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Abstract.

In many European countries, the management of transport infrastructure networks faces major challenges due to such issues as climate change, ageing infrastructure facilities, new mobility technologies, and the energy transition. To deal with these challenges, public infrastructure administrators need to develop responsive and innovative solutions while at the same time sustaining and optimising current performance of the present infrastructure networks. This ability to balance innovation and optimisation is called ambidextrous capacity. In addition, developing and implementing new or improved solutions requires the capacity of an organisation to learn. This is especially challenging in project-oriented organisations, where innovations are explored in pilot projects, separated from production-oriented day-to-day processes.

This paper aims to analyse what public infrastructure administrators can do to enhance ambidextrous and learning capacities to develop sustainable solutions and thereby enhance resilience. To this end, we studied the Dutch public infrastructure administrator Rijkswaterstaat. Based on the findings from our study, we propose three recommendations to public infrastructure administrators: (1) formulate and clearly communicate an overall strategy, and translate this strategy to the tactical and operational level, (2) use integrative tactics to overcome the drawbacks of the structural ambidexterity of projects, and (3) strengthen organisational learning by implementing supportive arrangements.

Keywords: Ambidexterity; Learning; Organisational Resilience; Project-oriented Organisation; Public Infrastructure Administrator.

1 Introduction

In many European countries, the management of transport infrastructure networks faces major challenges due to such issues as climate change, ageing infrastructure facilities, new mobility technologies, and the energy transition (Arts et al., 2021). Enabling sustained and improved performance of transport infrastructure networks in such contexts, requires a resilient organisation to manage these networks (Brown et al.,

2017). Although the concept of organisational resilience still lacks a clear definition, a recent literature review by Hillman and Guenther (2020) showed that organisational resilience generally means surviving and thriving amidst adversity. Whereas surviving uncertain environments on the short term involves anticipation and coping capabilities, thriving and fostering future success require adaptation capabilities (Duchek, 2020). As such, organisational resilience involves balancing short- and long-term interests.

The growing need for sustainable solutions in infrastructure planning requires public infrastructure administrators to adapt by exploring, developing and implementing new products and processes – i.e., innovation. At the same time, a huge renovation task necessitates public infrastructure administrators in many countries to standardise products, procure faster and more efficiently, and to optimise production processes – i.e., optimisation. Both innovation (exploration, for the long term) and optimisation (exploitation, for the short term) are essential to build organisational resilience; however, they compete for scarce resources. Hence, combining innovation and optimisation requires ambidextrous capacity of public infrastructure administrators – i.e., the capacity to balance exploration and exploitation (Gieske, 2019; March, 1991). Furthermore, the innovation and optimisation processes that are necessary for organisational resilience, require organisational learning – i.e., integrating and institutionalising at organisational level of what was developed and learned at (project-)team level (Crossan, et al 1999; Evenseth et al., 2022). Therefore, the aim of this paper is to analyse what public infrastructure administrators can do to enhance ambidextrous and learning capacities to develop sustainable solutions and thereby become more resilient.

2 Theoretical framework

The relationship between organisational resilience and ambidexterity is clearly indicated by March (1991, p.71) who argued that “maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity”. More recently, a.o. O’Reilly and Tushman (2013) and Gieske (2019) concluded that organisational ambidexterity has a positive effect on the performance of private and public organisations. There is, however, no ‘one-size-fits-all’ solution in achieving ambidexterity (Brix, 2019). Ambidexterity involves structural and temporal (or sequential) organisational designs, in which exploration and exploitation activities are separated in respectively place and time, as well as contextual designs that allow for simultaneous exploration and exploitation (Kassotaki, 2022; O’Reilly & Tushman, 2013).

Organisational learning can integrate exploration and exploitation. New concepts, knowledge, technologies, policy goals, et cetera, need to be interpreted, implemented and institutionalised at the organisational level. Current activities, processes, technologies have to be optimised to enhance efficiency and renewed to be able to adapt to new challenges. This is quite a challenge for public infrastructure administrators as they often use a project-oriented approach to efficiently realise and renew infrastructure facilities (Arts et al., 2021). Projects can be seen as temporary constructs with a short-term delivery focus for optimising infrastructure networks. However, the short-term logics of projects are often at odds with long-term policy goals of the organisation as a

whole. To safeguard optimisation (the focus of project teams) and at the same time ensure exploration of innovative solutions, innovation is often organised in temporary arrangements, such as pilots and programmes, or in separate departments of the organisation. This separation of exploration and exploitation across different units of the organisation can be considered as structural ambidexterity.

The upscaling of innovations into the broader organisation and in organisational routines involves learning processes in which professionals collectively interpret the relevance and impact of innovations on their work, and institutionalisation of what is learned in organisational norms, routines, procedures, et cetera (Crossan, et al., 1999; De Groot et al., 2023). Innovation processes typically follow a temporal design, in which an innovation is piloted in one project and context, before upscaling it for implementation in other projects and contexts, and institutionalising it at the organisational level. Despite the benefits of structural ambidexterity, a downside is that what was learned may remain limited to the single project in which it was realised. The larger the institutional distance between projects and their parent organisation, the more learning processes are impeded (Liu et al., 2021; De Groot et al., 2022).

In sum, the literature shows that ambidextrous and learning capacities are important for organisations to balance exploration and exploitation, and thereby enhance resilience. However, it remains challenging for public infrastructure administrators to actually balance innovation and optimisation in practice.

3 Methods

For the aim of this paper, we studied the public infrastructure administrator Rijkswaterstaat. As the executive agency of the Ministry of Infrastructure and Water Management in the Netherlands, Rijkswaterstaat is responsible for the planning, design, construction, and maintenance of the main road network, waterway network and water systems. This case is particularly interesting, because the ministry set explicit ambitions for climate neutrality and circularity for the year 2030.

We analysed a Rijkswaterstaat programme for climate-proof and circular infrastructure (Cannaerts, et al. 2022) to identify organisational aspects that should be strengthened to be able to realise the ambitions. We used the ‘Erasmus Model for Innovative Capacity’ (Gieske, et al., 2019) to analyse the connective, ambidextrous, and learning capacity of the programme and the Rijkswaterstaat organisation. The extent of innovation and optimisation in products, processes and instruments for sustainability, and the perceived performance on sustainability goals were measured through a questionnaire (n = 678). Through regression analysis, we determined the contribution of the different capacities to innovation and optimisation. Subsequently, the results and potential action perspectives were discussed in 6 focus groups.

To get more insight in learning capacity, we also analysed the contribution of communities of practice (CoPs) to developing sustainable solutions and upscaling innovations. We conducted a questionnaire among 58 participants of 4 CoPs on project, contract, risk, and quality management, complemented with interviews with 4 CoP leaders and a focus group with 5 Rijkswaterstaat professionals to discuss our findings.

4 Results

The extent in which Rijkswaterstaat optimised products, technology, processes, regulations and routines to achieve sustainable goals was rated 6.2 on a 10-points scale, whereas for innovation this was 5.5. Organisational learning was rated at 5.6. Statistical analysis showed that organisational learning is strongly correlated to both innovating and optimising ($\beta = 0.36$, $p=0.001$), as are ambidextrous activities by managers (rated 6.2, $\beta = 0.35$, $p=0.001$) and ambidextrous activities by employees (rated 6.3, $\beta = 0.15$, $p=0.05$). Reason for the relatively low scores, according to the focus groups, is the difficulty of translating abstract (strategic) goals to actionable (operational) goals. Regarding this, it was considered helpful that, e.g.: concrete paragraphs on sustainability were included in formal project documents; instruments were developed to rate the sustainability of bids by contractors; and specific roles related to sustainability were assigned to support project teams. It was considered helpful that upper management stated and translated the leading (strategic) principle 'we work sustainable, or we don't work'.

The focus group discussions also revealed significant tensions between running projects (focussing on scope, budget, and time), and time for learning within a project and especially for organisational learning. Tensions were also mentioned between current protocols and regulations (mostly based on good practices in the past) and the implementation of new solutions. As a possibility to overcome this, the role of boundary spanners was mentioned. The study of 4 communities of practice (CoPs) corroborated the aforementioned tensions and provided additional insight in their role in organisational learning related to innovation and sustainability.

The results show that the CoPs predominantly contribute to optimisation of work in projects and the organisation by discussing issues from practice and striving for uniformity by developing procedures and templates. However, the extent that CoPs pay attention to innovation – i.e., 'developing innovations' and 'experimenting' – ranged from 8% for contract management to 24% for quality management according to respondents, so was relatively low. In general, respondents argued that participation in CoPs was supported, and even encouraged, by senior management. However, *"CoPs are important, but less urgent than work in projects"* as an interviewee argued. Another interviewee stated *"if it is not really important to senior management and linked to an overall strategy, then motivation to put effort in such developments decreases and it does not work"*. This corresponds to the finding that it is difficult to translate strategic goals to the tactical or operational level.

5 Discussion

Public infrastructure administrators face the challenge of providing adequate infrastructure facilities today and at the same time enabling the provision of adequate infrastructure in the future. It is a balance between short-term optimisation and innovation for long-term uncertain benefits. However, since public infrastructure administrators in general are prone to public scrutiny, they focus on delivering concrete results

to demonstrate that they are using societal resources efficiently. As such, they are vulnerable to the 'optimisation trap', where continued optimisation no longer contributes to performance (Gieske et al, 2019). In order to become more resilient, organisations need to explore and innovate next to optimisation. Both literature and our study indicate that the project-oriented character of public infrastructure administrators safeguards optimisation, but also facilitates (local) innovation in separate projects and programmes because projects may act as innovation niches. However, structural ambidexterity challenges the integration of innovations into the broader organisation.

Our study confirms the contribution of learning to (the building of) ambidextrous capacities, but that a multitude of connective and learning tactics have to be applied to make this contribution effective. Institutionalising new solutions and procedures in the current regime and practice remains challenging. Our study also shows that CoPs enable learning relationships across projects and their parent organisation. As such, they decrease the institutional and perceived 'distance' between projects and their parent organisation that impedes organisational learning (De Groot et al., 2022; Liu et al., 2021). Moreover, CoPs may contribute to institutionalisation of new solutions through the development of guidelines and procedures (Crossan et al., 1999). In contrast to programmes, CoPs are (usually) not intentionally designed by the organisation (De Groot et al., 2023). Although this fits with the informal character of CoPs as defined by Wenger-Trayner & Wenger-Trayner (2015), the results indicate that the involvement of management may enhance the contribution of CoPs in the upscaling of innovations as well as in optimisation activities.

CoPs and programmes are in itself insufficient for overall organisational ambidexterity. Innovation and optimisation can exist parallel in different places in the organisation without real choices have to be made or without connecting them or explicitly balancing the one against the other. Our study underlines that a deliberate strategy to connect these processes is necessary to enhance the ambidextrous capacity of project-oriented organisations. Such a strategy may include to combine both processes within the same organisational unit (e.g., a project or a programme) where exploration and exploitation occur sequentially of simultaneously (Brix, 2019; Kassotaki, 2022). Learning within the unit and from the unit to the broader organisation (through CoPs) may further enhance the building of ambidextrous capacity as operationalisation of the afore mentioned strategy.

In sum, our study provides directions to enhance ambidextrous and learning capacities of public infrastructure administrators in practice:

1. Develop, communicate and operationalise an overall strategy that balances innovation and optimisation to achieve both long- and short-term goals. Pay deliberate attention to the translation of (abstract, strategic) organisational goals and ambitions into (concrete, operational, actionable) working processes;
2. Instead of using structural ambidexterity as a 'one-size-fits- all' solution, add sequential and contextual ambidexterity, and apply integrating tactics in addition to differentiating tactics, for example by incorporating sustainability early and explicitly in the scope of projects;
3. Strengthen organisational learning by stimulating and facilitating different types of hubs (CoPs, programmes, et cetera) where knowledge and lessons learned can be shared and given joint meaning.

6 Conclusion

Although the results corroborate that balancing innovation and optimisation is indeed challenging for public infrastructure administrators, this study also gives practical directions as to how to enhance innovation and optimisation in combination. This study especially shows that the absence of a clear common approach and overarching strategy for innovation and optimisation limits the ambidextrous and learning capacities of a project-oriented organisation. Since projects remain prominent vehicles for sustaining and improving the performance of transport infrastructure networks, developing a balanced and implementable strategy that incorporates different types of ambidexterity and approaches to organisational learning appears necessary to enhance ambidextrous and learning capacities for the resilience of public infrastructure administrators.

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