Could we manage our strategic innovation projects better?

Unraveling unexpected waiting times as a key project uncertainty

Brix, Jacob; Horsager, Betina

R&D 2022 Management Conference
Innovation for People and Territories
Trento, Italy – July 9-13

***** Working paper *****

Could we manage our strategic innovation projects better?
Unraveling unexpected waiting times as a key project uncertainty

Jacob Brix
jbri@business.aau.dk
Aalborg University Business School

Betina Horsager
Independent Consultant

ABSTRACT

Purpose:
The paper explores unexpected waiting times in strategic innovation projects as a key project uncertainty. Empirical examples of unexpected waiting times in strategic innovation projects are investigated and related to the innovation management literature.

Methods:
A qualitative multi-method research strategy was applied based on 1) participant observation, 2) semi-structured interviews, and 3) practitioners as co-researchers during data collection. 38 strategic innovation projects were studied in 10 large tech organizations in Denmark for 14 months.

Novelty of findings:
The study finds that 10 percent of the unexpected waiting times identified were related to 'technical errors', and that 90 percent were caused by 'human errors'. This implies that there is an unexploited potential in better understanding how innovation managers can work proactively to reduce the amount and impact of unexpected waiting times.

KEYWORDS
Innovation Management; Strategic Innovation; Case Study; Uncertainty; Information Processing

INTRODUCTION

In this study we want to better understand the phenomenon of 'unexpected waiting times' in the context of strategic innovation. With strategic innovation we mean "(…) *innovation undertaken by the organization that is intentional and can provide whole new platforms of growth through major market impact.*" (O'Connor et al., 2018: xvi). More precisely we are interested in unraveling empirical patterns of unexpected waiting times as a key project uncertainty and how these occur during the realization of innovation projects with medium to high degrees of uncertainty (Biazzo et al., 2016; Faems, 2020). The argument is that unexpected waiting times are undesirable e.g., because they can make it difficult to handle resources efficiently and since they can lead to longer time to marked than expected (e.g., Schoonhoven et al., 1990; Woschke et al., 2016). Hence, a better understanding of unexpected waiting times as a key project uncertainty can create new knowledge for identifying the causes and mechanisms that organizational internally and/or externally can be mitigated by a proactive focus on the phenomenon (O'Connor and Rice, 2013). In short: if we can identify the mechanisms that trigger unexpected waiting times in strategic innovation projects, we can better direct attention towards these mechanisms and reduce the likelihood of them to occur.

The purpose of this study is to study strategic innovation projects as they unfold in practice and investigate 1) the causes of unexpected waiting times, 2) the impact of the unexpected waiting times and 3) how the unexpected waiting times are mitigated in practice. This knowledge is important to research since it can inform us on how to built better theoretical and methodological explanations for the management of strategic innovation projects. For practitioners the study identifies three concrete recommendations that can help reduce the amount of unexpected waiting times in practice

THEORETICAL BACKGROUND

The study situates itself in the literature of strategic innovation management and it investigates the empirical phenomenon of unexpected waiting times. This section provides a short background to strategic innovation management to theoretically frame the study. Hereafter, focus is directed at defining waiting time in the context of strategic innovation. The section ends with a table that summarizes and synthesizes knowledge on waiting times in the context of strategic innovation management.

Strategic Innovation Management and Uncertainty

It is no longer breaking news that the ability of organizations to acquire "(…) the organizational capability to respond rapidly to environmental change, develop new technologies, and promote business development (…) is crucial." (Kodama and Shibata, 2014: 76). What is however difficult is to explain the different roles and responsibilities that managers and employees must take in the processes of realizing strategic innovation projects (O'Connor et al., 2018), e.g., when choosing the appropriate methodology for new knowledge creation and -application within or across organizational boundaries (Brix and Peters, 2015; Salerno et al., 2015; Barbosa et al., 2021). What is special regarding the management of strategic innovation is that it goes beyond incremental adjustments to existing products and product extensions, and focus is therefore on organizational rejuvenation; the creation of the future for the company (O'Connor et al., 2018). Understanding the uncertainties that are at stake in strategic innovation is important because they can negatively influence an ambitious innovation project if not managed properly (Sanio et al., 2012; Salerno et al., 2015; Kristiansen and Ritala, 2018). O'Connor and Rice (2013) built the 'uncertainty matrix' theory related to strategic innovation that categorizes uncertainty into three dimensions. On the Z-axis they present four core areas: 1) Technical, 2) Market, 3) Organizational, and 4) Resource uncertainty. On the Y-axis is the latency (unanticipated or anticipated), and on the X-axis is criticality (routine or showstopper). This model is exemplary to illustrate where, why, and how different types of uncertainty can affect an innovation project. With point of departure in this framing of uncertainty in strategic innovation projects we proceed to shortly unfold how and why (unexpected) waiting times is an important uncertainty phenomenon that must be handled.

Defining waiting times in innovation studies

Inspired by Black's online Law Dictionary, we define waiting time as "*a period in a project where the team is unable to work due to factors its members cannot control; or because change of scope or unsatisfactory results have led to rework and thus delay of a project deliverable.*" (Black's Law Dictionary). Based on our definition, a waiting time is a multifaceted phenomenon. It can be *expected* e.g., waiting for a prototype to be created; or it can be *unexpected* e.g., if the prototype is not delivered according to schedule. Moreover, a waiting time can lead to project *standstill* e.g., when waiting for test results or a project *in process* e.g., if changes to the prototype must be made. The complexity of a waiting time can therefore be illustrated as a matrix model:

Table 1: Waiting time matrix

WAITING TIME	Project in process	Project standstill
Expected	***Foreseen***	***Planned***
Unexpected	***Critical***	***Highly critical***

Source: Authors' development

As noted, the foreseen waiting times that occur are typically expected and taken into consideration when making plans and scheduling how resources are to be used in the innovation project. These expected waiting times are not the focus of this study, but however a natural part of innovation projects. The *unexpected waiting times* are, however, not possible to plan or schedule because of their unanticipated nature (O'Connor and Rice, 2013). Therefore, when the unexpected waiting times occur, they are *critical* or *highly critical* and they will require immediate managerial attention so the innovation project can get back on the track and in time be pushed to market the best way possible (Brix, 2020).

Causes of unexpected waiting times in innovation projects

From previous research, we know generally that three key factors might cause unexpected waiting time in projects. These factors relate to 1) organizational structure and culture, 2) resource and skill availability, and 3) organizational work authorization systems (PMI, 2013). In addition to this, Brix (2015) established that unclear roles and responsibilities cause a long stretch of unnecessary waiting time in on-going innovation projects. Levitt et al. (1999) introduce the concept of 'exceptions' which can influence time, cost and quality, both positively and negatively. Related to our study there are two project exceptions that influence time negatively. The first is a counterproductive non-conformance. Counterproductive non-conformance occurs when incongruence exists between the manager's goals and priorities and those of subordinate(s). These incongruences can e.g., relate to different definitions of quality, differences in priority, or delay in delivery. The second exception is a 'technical error', which can be unskilled/incompetent use of technology (human made) or a technical breakdown. In line with this, O'Connor and Rice (2013) study positive and negative discontinuities in innovation projects. They claim that loss of an idea champion, change in attitudes in a business unit, change of management and change of project priority (lowering priority) may influence the innovation project negatively (see also Woschke et al., 2016). Moreover, O'Connor and Rice (2013) determine that loss of key team member or loss of project funding lead to project discontinuity. To avoid the loss of relevant information Cuijpers et al. (2011) stress that it is

imperative to our focus on improving information processing and communication to reduce errors and unwanted waiting times in innovation projects. They stress that: "*managers should facilitate the transfer of best practices between departments; invest in collaborative information and communication technologies; and invest in shared meeting space in order to increase the number of encounters between members of different departments and thus information exchange*" (Cuijpers et al., 2011: 573). Hence, well-functioning information processing is imperative (Jespersen, 2012; Hendricks and Singhal, 2008).

Synthesis and summary: Unexpected waiting times in strategic innovation

The causes of unexpected waiting times in innovation projects are summarized in Table 2 below. The "categories" are inspired by O'Connor and Rice's (2013) uncertainty matrix and the examples are synthesized from the section above. Table 2 serves as the theoretical background of the study of unexpected waiting time phenomena for the rest of the study.

Table 2: Summary of examples leading to waiting time in innovation projects

UNCERTAINTY CATEGORY	Examples	Reference
Organizational	*Unclear roles and responsibilities* *Counter productive non-conformances;*	Brix (2015) Levitt et al. (1999)
Resources	*Human made technical errors; loss of funding; loss of idea champion; loss of key team member;*	Levitt et al. (1999) O'Connor and Rice (2013)
Organizational work authorization system	*Change in management; change in management priority*	O'Connor and Rice (2013) Woschke et al. (2016)
Information processing and communication	*Inaccurate or delayed information to decision makers; information processing breakdown; under fit in information processing capacity*	Cuijpers et al. (2011) Levitt et al. (1999) Hendricks and Singhal (2008) Jespersen (2012)
Technology	*Technical errors or breakdowns*	Levitt et al. (1999)

Source: Authors' development

METHODOLOGY

The study is based on the participation of 10 case organizations situated in Denmark who were running 38 innovation projects with medium to high degrees of uncertainty. All organizations had adopted and relied on the Stage-Gate process principles new product development (Cooper, 2008). We are aware that there in the literature is disagreement about the applicability of Stage-Gate models for strategic and radical innovation (O'Connor et al., 2018; Cooper, 2008). However, the organizations studied had decided to apply the Stage-Gate model to their work with strategic

innovation in practice and this empirical decision is out of the hands of us researchers. For 14 months the co-author acted as external consultant in the 10 case organizations and could observe, take field notes, and make semi-structured interviews during her participation in their innovation projects. An important addition to the data collection was that the innovation project managers in the organizations also were committed to register all types of waiting times and provide the research team with the information. They hence took the role as co-researchers. A qualitative, multimethod research design (Hass-Bieber and Johnson, 2015) was applied combined of participant observation (Kristiansen and Krogstrup, 2016) and semi-structured interviews (Kvale, 2016).

Table 3: Illustrating the empirical evidence

Data collection activity	Time	Data type(s)
Observations: (first author)	14 meetings: 45 hours.	Field notes and unstructured interviews
Participant observation: (Co-author registering data in database)	*Ongoing process for 14 months*	Semi-structured interviews, unstructured interviews; field notes
Follow-up interviews: (made by the co-author)	Approximately 30 minutes interview with the contact person(s) of the projects in the 10 participating organizations	The co-author has made 1 interview with the contact person(s) at all organizations

Source: Author's

FINDINGS:
During the data collection period of 14 months 155 waiting times were recorded and as can be seen in table 4, most of these waiting times happened unexpectedly.

Table 4: Types of waiting time and their effect on the project

Waiting time	Project in process	Project standstill
Expected	***Foreseen*** 19% *13 days*	***Planned*** 10% *48 days*
Unexpected	***Critical*** 49% *19 days*	***Highly critical*** 22% *30 days*

Percentages demonstrate the division of the waiting times.
Days are the median period of time per waiting time

A total of 71 per cent of these 155 waiting times occurred unexpectedly whereof 49 per cent were *critical* and 22 per cent *highly critical* leading to innovation project standstill. See Table 5 below for examples and division of all unexpected waiting times and their concrete impact timewise to the

innovation project. Table 5 is elaborated inductively on the causes of the problems (the mechanisms), how these causes could be recognized, and concrete examples from practice.

Table 5: Causes of unexpected waiting time in strategic innovation projects

Cause of problem	**Recognized by…**	**Concrete examples** (days of unexpected waiting time in brackets)	**Stage-Gate phase**
Information processing (30%)	Inaccurate information; delayed information; unclear information; information overload; lack of information, etc.	The project team needed information concerning a test failure from a business partner (4 days)	Testing
		Deliverables from another project interferes with the deliverables of this project: inter-project collaboration is started up to solve issues (180 days)	Testing
		The project cannot proceed before another project contract is updated and signed because of interdependence (20 days)	Building Business Case
		The supplier worked slower than expected to deliver the information in the deliverable (49 days)	Development
Project planning and scheduling (26%)	Poor discipline to meet deadlines; deployment of inappropriate employees to project; missing focus on relevant activities, etc.	The deliverable in the project did not get the correct amount of resources to deliver on time (14 days)	Development
		A business unit did not deliver test results on time according to critical path (21 days)	Testing
		The project manager and key supplier did not coordinate activities according to critical path (60 days)	Building Business Case
		Project member did not deliver results on time (10 days)	Development
Changing priorities (22%)	Modification within the process; scope creep; unclear targets; cancellation of meetings, etc.	The steering committee cancelled a pre-arranged gate-review (7 days; 17 days; 21 days)	Development
		The project did not get the number of man-hours which was planned – resources were transferred to another project (30 days; 7 days; 210 days)	Testing
		A portfolio manager questions the relevancy of the project and needs more information (17 days)	Building Business Case
Decision-making (12%)	Accepting progress without providing resources; exaggerated expectations; new priorities	The decision-makers ask for changes to an already accepted business case (14 days)	Development
		The decision-makers ask for changes in project deliverable to fit another project (45 days)	Building Business Case
		The steering committee ask for additional information in the development of the business case at a gate-review (90 days)	Building Business Case
Technical error (10%)	Breakdown in test equipment; failure in prototype, etc.	Error in data integration between two technology platforms – the system stopped functioning after one week of test (30 days)	Testing
		Two of the project's prototypes failed quality requirements which lead to rework (14 days)	Testing
		The technology received from supplier does not live up to the specifications in the contract and cannot be used (90 days)	Building Business Case

Source: authors' own development

In the following these empirical, inductive causes will be discussed in related to Table 2 that was developed in the study's theoretical background.

DISCUSSION & IMPLICATIONS

As reminder, it is important to stress that unexpected waiting times will be a key uncertainty in the context of strategic innovation projects because of the medium to high degree of uncertainty (O'Connor and Rice, 2013). Equally important, the unexpected waiting times are problematic e.g., because they cause delays to market and keep the costs of processing the innovation projects high (Schoonhoven et al., 1990; Woschke et al., 2016).

In the 38 strategic innovation projects we followed, our study demonstrates that five empirical mechanisms were accountable for the unexpected waiting times that emerged. These mechanisms were 1) information processing, 2) project planning and scheduling, 3) changing priorities, 4) decision-making, and 5) technical error. When comparing these mechanisms to the theoretical background we find that there is an overlap, where our results complement but also identifies important empirical nuances that can be used to strengthen current knowledge base of unexpected waiting times as an uncertainty category in strategic innovation management (Cuijpers et al., 2011; O'Connor and Rice, 2013; Woschke et al., 2016). See Table 6 where we provide examples from our study that complements and/or gives new nuances to the literature.

Table 6: Contributions unexpected waiting time

UNCERTAINTY CATEGORY	Examples from the literature	Examples and new nuances from the study
Organizational	Unclear roles and responsibilities Counter productive non-conformances;	*The project manager did not coordinate activities with suppliers in the project planning (60 days); a team member did not deliver results on time (10 days); a business unit does not deliver results on time (21 days)*
Resources	Human made technical errors; loss of funding; loss of idea champion; loss of key team member;	*Resources (man hours) are transferred to another project (7; 30; 210 days); waiting for access to test new technology in the production (31 days)*
Organizational work authorization system	Change in management; change in management priority	*Decision makers cancel scheduled review meeting (7; 17; 21 days); decision-makers ask for changes in already accepted business case – scope creep (14; 45 days); Decision-makers require more information before acceptance of new business case (90 days); a portfolio manager questions the relevancy of the project – answers are needed to proceed (17 days)*
Information processing and communication	Inaccurate or delayed information to decision makers; information processing breakdown	*Information pull: waiting for answers from business partner on test failure (4 days); delayed information from supplier (49 days)* *Interdependence: waiting for acceptance of gate review from another project (20 days); conflict between deliverables in two projects – solution is needed (180 days)*
Technology	Technical errors or breakdowns	*Error in data integration between two technology platforms (30 days); Prototype failure during test leading to rework and new test(s) (14 days); Supplier delivers technology that does not work according to specifications*

Source: Authors' development

We find that especially *information processing* as mechanism is the largest cause of unexpected waiting times in our study, e.g. inaccurate or delayed information. This complements the studies of Hendricks and Singhal (2008), Cuijpers et al. (2011) and Jespersen (2012) by identifying similar and new nuances to the literature. Especially the impact on time is a novel addition to the current literature. The other important mechanism is *planning and scheduling* in innovation projects although will be a hard task if not almost impossible when the degree of uncertainty is medium to high (O'Connor et al., 2018; Brix, 2020). Our study brings out important nuances because actions such as 1) 'cancelling scheduled review/decision meetings' can bring innovation projects to standstill for multiple week or 2) making changes to an accepted business case which requires rework could impact an innovation project timewise for more than a month (Woschke et al., 2016). The third mechanism *changing priorities* are recognized by e.g., unclear targets and measures, and cancelling planned meetings are found to create unexpected waiting times in strategic innovation projects (O'Connor et al., 2018). The same problem occurs with scope creep as a change of priority – when an innovation project is redefined, and the scope is made broader than originally thought. This is another problem compared to pivoting, where elements are left out (Arteaga and Hyland, 2013). The study also brings out interesting indicators related to *decision-making* in the context of strategic innovation projects. Accepting that an innovation project gets permission to continue without providing more resources occurred in the cases we studied. This is not a unique finding cf. both Cooper (2008) and O'Connor et al. (2018); it is however interesting how and why innovation managers and management teams in general expect that innovation projects can continue without having the resources needed. In sum, we find that the human aspect of managing the uncertainty category 'unexpected waiting times' in strategic innovation projects is important to focus on – it might be a new role that is ascribed to innovation (project) managers cf. (O'Connor et al., 2018) when the ambition is to have innovation management as a function in established organizations.

Implications for practitioners

Our study demonstrates that only 10 per cent of the unexpected waiting times in strategic innovation projects studied could be explained by technical errors and that 90 per cent could be explained by conscious or unconscious human errors. The three most important points of advice to practitioners are:

1. Ensure that the members of the steering committee are available, that they know their roles and responsibilities and that they have the mandate to decide
2. Make explicit the project manager's decision mandate so the steering committee does not have to be involved regarding minor issues
3. Maintain contact with people both organizational internal and external where activities are dependent on each other to have updated information about status and progress

REFERENCES:

Arteaga, R., and Hyland, J. (2013). *Pivot: How top entrepreneurs adapt and change course to find ultimate success*. John Wiley & Sons.

Barbosa, A.P.F.P.L., Salerno, M.S., de Souza Nascimento, P.T., Albala, A., Maranzato, F.P., and Tamoschus, D. (2021). "Configurations of project management practices to enhance the performance of open innovation R&D projects." *International Journal of Project Management 39* (2): 128-138.

Biazzo, S., Panizzolo, R., and Crescenzo, A.M.D. (2016). "Lean management and product innovation: a critical review." In Understanding the lean enterprise, edited by A. Chiarini, P. Found and N. Rish, 237-260. New York: Springer.

Brix, J. (2020). "Building capacity for sustainable innovation: A field study of the transition from exploitation to exploration and back again." *Journal of Cleaner Production*, *268*, 122381.

Brix, J. (2015). "Fail forward: Mitigating failure in energy research and innovation." *Energy Research & Social Science*, *7*: 66-77.

Brix, J., and Peters, L.S. (2015). "The performance-improving benefits of a radical innovation initiative." *International Journal of Productivity and Performance Management, 64* (3): 356-376.

Chiarini, A., Found, P., & Rish, N. (2016). *Understanding the lean enterprise*. NY: Springer.

Cooper, R. G. (2008). "Perspective: The stage-gate® idea-to-launch process—update, what's new, and nexgen systems." *Journal of Product Innovation Management 25* (3): 213-232.

Cuijpers, M., Guenter, H., and Hussinger, K. (2011). "Costs and benefits of inter-departmental innovation collaboration." *Research Policy* 40 (4):565-575.

Faems, D. (2020). "Moving forward quantitative research on innovation management: a call for an inductive turn on using and presenting quantitative research." *R&D Management 50* (3): 352-363.

Hendricks, K.B., and Singhal, V.R. (2008). "The effect of product introduction delays on operating performance." *Management Science* 54 (5):878-892.

Hesse-Biber, S.N., and Johnson, R.B. (Eds.). (2015). *The Oxford handbook of multimethod and mixed methods research inquiry*. Oxford: Oxford University Press.

Jespersen, K.R. (2012). "Stage-to-Stage Information Dependency in the NPD Process: Effective Learning or a Potential Entrapment of NPD Gates?" *Journal of Product Innovation Management* 29 (2):257-274.

Kodama, M., and Shibata, T. (2014). "Strategy transformation through strategic innovation capability–a case study of Fanuc." *R&D Management* 44 (1):75-103.

Kristiansen, S., and Krogstrup, H.K. (2015). *Deltagende observation*. 2. udgave. København: Hans Reitzels Forlag

Kristiansen, J.N. and Ritala, P. (2018), "Measuring radical innovation project success: typical metrics don't work." *Journal of Business Strategy* 39 (4):34-41.

Kvale, S. (2012). *Doing interviews*. Sage.

Levitt, R.E., Thomsen, J., Christiansen, T.R., Kunz, J.C., Jin, Y., and Nass, C. (1999). "Simulating project work processes and organizations: Toward a micro-contingency theory of organizational design." *Management Science* 45 (11):1479-1495.

O'Connor, G.C., and Rice, M.P. (2013). "A comprehensive model of uncertainty associated with radical innovation." *Journal of Product Innovation Management* 30 (S1): 2-18.

O'Connor, G.C., Corbett, A.C., and Peters, L.S. (2018). *Beyond the champion: institutionalizing innovation through people*. Stanford University Press.

Project Management Institute. (2013). *Project Management Body Of Knowledge (PMBOK),* Global Standard, Newtown.

Salerno, M.S., de Vasconcelos Gomes, L.A., Da Silva, D.O., Bagno, R.B., and Freitas, S.L.T.U. (2015). "Innovation processes: Which process for which project?." *Technovation* 35: 59-70.

Sainio, L.M., Ritala, P., and Hurmelinna-Laukkanen, P. (2012). "Constituents of radical innovation—exploring the role of strategic orientations and market uncertainty." *Technovation* 32 (11): 591-599.

Schoonhoven, C.B., Eisenhardt, K.M. and Lyman, K. (1990). "Speeding products to market: Waiting time to first product introduction in new firms." *Administrative Science Quarterly* 35:177-207

Woschke, T., Haase, H., and Lautenschläger, A. (2016). "Waste in NPD processes of German SMEs." *International Journal of Productivity and Performance Management* 65(4): 532-533.