizations feel comfortable with the initial results of Mode-2 operations in small scale, they proceed with agile development at scale. Difficulties in this transition include (Comella-Dorda et al., 2016):

- “organizational structure: from application oriented to product focused focus;
- interactions between business and IT: Development process is managed by strong product owner from business, who works closely with IT at all stages;
- Roles and responsibilities: All roles are integrated within self-organizing scrum teams; project manager role is minimized and line managers focus on capability building;
- Budgeting and planning: Venture-capital-style budgeting, where minimally viable product is launched and future funding depends on product performance.”

Transition from pure Mode-1 to bimodal operation, in the form of either PoC, or pilot, or customer journeys, or full-scale agile, and the structural changes happening alongside the relevant project management methods, require very careful decisions due to their impact of staff's morale, misinterpretation of the Mode-2 attitude towards quality standards, documentation and detailed design, as well as confusion as far as the project management style, methods and techniques that should be used. Also, people working back and forth between Mode-1 and Mode-2 operations get sometimes confused and loose the reporting lines to be maintained. On the other hand, people who are kept stuck in Mode-1 operations only feel quite often demotivated and neglected, while agile teams members feel the freedom to experiment, improvise and innovate. These problems have urged some organizations to go full-blown agile, a very risky decision, if top management does not properly prepare the organization. In such an extreme case, organizational structure of several vertical functions are dissolved and staff applies for new roles and teams to be repositioned according to their skills and experience. (Barton et al., 2018; Calnan and Rozen, 2019)

Scaling up agile teams from a handful to several hundred requires appropriate management of the following challenges: “figuring out where to start and how fast and far to go, deciding which function can and should be converted to agile teams and which should not, and preventing slow-moving bureaucracies from impeding those that do convert”. (Rigby et al., 2018)

MANAGEMENT CHALLENGES WHEN RUNNING BIMODAL

Agility comes also at a price, which is best described with these 5 main disadvantages of agile methodology (Fridman, 2016):

- Less foreseeability: given that functional analysis specifications are part of the work organized in sprints and that business requirements change during the

course of the work, it is very difficult for IT people to predict time and effort to completion.

- More Time and Dedication: agile methods are time and energy savvy, since synchronization among team members is achieved through several rituals and continuous chattering to align views and opinions. Findings relate small team sizes with more successful agile projects (Ambler, 2010) as well as with group efficiency and communication. (Ancona and Caldwell, 1992). However, team size obviously depends on the necessary skills and knowledge that is required for the production of the deliverable.
- Greater Developer and Customer Demands: customers participate implicitly (e.g. focus groups) or explicitly (e.g. assessing beta versions) in product development and provide feedback iteratively which causes continuous improvement efforts for developers through several rounds of rework.
- Lack of documentation required: minimum documentation kept generates problems and misunderstandings when new team members join or the work is handed over to Mode-1 teams for maintenance and support.
- Project falls off track readily: scope creeping is always dangerous and potentially wrong customer opinions may drive useless development.

In another research (Miller, 2013) “50 challenges were identified in introducing agile methodologies into an organization or working with agile projects. The problems include issues with (1) communicating; (2) managing day-to-day operational problems; (3) gaining buy-in from management, customers, and team members; (4) changing culture and mindset; and (5) gaining experience and making it work. Of course, some of the issues and challenges are unique and occur due to differences and idiosyncrasies in the organization or the project.”

The main findings of our field observations regarding the challenges faced by the management of IT organizations while running bimodal, can be summarized under these four categories (Koi-Akrofi et al., 2019): management and organizational challenges, people, process and technology.

i. Management and organizational challenges

“Traditional project managers manage their projects against the budget, schedule and scope. Metrics and variance can be tracked against the planned baselines. The traditional project manager wants to reduce risk and preserve the constraints of time and money. In contrast, the agile project manager is focused instead on deliverables and business value and budget and timeline are secondary. The agile project manager is trained to deliver a product instead of adherence to a process like the traditional project manager”. (Fernandez & Fernandez, 2008) However, top management needs to get reporting about the progress of the projects' portfolio with as little ambiguity as possible. How can this be achieved in a bimodal IT world? There

is no direct answer, but approaches to resolving this significant management problem include some or all of the following:

(a) “a novel cocktail model that balances the structure of waterfall-based models with the flexibility of agile principles. This model has the benefit of meeting the financial, legal and procurement standards of large companies through its use of the ISO standard elements, while introducing the agility required to adapt to changing priorities and environments.” (Binder et. al., 2014).

(b) Appointment of both a project manager and a scrum master in Mode-2 operations. The former is accountable for the time and cost / budget dimensions while the latter is accountable for the scope and quality of deliverables. Such dichotomy of responsibilities aims at a compromise of the two project management worlds in favour of unified, homogeneous reporting to the top management and a good alignment with overarching IT governance frameworks. Some bimodal organizations are observed to use this approach successfully.

(c) Allocation of dedicated teams to specific products or business areas which are of strategic importance for the business. For example, some banks has set-up dedicated agile teams for their e-banking channels, abolishing the concept of projects in favour of managing these channels as an endless agile project. In such a way, the IT organization has allocated some permanent resources to ebanking channels, without caring about schedules and cost. The teams are led by the business owners of these e-banking channels, while internal costing of IT resources is easily calculated as the cost of the effort of a team of people for one year. Obviously, such an approach is not viable for all the products and/or business units of an organization, but can work effectively for the most strategic ones. In such cases, the term digital factories is more often used to denote less permanent structures, such as those for the digital customer journeys, whereas tribes and chapters (scrum terminology) are used for permanent structures that develop key business products as an endless agile project.

Organizational challenges also arise in bimodal IT organizations, when a functional manager is responsible for people that belong to Mode-1 and Mode-2 operations. Mode-1 staff is tightly coupled with their functional area, whereas Mode-2 loosely. This has a direct effect on staff manageability, loosing of functional accountability in favour of the agile self-organized teams and occasionally, loss of functional knowledge advancement since people in Mode-2 operations are somehow cut-off from the functional area of knowledge and they can only be as good as the best member of the same team in the same role (e.g. developer, tester, business analyst, etc.)

ii. People

Zavyalova et. al., (2020) stress “the importance of ensuring a good fit between a company’s project management approach and human resources management (HRM) architecture.” Findings of the study “suggest that HRM architectures of high-performance agile firms imply a broad use of ability-

motivation- and opportunity-enhancing practices and a high degree of HRM process centralization, while traditional firms adopt more diverse HRM architectures.” In bimodal organizations, people issues are complex because Mode-1 teams follow a typical functional career path approach, while Mode-2 people participate in self-organizing agile teams. Such teams “can be characterized by existing informal roles like a mentor, coordinator, translator, promoter, champion, terminator.” (Perlak, 2019) Informal roles are well received by the staff at the beginning of Mode-2 adoption as innovation opportunities, intellectual challenges etc. but in the long run may create anxiety and tensions with relation to career path and advancement, especially as compared to Mode-1 teams members.

The role of business users within agile teams is also important. They have to continuously reprioritize alternatives, explore possibilities, and consume IT resources for best business value creation at any given time. Therefore, they have to be trained to listen to the voice of the customers, to understand the IT language, to measure business value delivered in new ways such as Net Promoter Score (Grisaffe, 2007), (Fisher & Kordupleski, 2019).

Regarding project managers, Tripathi & Goyal (2014) propose that: “Skills need to be learned by agile project managers”, “skills needs to be unlearned if any project manager is moving from traditional project to agile project. [...] Project managers need to change their mind set and should be ready for Accepting changes and uncertain requirement.” Training sessions for project managers and scrum masters have to be carefully designed, since organizations use methods “for adaptation and implementation of the agile project management methodology according to the project team specific”. (Rasnacis & Berzisa, 2017). Finally, people in Mode-2 operations need to be receptive of the idea that assessment and reward is more team based and less personal, as it is in Mode-1 operations. Success and failure is attributed more to teams than to persons; this difference of approach sometimes creates tensions because personal work becomes less visible from people outside the agile teams.

iii. Process

The main process question is how to split work between Mode-1 and mode-2 operational team. Our observations have found the following approaches:

- Work is assigned according to the level of granularity of business requirements as well as their degree of completeness and certainty. Requests with lower degrees of ambiguity are assigned to Mode-1 teams.

- Applications with heavy user interface/ user experience requirements are assigned to Mode-2 operations and the others to mode-1.

- Change management types of requests for the same product are managed by Mode-1 team, while brand new functionality is undertaken by Mode-2 team.

- If a product or service is constantly updated, either incrementally or radically, a dedicated Mode-2 team had better

undertake all relevant tasks, without splitting the work between Mode-1 and Mode-2 teams.

- All requests go to Mode-2 teams and then are assigned to Mode-1 only for maintenance and support.

Moreover, process issues have also to do with how deliverables are organized and stored by Mode-2 operations. In Mode-1 operations, documentation and deliverables are easily found in the appropriate project management repository tool. In Mode-2, files organized in wikis are used to record business requirements, whereas functional specifications, usually expressed in the format of user stories, are organized in sprints, i.e. grouped along the time dimension, as these projects develop. The organization of functional specifications in sprints makes search and modification of implemented functionality very difficult, if not chaotic; any hand-over to people other than those of the team which developed them is very time consuming and complex. To avoid these problems, functional specifications (user stories) need to be reorganized right after their implementation on the basis of a high-level functional map, so that they can be easily traced.

iv. Technology

The two main challenges in this area, as observed in the field are embracement of devops and creation of technical debt. Since “quality deliveries with short cycle time need a high degree of automation” (Ebert et. al, 2016), IT organizations need to acquire devops technology. “DevOps is a set of practices intended to reduce the time between committing a change to a system and the change being placed into normal production, while ensuring high quality.” (Bass, et. al., 2015) It is a management challenge for IT organizations to onboard devops, because new tools, techniques, skills and investments are needed. Mode-2 operations where development takes places with time to market in mind, usually creates technical debt, i.e. the need to refactor the code after some time in production, to ensure compliance to standards, interoperability and maintainability, as well as reconfiguration for better performance. When created, technical debt should be clearly documented and presented so that it can estimated and planned for implementation.

CONCLUSIONS

“The primary purpose of developers and development teams in general is to deliver functional software within an optimum timeframe that can bring the highest value to all the stakeholders involved, including employees and clients. However, most projects fail on a general level or do not manage to deliver the desired value.” (Carmen and Ciochina, 2018). To address this failure, IT organizations have grown to operate in two models: traditional and agile. “The conclusions point out some of the most important pre-requisites for agile transformation, such as: training and workshops, implication of agile experts, support and effectiveness, establishment of community practice and learning organizational culture. Nevertheless, the endless learning process as a part of the

learning organizational culture, was the biggest agile challenge within companies’ transformation, which is like a journey without a final destination, always having to adapt to changes.” (Olteanu, 2018).

Running in two different modes of operation, IT organizations face multiple challenges, which can be grouped as management and organizational, people, process and technology-oriented. Some of these challenges have been discussed in this paper, based on the observations made on some organizations moving into or already running in a bimodal way. Problems and challenges regarding scaling-up agile frameworks have been presented by (Conboy and Carroll, 2019; Duncan, 2018; Wińska and Dąbrowski, 2020), etc. but may also be further researched as organizations become more mature in this area. Management challenges are also related to which of the four bimodal archetypes an IT organization aims to go and through which steps it decides to arrive there.

It is obvious from the findings discussed, the agile work is not confined to the boundaries of the IT organizations but affects the rest of it as well. Scaling up bimodal organizations requires that “leaders should use agile methods themselves and create a taxonomy of opportunities to set priorities and break the journey into small steps. Workstreams should be modularized and then seamlessly integrated. Functions not reorganized into agile teams should learn to operate with agile values.” (Rigby et al., 2018).

Concluding, we have shown that bimodal operations in IT organizations is not a luxury but a necessity, however a lot of questions about their optimal management remain unanswered. The findings of our observations which identify the management challenges in bimodal IT organizations are expected to contribute positively both to research as well as practitioners’ decisions.

REFERENCES

- Adelakun, O., Garcia, R., Tabaka, T., Ismail, R., 2017. Hybrid project management: Agile with discipline, in: CONF-IRM 2017 Proceedings. Presented at the International Conference on Information Resources Management (CONF-IRM), Association For Information Systems.
- Ahmad, G., Soomro, T., Naqvi, S.M., 2016. An overview: merits of agile project management over traditional project management in software development. *Journal of Information & Communication Technology* 10, 105–120.
- Ancona, D.G., Caldwell, D.F., 1992. Work-groups; Organizational-climate; Organizational effectiveness. *Administrative Science Quarterly* 37, 634–665.
- Augustine, S., Payne, B., Sencindiver, F., Woodcock, S., 2005. Agile project management: Steering from the edges. *Commun. ACM* 48, 85–89.
- Barton, D., Carey, D., Charan, R., 2018. One bank’s agile team experiment. [WWW Document]. *Harvard Business Review*. URL <https://hbr.org/2018/03/one-banks-agile-team->

- experiment
- Bass, L., Weber, I., & Zhu, L. (2015). *DevOps: A software architect's perspective*. Addison-Wesley Professional.
- Cabri, A., & Griffiths, M. (2006, July). Earned value and agile reporting. In *AGILE 2006 (AGILE'06)* (pp. 6-pp). IEEE. Presented at the AGILE 2006, IEEE, pp. 6– 22. <https://doi.org/10.1109/AGILE.2006.21>
- Calnan, M., Rozen, A., 2019. ING's Agile Transformation— Teaching an Elephant to Race. *Journal of Creating Value* 5, 190–209. <https://doi.org/10.1177/2394964319875601>
- Carmen, N., Ciochina, R.S., 2018. Challenges of Applying Agile Principles and Values to IT Project Management. *Journal of Entrepreneurship, Management and Innovation* 14, 43–62. <https://doi.org/10.7341/20181442>
- Comella-Dorda, S., Lohiya, S., Speksnijder, G., 2016. An operating model for companywide agile development [WWW Document]. McKinsey Digital. URL <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/an-operating-model-for-company-wide-agile-development>
- Conboy, K., Carroll, N., 2019. Implementing Large-Scale Agile Frameworks: Challenges and Recommendations. *IEEE Software* 36, 44–50. <https://doi.org/10.1109/MS.2018.2884865>
- Crowder, J.A., Friess, S., 2015. Measuring Success in an Agile World: Agile EVMS, in: *Agile Project Management: Managing for Success*. Springer, Cham.
- Cunha, M., Gomes, J., 2003. Order and Disorder in Product Innovation Models. *Creativity and Innovation Management* 12, 174–187. <https://doi.org/10.1111/1467-8691.00280>
- Dias, J., Ionutiu, O., Lhuer, X., Ouwerkerk, J.V., 2016. The four pillars of distinctive customer journeys. McKinsey Digital.
- Duncan, S., 2018. Nexus framework for scaling scrum. *Software Quality Professional* 21, 51–52.
- Ebert, C., Gallardo, G., Hernantes, J., & Serrano, N. (2016). *DevOps*. Ieee Software, 33(3), 94-100.
- Fernandez, D. J., & Fernandez, J. D. (2008). Agile project management—agilism versus traditional approaches. *Journal of Computer Information Systems*, 49(2), 10- 17.
- Fisher, N. I., & Kordupleski, R. E. (2019). Good and bad market research: A critical review of Net Promoter Score. *Applied Stochastic Models in Business and Industry*, 35(1), 138-151.
- Fitsilis, P., 2008. Comparing PMBOK and Agile Project Management software development processes, in: Sobh, T. (Ed.), *Advances in Computer and Information Sciences and Engineering*. Springer Netherlands, Dordrecht, pp. 378–383.
- Fridman, A., 2016. The Massive Downside of Agile Software Development [WWW Document]. INC. URL <https://www.inc.com/adamfridman/the-massive-downside-of-agile-software-development.html>
- Grisaffe, D.B., 2007. Questions about the ultimate question: conceptual considerations in evaluating Reichheld's net promoter score (NPS). *Journal of Consumer Satisfaction* 36.
- Haffke, I., Kalgovas, B., Benlian, A., 2017. Options for Transforming the IT Function Using Bimodal IT. *MIS Quarterly Executive* 16, 101–120.
- Hayat, F., Rehman, A. U., Arif, K. S., Wahab, K., & Abbas, M. (2019). The Influence of Agile Methodology (Scrum) on Software Project Management. Presented at the International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD), IEEE, pp. 145–149. <https://doi.org/10.1109/SNPD.2019.8935813>
- Hoda, R., Noble, J., & Marshall, S. (2008). Agile project management. In *New Zealand computer science research student conference*. 6, pp. 218-221.
- Koi-Akrofi, J., Henry Matey, A., Koi-Akrofi, G., 2019. Understanding the Characteristics, Benefits and Challenges of Agile IT Project Management: A Literature Based Perspective 10, 25–44. <https://doi.org/10.5121/ijsea.2019.10502>
- Kumar, G., Bhatia, P.K., 2012. Impact of agile methodology on software development process. *Journal of Computer Technology and Electronics Engineering (IJCTEE)* 4, 46–50. <https://doi.org/10.5539/cis.v8n2p9>
- Mihalache, A., 2017. Project Management Tools for Agile Teams. *Informatica Economica* 21, 85–93. <https://doi.org/10.12948/issn14531305/21.4.2017.07>
- Miller, G.J., 2013. Agile problems, challenges, & failures. Project Management Institute, North America, New Orleans, LA. Newtown Square, PA.
- Olteanu, C.G., 2018. IT agile transformation, in: 1. *Academy of Economic Studies. Economy Informatics*, pp. 23–31.
- Perlak, J. (2019). Characteristics of self-organizing teams in agile project management: A case study. *Acta Universitatis Nicolai Copernici. Zarządzanie*, 46(1), 19-27.
- Rasnacis, A., & Berzisa, S. (2017). Method for adaptation and implementation of agile project management methodology. *Procedia Computer Science*, 104, 43-50.
- Rico, D.F., Sayani, H.H., Sone, S., 2009. The Business Value of Agile Software Methods: Maximizing ROI with Just-in-Time Processes and Documentation.
- Rigby, D.K., Sutherland, J., Noble, A., 2018. Agile at scale. *Harvard Business Review*, Harvard Business Review 96, 88–96.

- Salameh, H., 2014. What, when, why, and how? A comparison between agile project management and traditional project management methods. *International Journal of Business and Management Review* 5, 52–74.
- Schwaber, K., 2004. *Agile project management with Scrum*. Microsoft press.
- Stare, A., 2013. Agile project management – a future approach to the management of projects? *Dynamic Relationships Management Journal* 2, 43–53. <https://doi.org/10.17708/DRMJ.2013.v02n01a04>
- Thesing, T., Feldmann, C., Burchardt, M., 2021. Agile versus Waterfall Project Management: Decision Model for Selecting the Appropriate Approach to a Project. *Procedia Computer Science* 181, 746–756. <https://doi.org/10.1016/j.procs.2021.01.227>
- Tripathi, V., & Goyal, A. K. (2014). Changing Roles and Responsibilities from Traditional project management to Agile project management. *International Journal on Recent and Innovation Trends in Computing and Communication*, 2(5), 1005- 1009.
- Verlaine, B., Jureta, I., Faulkner, S., 2015. Towards the Alignment of a Detailed Service-Oriented Design and Development Methodology with ITIL v.3, in: Nóvoa, H., Drăgoicea, M. (Eds.), *Exploring Services Science*. Springer International Publishing, Cham, pp. 123–138.
- Verlaine, B., Jureta, I., Faulkner, S., 2016. How Can ITIL and Agile Project Management Coexist? An Adaptation of the ITIL v.3 Life Cycle in Order to Integrate SCRUM, *Lecture Notes in Business Information Processing* 247, 327–342.
- Williams, T., 2005. Assessing and moving on from the dominant project management discourse in the light of project overruns. *IEEE Transactions on engineering management* 52, 497–508.
- Wińska, E., Dąbrowski, W., 2020. Software Development Artifacts in Large Agile Organizations: A Comparison of Scaling Agile Methods, in: Poniszewska-Marańda, A., Kryvinska, N., Jarzabek, S., Madeyski, L. (Eds.), *Data-Centric Business and Applications: Towards Software Development (Volume 4)*. Springer International Publishing, Cham, pp. 101–116. https://doi.org/10.1007/978-3-030-34706-2_6
- Wysocki, R., 2006. *Effective Software Project Management*, Wiley Publishing Inc. ed.
- Zavyalova, E., Sokolov, D., & Lisovskaya, A. (2020). Agile vs traditional project management approaches: Comparing human resource management architectures. *International Journal of Organizational Analysis*.
- Zhu, L., Bass, L., & Champlin-Scharff, G. (2016). DevOps and its practices. *IEEE Software*, 33(3), 32-34.