Process Management as a Foundation for Integrating Agility and Discipline in Information Systems Development

Jerzy Auksztol
Business Informatics,
Management Faculty,
University of Gdańsk
Sopot, Poland   *Jerzy.Auksztol@ug.edu.pl*

Abstract

Agility and discipline are often treated in the literature on information systems development (ISD) as contradictory concepts. We demonstrated that this claim is grounded in human susceptibility to quick dichotomous inference and can be successfully overcome by eliminating unnecessary linguistic biases. Both concepts can positively affect the successful conduct of ISD projects. To address this challenge, we propose using a process management framework as a foundation for integrating various technical, organizational, and social ideas. This approach allows for constructing systems and software in a smooth and agile manner while maintaining sufficient control through discipline.

The methodology consists of two research methods. One, critical realism (CR) paradigm is used to identify the source of linguistic biases in discourse about agility and discipline. The other method involves studying practices to assess the efficacy of process management in designing organizational solutions for agile project management.

Keywords: Process Management, Agile Project Management, Critical Realm Paradigm, Study of Practices

1. Introduction

The publications by Beck and Boehm [1] along with Boehm and Turner [2], well received by the ICT community, discuss the contradictions between agility and discipline which appear in agile project management field of study. The foundations of the agility concept itself were laid in 2001 as the "Manifesto for Agile Software Development" [3, 4] which leads us to the conclusion that limitations were indicated two years later, at the very beginning of the widespread of this idea, limitations were indicated, and in further scientific discourse [5, 6, 7, 8]. We will treat these as a drawback of unreflective and oversimplified application of the rules established at a high level of generality.

Boehm and Turner initiated a fruitful discourse by formulating the following recommendation [2, p. 46]: "… to synthesize the best from agile and plan-driven methods to address our future challenges of simultaneously achieving high software dependability, agility, and scalability". We agree with this opinion and go even further. We claim that the approach outlined in "Manifesto …" uses contradictions as a source of power to integrate teams in performing project tasks having an undesired effects especially in psychological context. We demonstrate that the crucial assumptions of the agile software development concept were outlined with some linguistic biases [9], causing unnecessary tension in scientific and professional discourse. They could induce an internal disharmony blocking smooth integration of diverse concepts in the complex ISD.

To address this challenge, we propose a process management framework as a foundation for integrating a visionary and flexible organizational approach associated with the agility accompanying project-oriented disciplinary setting, referred to plan-driven methods. We will demonstrate that this framework can also facilitate the integration of other management concepts essential for successful agile projects building high-value

systems and software.

Having the above in mind, we can formulate the following postulation as a research issue.

> *The agility and the discipline are the* intertwined *concepts which, when used jointly, positively affect the achievement of the objective set within the system and software development process steadily adjusting to uncertainty.*

We assert in the postulation that the agility and the discipline are intertwined concepts in software and systems development. We contend that these concepts should be constantly and complementarily applied in every activity within the development process. Engaging in discourse that treats agility and discipline as opposing forces is counterproductive, as it inevitably fosters unnecessary internal conflicts within development teams. It is more advantageous to persuade visionaries, characterized by their field-independent cognitive style [10, pp. 197-198; 11, pp. 718-725] and propensity for open-mindedness and dynamism, to consider precise software project circumstances such as budget, time frame and end-product quality, rather than allowing them to dominate the entire team. Simultaneously, we must address a goal-oriented members, who exhibit field-dependent cognitive style [10, pp. 197-198; 11, pp. 718-725] and often remain silent within the team. In response to the ambiguity of the "Manifesto ...", it is essential to encourage mutual understanding and cooperation between these two groups. Their synergetic integration could serve as a foundation for developing innovative solutions.

The postulation also addresses also the importance of defining objectives. Activities related to building any system are inherently future-oriented, aiming to project its functionality and operation. Therefore, its characteristics should be articulated at the outset of the process and meticulously managed with steady adjustment throughout its development. A disciplined approach is essential in this regard. Yeo's study on critical failure factors in information system projects [12, p. 245] highlighted that the factor named "Weak definitions of requirements and scope" takes second place among the process issues. This underscores the conclusion that any negligence in stating objectives may jeopardize obtaining the expected result. The systems and software development processes are closely tied to the activities involved in building stated results, which are typically organized in accordance with the process management concept [13]. Furthermore, we propose that the process of systems and software development can be managed as a system itself, suggesting a perspective where the development system constructs the information system, thereby addressing our research problem.

Furthermore, the postulation addresses further the concept of steadily adjusting to uncertainty delving into the core rationale behind introducing agile approaches in project management practices. Complaints articulated during the formulation of agility principles mostly revolved around the issue of rigid assumptions and rules that are unable to adapt quickly enough to changing circumstances, thereby generating obstacles to achieving stated objectives.

2.   Methodology

We will adopt an approach inspired by the qualitative research category to explain and conform to the postulation stated in the previous chapter. Our methodology will not be as strict and rigid as in research conducted according to the positivist paradigm which can be derived from Denzin and Lincoln statement [14, p. 6]: "As a site of discussion, or discourse, qualitative research is difficult to define clearly. It has no theory or paradigm that is distinctly its own."

Our goal is to gain insight into social factors at play within software development community, which have led to the paradoxical overestimation of agility's efficacy in project management. This phenomenon raises a question about the role of discipline within ISD practices. This exploration will serve as the foundation for the proposed organizational recommendation in the form of process management framework.

At the outset, we examine the foundation of the agile movement [3] through a

challenging lens, employing the framework of CR paradigm [15]. This approach involves questioning established patterns and striving to explain the paradoxical rise of contradiction between agility and discipline. Subsequently, we will derive a recommendation from CR, aiming to overcome the conceptual dichotomy introduced by agile principles. To achieve this, we will employ the study of practices method, derived from the qualitative group of research methods used in social sciences [16, 17].

3.   Critical perspective of the agile principles

The agile principles, as outlined in "Manifesto …" [3], emerged in 2001, making a significant shift in project management practices, where the flexibility and team focus became a cornerstone for successful project execution. However, after a period of enthusiasm and optimism, we find ourselves at the juncture, where the reflation is necessary to address the challenges posed by this concept and propose adjustment to enhance project management practices in ISD. To achieve this this goal, we will adopt a simple yet effective approach. We will conduct a linguistic analysis of words and sentences used within the "manifesto" document, drawing conclusions about the drawbacks that may give rise to issues related to the concept of discipline in agile ISD. Our analysis will be divided into two groups: those related to all the rules collectively and those related to each of them individually.

The two comments addressing all the rules are as follows: (1) The use of the term 'manifesto' [18] in professional discourse within ISD extends beyond its original purpose, as this term is strongly associated with political context. We believe that adopting a language narration that incites struggle and emotions through linguistic narration is not conducive to the ISD community. Instead, we advocate for terms like "guidelines" or "rules" that promote inclusion and discourse. (2) On the landing page of the agility movement [3], we encounter summary statements, starting with the rule: "Individuals and interactions over processes and tools" This suggests a persuasive style aimed at inducing cognitive biases, favoring fast over slow thinking [19]. One such technique is the use of the preposition "over", which implies hierarchy by importance. This technique is commonly used in scientific discourse to identifying key factors influencing specific phenomena. In this context however, it appears to assert claims without evidence, leading to emotional discussions. Another technique involves using visual effects, with the more important term "individuals and interactions" presented in a larger font, and the less important "processes and tools" in a smaller one. This confirms our assertion that the authors of the "manifesto" employed techniques to evoke emotional responses and capture attention.

The comments addressing each of the agile principles are presented in the Table 1, consisting of four columns. The first one is intended to organize the discourse. The second column contains the repetition of the text of principle itself. The third column discusses the issue addressed by each principle, explaining the probable reason for its creation. The fourth one addresses the issues that arise from unreflective application of each principle.

The discourse presented in Table 1 was constructed based on the ontological and epistemological principles outlined in the CR paradigm [15, pp. 789-795]. We acknowledge that analyzing the ISD phenomenon involves considering a stratified perspective, where different elements of reality coexist, but our understanding is hindered by various levels of stratification that are not clearly identified [15, p. 790]. Our aim was to shed light on some of these levels and present them in Table 1.

It is noteworthy that authors of agile principles tried to address obstacles in ISD perceived in rigid organizational structures, constrained by strict regulations and resistant to adopting to changing circumstances. They identified these obstacles and highlighted them on the landing page of the agility movement [3], presenting practices such as "processes and tools", "comprehensive documentation", "contract negotiation" and "following plan", placed after preposition "over". This placement juxtaposed them with key success factors like "individuals and interactions", "working software", "customer collaboration", and "responding to change". Consequently, the discipline primarily related

to processes, documentation, contracts, and planning was automatically stigmatized and could be belittled in the conduct of ISD execution.

Our proposal, following the discussion by Boehm and Turner [2], is to link the agility and the discipline together and with the help of process management integrate many concepts found in diversity of hybrid agile methods [23, 24, 25] together with other organizational, technical, and social ideas, which can effectively work cooperatively together.

Table 1. Issues addressed and issues omitted in "Manifesto for Agile Software Development"

No	Manifesto's principles [4]	Issues addressed	Issues omitted
1.	"Our highest priority is to satisfy the customer through early and continuous delivery of valuable software"	Focus on understanding customer expectations and identifying the appropriate approach to meet them	Customer's opportunistic behavior
2.	"Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage"	Customer expectations' uncertainty and variability	Impact of the introduced changes on the timetable and budget
3.	"Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale	Timetable discipline	Staff and material deficiencies to frequently evaluate the effects
4.	"Business people and developers must work together daily throughout the project."	Obstacles to external communication	Lack of disciplined approval of arrangements between businesspeople and developers
5.	"Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done."	Treating individuals with respect	Disarray in performing complicated tasks without discipline
6.	"The most efficient and effective method of conveying information to and within a development team is face-to-face conversation."	Obstacles to internal communication	Face-to-face conversation also has limitations that should be addressed in ISD
7.	"Working software is the primary measure of progress."	Goal-oriented approach of ISD [20]	There are many other measures that determine the success of an ISD project, such as stakeholders' satisfaction
8.	"Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely."	A holistic view of ISD	An imprecise and vague communication between stakeholders
9.	"Continuous attention to technical excellence and good design enhances agility."	Quality in software [21]	Other than engineering perspective of the complex socio-technical systems
10.	"Simplicity – the art of maximizing the amount of work not done – is essential."	Introduction to the Lean Software Development approach [22]	Oversimplification of complex terms related to the proper arrangement of processes within ISD and the systems they produce
11.	"The best architectures, requirements, and designs emerge from self-organizing teams."	Underappreciated organizational methods applied in creative processes producing complex systems	Oversimplification of circumstances in ISD processes
12.	"At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly."	Continuous improvement	The principle is clear

Source: own elaboration based on [4, 21, 22, 23]

4.   Process management framework

Building upon theoretical background outlined in the paper [26, pp. 17-18], we can assert

that the concept of process management has evolved over the past half-century. It was originated in 1967 by Williams [27], who proposed enhancing manufacturing processes with the aim of improving their efficiency, thus laying the groundwork for discipline that shaped the field of scientific discourse. For our purposes, we adopt the idea of applying this concept to integrate the myriad complex and intertwined components in the ISD, encompassing both social and technical characteristic.

We accept the following definition of the term process formulated by Davenport [28, p. 5]: "A process is thus a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action". This definition serves as the elementary building block for larger construction known as process management framework. The concept of process has evolved along various stages of development, from initiation [29], through the promise of becoming a key management concept triggered by Hammer's publication [29], to maturation [30] and further quiet, successful implementations [26]. In our framework, we will examine this concept through the lens of supporting techniques.

5. ISD in the context of processes

Designing organizational constructs using the process perspective reveals its value in various circumstances that affect the internal structure of the projected system and its context. Initially, we will review two cases using the study of practices method [14], where the process-based approach demonstrates its efficacy, and then we will delve into selected domains of implementations.

The first case examines the implementation of enterprise information systems (EIS) and focuses on successful application of the process perspective. EIS producers have undergone significant evolution [31] in managing the implementation process and its profound impact on business. Initially, organizations approached implementation using a resource perspective [32], leading to the deployment of separated and fragmented applications that were difficult to integrate into cohesive information system. However, by incorporating a process-based approach alongside the resource-based perspective [33], organizations were able to overcome fundamental challenges both during the implementation and in the composition of building blocks within the EIS.

The second case focuses on compliance with legal data protection. Initially, attempts were made to address restrictive obligations through a resource-based perspective, identifying the applications for recording data that required protection. However, this approach proved insufficient as it neglected activities affecting disclosure, such as collection, transmission, or dissemination. By incorporating a process-based approach alongside the resource-based perspective, institutions where able to adapt their organizational and technological structures to legal practices [34].

The two cases discussed above enable us to draw a descriptive interpretation. A narrowly focused design can be successful within fragmented implementation of isolated and clearly separated units. However, the process-based perspective demonstrated its usefulness in complex systems like ISD, where social and technical intertwined components are prevalent [35]. These benefits are also appreciated in other domains, such as: lean management, activity-based costing, total quality management, process innovation, workflow management, supply chain management, capability maturity model, business continuity management [26, p. 17], and even occupational health and safety management systems.

Thera are numerous references to processes in ISD domain. For example, in the ISO/IEC/IEEE 24765:2017 standard defining software engineering vocabulary [36, p. 337], a detailed explanation of this term is provided along with a list of other standards where it is used. However, agile principles tend to pay less attention to the process management, often emphasizing the drawbacks in performing successful agile ISD projects.

Yet the process perspective can integrate agile flexibility with disciplined arrayments. The first step in achieving this integration is to map ISD activities occurring within a

specific internal and external organizational context. A list of activities outlined in the software engineering standards can serve as a reference point. It is crucial to adjusting to the circumstances and stakeholder expectations of the project.

The range of reference ISD processes and activities available is wide and can be chosen for further consideration. The introductory standard, often referred to as the body of knowledge [37] consists of 346 pages. Every idea visible in agile principles can be realized through properly chosen and adjusted standard activities. The framework for software life cycle management encourages the implementation of agile methods with recommended practices [38], alongside with the business and IT strategy while considering the limitations of available resources.

The second step involves the integration of various ideas and concepts in organizational structure and processes. While their references and descriptions point to the fragmented domains of activities and can be found, e.g. in the standards, such as ISO or IEEE, connecting them together poses a significant challenge. Integrating separate terminology, knowledge, competences, good practices, and awareness of domain-specific risks in one cohesive organization is burdensome and time consuming.

6.   Future research

The inspiration for the research discussed in this paper stems from the influential publications by Boehm and Turner [2]. We extended their work by addressing two distinct discourse categories that deserve further consideration. The first category involves linguistic biases identified in the initial assumptions of agile software development, which could limit the cognitive perspective of reality. The second category focuses on future research that will examine the effectiveness of process management frameworks in composing agile methods within a hybrid approach. This research requires a detailed understanding of the essence and characteristics of each agile method and attempts to adapt them to specific project conditions.

7.   Conclusion

n this paper, we investigated the ongoing dispute within the ISD community between supporters of disciplined, plan-driven project execution and advocates of agile, flexible approaches. By using a critical realism perspective, we identified linguistic biases as the source of this emerging paradox. We further concluded that both approaches are complementary and can be smoothly integrated using a process management framework. The efficacy of this integration was demonstrated through the study of two cases involving the use of a process perspective in the implementation of complex information systems. We suggest that supporters of both sides represent specific cognitive style groups, highlighting the need for a specialized communication platform that promotes discourse, inclusion, and mutual understanding.

References

1. Beck, K., Boehm, B.: Agility through Discipline: A Debate. IEEE Comput. 36 (6), 44-46 (2003)
2. Boehm, B. W., Turner, R.: Balancing Agility and Discipline: A Guide for the Perplexed. Addison-Wesley Professional, Boston (2004)
3. Manifesto for Agile Software Development (2001), https://agilemanifesto.org/iso/en/manifesto.html. Accessed April 30, 2024
4. Principles behind the Agile Manifesto (2001), https://agilemanifesto.org/iso/en/principles.html. Accessed April 30, 2024
5. Agrawal, A., Atiq, M. A., Maurya, L. S.: A Current Study on the Limitations of Agile Methods in Industry Using Secure Google Forms. Procedia Comput. Sci. 78, 291-297 (2016)
6. Senapathi, M., Drury-Grogan, M. L.: Refining a model for sustained usage of agile

methodologies. J. Syst. and Soft. 132, 298-316 (2017)

7. Kuciapski, M., Marcinkowski, B.: Agile software development approach for 'ad-hoc' IT projects. Int. J. Inf. Syst. Proj. Manag. 11(4), 28-51 (2023).

8. Eloranta, V. P., Koskimies, K., Mikkonen, T.: Exploring ScrumBut – An empirical study of Scrum anti-patterns. Inf. Softw. Technol. 74, 194-203 (2016)

9. Beukeboom, C. J.: Mechanisms of linguistic bias: How words reflect and maintain stereotypic expectancies. In: Forgas J. P., Vincze O., László J. (eds.) Social cognition and communication, pp. 313-330. Psychology Press Taylor & Francis Group, New York and London (2013)

10. Riding, R., Cheema, I.: Cognitive styles - an overview and integration. Educ. Psychol. 11 (3-4), 193-215 (1991)

11. Guilford, J.P.: Cognitive styles: What are they?. Educ. Psychol. Meas. 40(3), 715-735 (1980)

12. Yeo, K. T.: Critical failure factors in information system projects. Int. J. Project Manage. 20(3), 241-246 (2002)

13. Swenson K. D., von Rosing M.: Phase 4: What Is Business Process Management?. In: von Rosing M., Scheer A.-W., von Scheel H. (eds.) The Complete Business Process Handbook: Body of Knowledge from Process Modeling to BPM, Volume I, Morgan Kaufmann, pp. 79-88 (2015)

14. Denzin N K., Lincoln Y.S.: The Discipline and Practice of Qualitative Research. In: Denzin N.K., Lincoln Y.S. (eds.) Handbook of Qualitative Research – 2nd ed., pp. 1-28. Sage Publication, Inc., Thousand Oaks (2000)

15. Wynn Jr, D., Williams, C. K.: Principles for Conducting Critical Realist Case Study Research in Information Systems. MIS Q. 36(3), 787-810 (2012)

16. Kemmis S., Taggart R.: Participatory Action Research. In: Denzin N. K., Lincoln Y. S. (eds.) Handbook of Qualitative Research – 2nd ed., pp. 567-605. Sage Publication, Inc., Thousand Oaks (2000)

17. Streeck, J., Mehus, S.: Microethnography: Fitch K. L., Sanders R. E. (eds.) The Study of Practices. In: Handbook of Language and Social Interaction, pp. 381-404. Psychology Press (2004)

18. Oxford learner's Dictionaries (2001), https://www.oxfordlearnersdictionaries.com/definition/english/manifesto/. Accessed April 30, 2024

19. Kahneman D.: Thinking, Fast and Slow. Farrar, Straus and Giroux, New York (2011)

20. Mylopoulos, J., Chung, L., Yu, E.: From Object-Oriented to Goal-Oriented Requirements Analysis. Commun. ACM 42(1), 31-37 (1999)

21. Denning, P.J.: What is Software Quality?. Commun. ACM 35(1), 13-15 (1992)

22. Poppendieck, M., Cusumano, M.A.: Lean Software Development: A Tutorial. IEEE Software 29(5), 26-32 (2012)

23. Gill, A. Q., Henderson-Sellers, B., & Niazi, M.: Scaling for agility: A reference model for hybrid traditional-agile software development methodologies. Inf. Syst. Front. 20(2), 315-341 (2018)

24. Kuhrmann, M., Diebold, P., Munch, J., Tell, P., Trektere, K., McCaffery, F., Garousi V., Felderer M., Linssen O., Hanser E., Prause, C. R.: Hybrid software development approaches in practice: a European perspective. IEEE Software 36(4), 20-31 (2018)

25. Noll, J., Beecham, S.: How Agile is Hybrid Agile? An Analysis of the HELENA Data. In: Product-Focused Software Process Improvement: 20th International Conference, PROFES 2019, Barcelona, Spain, November 27–29, 2019, Proceedings 20, pp. 341-349, Springer International Publishing (2019)

26. Auksztol, J., Chomuszko, M.: A Data Control Framework for SAF-T Reporting: A Process-based Approach. J. Entrepreneurship Manage. Innovation 16(1), 13-40 (2020)

27. Williams, S.: Business process modeling improves administrative control. Autom. 1967(12), 44-50 (1967)

28. Davenport, T.H.: Process Innovation: Reengineering Work through Information Technology. Harvard Business School Press, Boston (1993)

29. Hammer, M.: Reengineering Work: Don't Automate, Obliterate. Harv. Bus. Rev. 78(1), 104-112 (1990)

30. Becker, J., Rosemann, M., Von Uthmann, C.: Guidelines of Business Process Modeling. In: Business Process Management: Models, Techniques, and Empirical Studies, pp. 30-49. Springer, Berlin (2002)

31. Nah, F.F.H., Lau, J.L.S., Kuang, J.: Critical Factors for Successful Implementation of Enterprise Systems. Bus. Process Manage. J. 7(3), 285-296 (2001)

32. Barney, J.: Firm Resources and Sustained Competitive Advantage. J. Manage. 17(1), 99-120 (1991)

33. Arif, M., Kulonda, D., Jones, J., Proctor, M.: Enterprise Information Systems: Technology First or Process First?. Bus. Process Manage, J. 11(1), 5-21 (2005)

34. Birnhack, M.: A Process-Based Approach to Informational Privacy and the Case of Big Medical Data. Theor. Inquiries Law 20(1), 257-290 (2019)

35. Schuster, H., Georgakopoulos, D., Cichocki, A., Baker, D.: Modeling and Composing Service-Based and Reference Process-Based Multi-Enterprise Processes. In: Wangler B., Bergman L. (eds.) Advanced Information Systems Engineering: 12th International Conference, CAiSE 2000, pp. 247-263. Springer Berlin (2000)

36. ISO/IEC/IEEE 24765:2017: Systems and Software Engineering - Vocabulary. Geneva, International Organization for Standardization, Geneva (2017)

37. ISO/IEC TR 19759:2015: Guide to the Software Engineering Body of Knowledge (SWEBOK). International Organization for Standardization, Geneva (2015)

38. Edison, H., Wang, X., Conboy, K.: Comparing Methods for Large-Scale Agile Software Development: A Systematic Literature Review. IEEE Trans. Software Eng. 48(8), 2709-2731 (2021)