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Can we Adopt the Toyota Kata for the (Re-)Design of Business Processes in the Complex Environment of a Manufacturing Company?

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Abstract

Innovation is the key to the success of manufacturing companies in an increasingly complex business environment combining volatile, uncertain, complex, and ambiguous (VUCA) characteristics. In manufacturing companies, innovation predominantly involves temporarily destabilizing value-adding processes that are designed and optimized for stability. The *Toyota Kata* is a holistic management philosophy that strives for stability by providing cybernetic routines. These routines or katas support people in solving complex socio-technical problems in unstable environments. This contribution investigates the adoption of those problem-solving routines for innovating business processes and provides insight into a case in the manufacturing industry.

Keywords: Innovation Management, Manufacturing, Change Management, Problem Solving, Complexity, Kata, Hybrid Project Management

1. Introduction

Manufacturing companies and their products are shaped by the challenges of a VUCA market [1] and their endeavor to serve it with innovative products and processes [2, 3]. Innovation becomes the only constant for a successful and competitive organization [4]. The question is not whether, but only how much, companies and their products and processes must adapt [5]. However, rapid and frequent innovation also increases uncertainty and the risk of failure [6]. The balance between innovation dynamics and risk reduction is a critical success factor [7], making companies that innovate quickly, but also safely, more competitive than others [8].

Innovation projects frequently follow the guidelines of a conventional top-down controlled stage-gate process model, which in many cases, is criticized as too linear and too rigid [9]. This model usually involves detailed planning of project phases and milestones. However, conventional project management does not cultivate agile capabilities to quickly react to continuously occurring changes induced by a complex and dynamic environment. On the other hand, adopting methods and instruments from the agile project management domain, like *Scrum*, to manufacturing companies can cause oversteering [4]. Therefore, various guidelines for the integration of agile techniques to a manufacturer's environment propose a hybrid setting, merging conventional with agile practice to create better project performance (cf. e.g. [10–13]).

At the same time, ambidexterity has become a central research stream in organizational science to investigate how organizations can stay competitive over time in a complex and dynamic market (cf. [14, 15]). Corporate ambidexterity paraphrases the ability to achieve incremental improvement (exploitation) as well as radical innovation (exploration) in parallel [15]. A significant number of studies have shown that ambidexterity positively affects a company's sustainable performance, particularly under conditions of market and technology uncertainty [15]. The authors warn that manufacturing companies, building their competitive advantage on technological leadership, and sticking with a

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technology for too long, face the risk of walking into the "success trap" [14].

Knowledge-creating companies, therefore, systematically apply problem-solving routines to extend their corporate knowledge and cope with complex challenges [16]. With katas (routines), the *Toyota Motor Corp.* has established a management system that enables both exploitative and explorative problem-solving [17, 18].

2. Problem Statement and Scientific Questions

Based on the insights in the introduction, we generally pose the following problem statement: Project managers in manufacturing companies face a non-explorative project environment and lack methodological guidelines to achieve progress in complex innovation projects, especially when (re-) designing business processes.

In this paper, we investigate whether and how exactly the *Toyota Kata* management system can be adopted for the (re-) design of business process, guided by the following research questions (RQ):

RQ1 Is the *Toyota Kata* management philosophy generally a suitable approach for (re-)designing business processes?

RQ2 Which specific elements need to be modified or developed for an adoption?

RQ3 How can the solution be deployed in the daily project routine?

We address the formulated RQs in three sections. In the following section 3, we provide insight into the mechanisms of business process (re-) design and gather from expert interviews that technical problem solving plays a significant role in such projects. To specifically address RQ1, we then introduce the *Toyota Kata*, a management system formalizing problem-solving and knowledge-creating. Hereafter we then derive specific requirements for the adoption of the *Toyota Kata* in existing organizational structures in section 4 based on the literature analysis of various hybrid project management models (RQ2). Then, section 5 provides an attempt to deploy a planning kata for the (re-)design of business processes (RQ3). We finally conclude this paper with first experiences from a case in the manufacturing industry in section 6.

3. State of the Art in Business Process Innovation in Manufacturing Companies

In this section, we present an overview of the current business process (re-) design mechanisms and derive from expert interviews that technical problem solving plays a significant role in such projects. More in-depth insight into the *Toyota Kata* reveals that this management philosophy formalizes problem-solving and knowledge-creating with two main components: the *Improvement Kata* and the *Coaching Kata*.

3.1. Business Process (Re-)Design

Innovation in manufacturing companies involves "the critical analysis and radical redesign of established business processes to achieve breakthrough improvements in performance measures" [19]. It is closely related to the *Business Process Re-engineering* (BPR) programs of the 1990s comprising "the analysis and design of workflows and processes within and between organizations" [20]. This approach implies to redesign business processes radically in mainly top-down restructuring projects in order to achieve significant improvements in performance (cf. e.g. [21–23]).

In manufacturing companies, designing, prototyping, and simulating business processes has become a significant challenge in innovation projects and is performed by process engineers that combine technical, economic, and social knowledge [24]. In contrast to incremental improvements, architectural changes to the value creation processes are only achievable through intentional temporal instability and by accepting transitional losses in performance [25]. Business process (re-)design involves change and transformation management approaches to reduce risks and barriers and to increase agility (cf. [7]).

3.2. Technical Problem Solving

Interviews with process planning experts from an industry case located in the development and manufacture of electric drives have indicated, that the innovation of product- and process-related technologies represent a tremendous technical challenge due to a lack of experience and references. During the process of building up corporate know-how, many initially promising ideas turn out to be unfeasible or inefficient later in the project. Hence, when (re-)designing business processes, numerous technical problems emerge in the form of both engineering and manufacturing related issues. The effective and efficient solution of acute problems is an essential success factor for technical projects in complex environments [24]. Problems emerge, when intended achievements are endangered by obstacles that cannot be removed by routine activities, but require "conscious management […] of cognitive activities" or "a novel combination" [26].

Problem-solving is strongly related to a company's ability to systematically gain knowledge [16]. According to organizational science, corporate learning should include exploitation and exploration [27]. Exploitation is referred to as the improvement of existing assets and capabilities in order to optimize an organization's performance [27]. Exploration, by contrast, is the search and discovery of novel approaches for radical innovation [15]. The synergy of exploitation and exploration defines a company's capability for learning and adaptation [27].

3.3. Toyota Kata: a management system for the learning organization

Regular lean manufacturing and quality management tools are predominantly exploitative methods that allow optimization of previously existing assets and capabilities. Womack et al. [28] referred to these observable methods and practices at Toyota as *Lean Management*. Then, a closer look revealed that Toyota's excellent results primarily derive from the underlying corporate mindset with an emphasis on people and their routines of continuous exploitation and exploration

through scientific experimentation [17, 18, 29, 30]. Their success builds on two simple routines: the *Improvement Kata* and the *Coaching Kata* [17]. The term kata originates from Japanese martial arts and describes "ways of thinking and behavior which, through constant practice and application, develop into routines which are performed almost reflexively" [31]. The katas involve everyone within Toyota's organization, creating a cybernetic social system and apply to various situations and environments [17].

The improvement kata is a procedure that continuously, iteratively and with accordance to cybernetic systems theory follows four steps: (1) determine a vision and a direction regarding the final target (e.g., being competitive in a particular market for the next ten years), (2) analyze and assess the current as-is-situation, (3) determine a target to-be-state (4) eliminate or solve occurring problems and obstacles during the pursuit of the target state by applying fast, iterative PDCA-cycles (see figure 1). Toyota's improvement kata is an enabler for exploitative and explorative learning for a continuous adaptation to new requirements induced by a complex environment. [17]

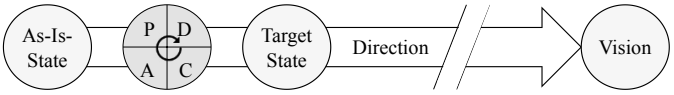

Figure 1: The Improvement Kata [17]

The Coaching Kata serves to teach the general mindset and the application of the improvement kata to the individuals of the organization. On this purpose, a mentor/mentee-dialogue (everyone within the organization is both mentor and mentee at the same time) comprises a sequence of steps and questions that form a practical problem-solving approach. The mentor guides the mentee towards the solution of the particular problem, step by step, without knowing the exact solution [17]. This routine enables an organization-wide knowledge-creating process and characterizes the knowledge-creating company [16].

According to [32], Toyota pursues the idea that for long-term success in a dynamic market, continuous improvements are essential, which are achieved by small incremental steps. Toyota calls this the next target state. Each next target state serves as a sub-step only to reach the overarching vision. Obstacles and problems that might be individual for each step emerge and need to be recognized and tackled by the employees themselves. The managers assist their mentees with solution-neutral questions enabling self-reflection. When the project team achieves a target, they analyze their new status quo and, together with the management, derive a new target state. With each cycle, they approach closer to the vision [32].

As suggested in this section, we consider the *Toyota Kata* to be generally applicable in complex business (re-)design projects implementing the idea of a knowledge-creating company, combining exploitative and explorative capabilities.

4. Literature Based Deduction of a Business Processes Innovation Kata

In the following, we analyzed in detail which specific requirements need to be considered for the adoption of the *Toyota Kata* in the complex environment of a manufacturing company in order to (re-)design business processes more successfully. We considered findings from the hybrid project management literature, where conventional approaches merge with agile concepts.

4.1. Integration in Existing Project Management Structures

When starting to (re-)design business processes, only a few relevant data and knowledge are available. This uncertainty in project goals conflicts with specific milestones. Hence, decisions on the subsequent steps must be made based on concepts that might be technically immature [12]. Conventional project management approaches predominately rely on stages and gates (cf. [33]). The stages mark the phases of the project in which the actual work and the activities take place, whereas the gates act as quality checkpoints to assess project progress [33]. Sommer et al. [34] were the first to report how companies adopt Cooper's classic stage-gate model in order to improve the operative agility of project management. Cooper & Sommer [11] later extended the proven stage-gate model academically by adding agile project management elements and therefore creating a hybrid-stage-gate. Sommer et al. [34] further distinguish a strategic, tactical, and operational level. On the strategic level, where long-term planning is situated, conventional stage-gate structures the meta-project management. Hence, with an agile approach like *Scrum* (cf. [35]) on the operative level, so the authors, task completion speed, and responsiveness regarding sudden changes increases [11]. Other literature proposes a similar setting (cf. e.g. [13, 36, 37]).

Sommer et al. [34] outline that companies adopting a hybrid/agile-stage-gate approach experienced significant improvements and overall better project performance. Especially in manufacturing companies, where many projects pursue to exploit existing assets and teams refine and extend established competencies and technologies [27], ambidexterity through hybrid stage-gate models might be a valid approach to increase business performance and sustainability. Introducing *Scrum* to manufacturing companies, however, requires significant organizational changes, new team roles and structures, and preparatory training [10, 12].

On the contrary, the *Toyota Kata* unfolds excellent technical problem-solving performance that allows a continuous improvement of processes as well as explorative innovation and, therefore, quick adaptation to changed requirements [17]. Developing a corporate kata culture, "learning organization" [30], or "knowledge-creating company" [16] might require a lot of effort and time. However, a project manager can instantly do the first leap by becoming a mentor to sub-project managers or team-members and implement the coaching kata by building on existing organizational relationships.

4.2. Setting the Tangible Target States

Provided that the kata philosophy documented by Rother [17] applies to the business process (re-)design projects under a hybrid model, what remains pending is how project managers should formulate tangible target states. Common efficiency-based KPIs cannot capture the achievement of explorative

knowledge gain, which complicates the expression of target states [16]. In the kata management system, target states derive from greater measurable "challenges" determined by senior management in advance [17]. This function should structurally allocate on the tactical level of a hybrid-stage-gate approach in which the project manager subdivides the milestones of the strategical planning level into smaller, tangible target states for each sub-project and phase. The formulation of said target states emerges from the cascaded mentor-mentee dialogues between project leader, sub-project leaders, and team members [30].

This conclusion seems to be reasonable not only from a structural and organizational point of view but also from the time-related aspect. The overarching stage-gate model structures the strategic level, whereas the real process improvement, day-to-day decisions, and actual operations take place on the operative level. This constellation leaves the weekly to monthly planning within the tactical level [34]. The latter intervals resemble the time needed to achieve the next target state within the kata [17].

To formulate valid target states in business model innovation projects, Ries [38] provides the concept of the *Minimum Viable Product* (MVP), which renders a tangible prototype allowing valid customer feedback. The routine that enables the project team to reach these states is the *Build-Measure-Learn* cycle [38]. The MVP then is the physical outcome, or "it is simply the fastest way to get through the *Build-Measure-Learn* feedback loop" with minimal effort [38]. Based on Ries' concept of an MVP, [37] propose a related approach for the definition of target states within factory planning in disruptive and agile environments: *Minimal Viable Production System* (MVPS). The MVPS is based on a few core dimensions (e.g., assembly, building), allowing fast validation of "producibility" and delivering feedback about the production of parts/products with minimal planning effort and maximal benefit [37]. In the agile software development domain and the *Scrum* framework, in particular, target states are captured in the *Product Backlog*. The *Backlog* contains items and is a prioritized list of basic functionalities that the product (or software) must accomplish [39].

An MVP of a business process should portray the required necessary steps of the process in order to allow testing with and learning through that prototype according to the *Build-Measure-Learn* feedback loop. This cybernetic approach enables steering of the complex innovation journey based on actually gathered data, allowing the team to pivot along with the current (innovation) path [38]. This approach coincides with the "probe-sense-respond"-based procedure, recommended in the *Cynefin-Framework* as "emergent practice" for complex contexts [40].

4.3. Literature-Based Results

The integrated use of the *Toyota Kata* and the *Build-Measure-Learn* feedback loop in a hybrid-stage-gate model appears to be a promising concept for (re-)designing business processes in manufacturing companies. With such an approach, the knowledge gathered on the operational level by applying the improvement kata can help to formulate more mature next target states. Referring to RQ2, we specify a modified meta-project management structure based on a hybrid-stage-gate model creating room for operational and tactical routines. We also provide an integrative, tactical routine for project managers to formulate tangible target states. These adaptions require no fundamental changes to a project structure or significant additional roles and capacities since project managers can build on established organizational relationships.

5. Integrating the Business Process Innovation Kata

The findings gathered in section 4 result in an integrational framework that allows deploying the kata in the daily project routine of business process (re-)design. This planning routine considers the specific requirements induced by established meta-project management structures in manufacturing companies and a project manger's room for maneuver.

5.1. Integrational Framework

The proposed framework comprises six steps adding up to a routine (see figure 2). This cybernetic cycle allows constant control of the results and an immediate adaptation to changing project requirements.

1. Assess the project-complexity and environment: how complex is the project, and is there a predetermined meta structure?
2. Select an adequate meta project-phase model if not preset for the strategic level (*Stage-Gate*-based phase models, e.g., *Design Thinking, Integrated Product Development*).
3. Regularly establish a *Coaching Kata* dialogue starting with the project leader, cascading to sub-project managers, and the team members.
4. Apply the *Tactical Planning Kata*: concerning the project's superordinate vision, challenge and milestones, formulate a tangible target state (process prototype).
5. Apply the *Improvement Kata* on the operational level to incrementally achieve set target states (*Plan-Do-Check-Act* cycle).
6. Assess the achievements and return to step 4: by learning from the gathered knowledge, formulate a new, next target state (closing the *Build-Measure-Learn* cycle), while verifying steps 1 & 2, and continually enhancing step 3.

5.2. Tactical Planning Kata

The *Tactical Planning Kata* (step 4) breaks down the superordinate vision, challenge, and milestones into tangible target states. This unfolds by formulating process prototypes and also consistently applying the coaching kata (step 3):

a) Analyze the overarching target of the project-phase and subdivide it into a smaller target state, formulated as a business process prototype. This prototype represents a smaller gate to be achieved within a time slot varying from one week to a few months [17]. (b) From each target state, identify individual goals for each sub-group of the project team. The organizational structure should correspond to a matrix model with distinct swim-lanes [41]. (c) The *Coaching Kata* helps to continually synchronize the goals of each swim-lane with the

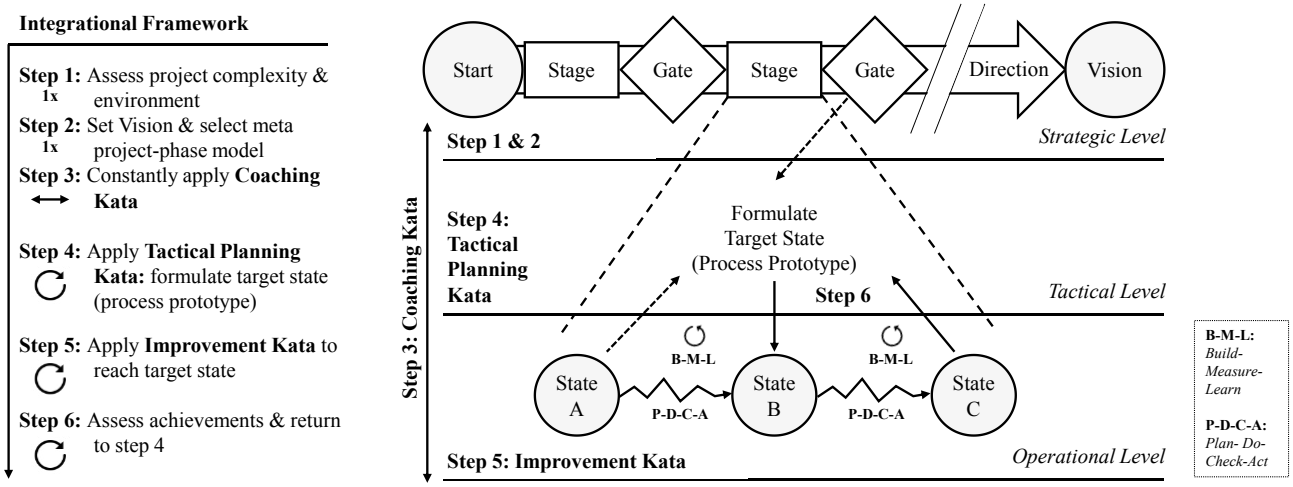

Figure 2: Hybrid planning model and Integrational Framework, based on models by [9-13, 17, 18, 29, 30, 34, 38]

overarching target state through several mentor-mentee dialogues.

The *Tactical Planning Kata*, in combination with the framework presented in the previous chapter, is a routine that also allows adaptation of subsequent target states by creating knowledge with feedback loops similar to the *Build-Measure-Learn* cycle [38]. Additionally, on the operative level, the team applies the *Improvement Kata* and its iterative PDCA-cycles in order to allow continuous improvement and adaptation during the achievement of previously set target states, or in this case, process prototypes.

5.3. Pilot Industry Application

We piloted the presented methodology in a mid-tier machine manufacturer and technology leader that started a very complex re-design of its engineer-to-order business process in order to cope with the globalized market. The project concurrently comprised the introduction of an ERP system and a general re-orientation towards value creation and faster order fulfillment. Key-account managers took responsibility for sub-projects, and the central functions of the future organization represented coaches for their team members. A superordinate vision provided by the project leader and the company's advisory board pointed the direction.

As proposed by our methodology, planning milestones incrementally as tangible target states on a three-month basis, significantly changed the project progress. Applying the tactical planning routine, the project leader, together with its sub-project managers, pivoted along the transformation path based on actual experiences the teams gathered along their paths to reach the next target state. An emerging process prototype visualized as a physical mock-up in a separate area called innovation lab endorsed each of these project phases. The prototype later included a simulation of the ERP system to support its integration. This guaranteed visual, osmotic communication among the team members and the rest of the company, and enabled participation, continuous improvement of the status quo, and drove the change process.

6. Discussion and Outlook

Concerning the stated question in the title of this paper, we gathered that the *Toyota Kata* systematically institutionalizes explorative and exploitative learning in a corporation from the reviewed literature. We concluded that these characteristics make it a promising approach for the (re-)design of business processes in a manufacturing company (RQ1). More in-depth insight into hybrid project management models revealed the need for a modified meta-project management structure based on a hybrid-stage-gate model and an integrative, tactical routine for project managers to formulate tangible target states (RQ2). To that end, we proposed an integrational framework and a tactical planning routine to modify existing hybrid project management models towards an integrated business process innovation kata (RQ3).

Our first industry pilot required strong effort and excellent communication. However, we experienced that the mentor-mentee dialogue harmonizes with existing organizational structures and enhances personal relations. The accompanied project manager acted as a role model for his sub-project managers. The latter shared their experience with their teams, which caused less resistance during the process redesign.

Further research efforts need to investigate other projects in various settings. However, first impressions have shown that adopting the *Toyota Kata* to complex innovation projects can achieve remarkable results and might be an alternative to the implementation of software-related frameworks, like, e.g., *Scrum*, particularly in manufacturing companies that already have successfully applied problem-solving routines.

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