25th International Congress on Modelling and Simulation, Darwin, NT, Australia, 9 to 14 July 2023
mssanz.org.au/modsim2023

# System dynamics and resilience in the pro-sport athletic department: Towards a capability-based theory

**Dirk Melton**

*University of Queensland Business School, Brisbane, Australia*
*Email: dirkmelto@gmail.com*

**Abstract:** A longitudinal case study on a pro-sport team within a national competition conceptualized the athletic department (referred to by practitioners as the high-performance system: HPS), as a complex social-ecological system. It was evident the HPS is multi-variate, heterogeneous, non-linear, cross-scale, and dynamic system, where knowledge is a primary critical organisation resource. It is proposed that the creation, accumulation, validation, storage, absorption, and transfer of knowledge required for org capability development plays an integral role enhancing HPS resilience, i.e., the ability of the HPS to withstand and adapt to disturbances without major functional and structural change. HPS governance inadequacies and associated systems thinking capacity constraints impact system understanding, thus inhibiting strategy development, resource allocation, and system management, culminating in poor team performance. With an aim to enhance knowledge flow, capability development, and system resilience; system dynamics as a research method was employed, with a view to build a simulation model to improve understanding of the HPS. To assist creation of the model, a theoretical frame was developed integrating the ecological science construct, adaptive governance, into the HPS. This construct was operationalized by the sequential and cumulative application of three concepts from the 'Resource-based View' (RBV) school of strategy, 'the knowledge creation spiral', 'absorptive capacity', and 'the learning organisation'.

During the case study research, three (3) years of unfettered access to the HPS was provided by the 'Head Coach' and 'General Manager'. A pragmatic constructivist philosophy drove the creation of system dynamics-action research mixed methods approach, considered for this project to be the most suitable to build, test, and validate a simulation model that would assist both strategy theory development and practitioner learning. The model attempts to establish the flow of knowledge through the HPS as it impacts the development of seventy-seven (77) capabilities. Determination of the specific capabilities, hierarchical capability structure, and cross-scale capability connectivity displayed in the model, evolved throughout the duration of the project, using considerable practitioner input. The foundations of the final structure consisted of the four main HPS dimensions, strategy, operations, coaching, and team development, aligned and integrated with the respective adaptive governance dimensions, science, policy, adaptive management, and system performance. The operationalisation of each integrated dimension, using the three (3) RBV concepts, established four (4) structures, each representing an adaptive life cycle (ALC).

Each ALC consisted of nineteen (19) capabilities, structured across three (3) capability levels or orders, the final structure mimicking the 'limits-to-growth' system dynamics archetype. Capability connectivity within the ALC was dependent upon crossing scales, represented by a capability hierarchy comprising zero, first, second, and third order capabilities, respectively referred to as substantive, dynamic, regenerative, and transformative capabilities. The research was able to empirically establish alignment between dynamic, regenerative, and transformative capabilities and the three (3) different types of system resilience; general, specified, and transformability. Connectivity between the four (4) ALCs was dependent upon the system capacity to cross thresholds to establish a 'Panarchy', an ability dependent on adequate and appropriate regenerative and transformative capability types. Facts gathered from the case-study assisted in determining capability specificity and suitable nomenclature, whilst development of the first principle-based model structure facilitated some important contributions to the areas of both strategy and system resilience.

This presentation will highlight contributions to the strategy field including the evolution, operationalisation, and empiricism of a capability hierarchy, the knowledge creation spiral, absorptive capacity, and the learning organisation. From a practitioner perspective, the presentation highlights principles for triple-loop-learning and its operationalization in the form of a strategy-oriented resilience practice, whilst outlining the model's potential as a tool for practitioner learning, establishing a system structure, dashboard, and outputs that identify the effects of knowledge flow, capability development, cross-scale connectivity, and cross-threshold connectivity on system resilience.

***Keywords:*** *Social-ecological systems, system dynamics, strategy, resilience, high-performance systems*