

Co-Production of Knowledge: Partnerships for SAON ROADS

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Co-production of knowledge (CPK) is fundamentally about partnerships with communities, those groups intended to benefit from the project. Through convergence process, CPK has been evolving with a few recent key literature sources do define it. Co-producing every step of the research process has emerged as essential to successful outcomes and increasingly becoming the consensus definition (Norström et al. 2020; Ellam Yua et al. Preprint; Djenontin and Meadow 2018; Wall, Meadow, and Horganic 2017; Mach et al. 2020; NSF 2022). Beyond the level of engagement, Norström et al. (2020) created four principles of CPK that distinguish it from other community engagement approaches. The *interactive* principle is consistent with the above definition. The *pluralistic* principle requires inclusivity to both the scientific and local/Indigenous worldviews and ways of knowing. The principles *context-based* and *goal-oriented* emphasize the need to do research differently to create a meaningful and beneficial project for community partners. The terminology of *partnership* comes from the Ellam Yua (Preprint) CPK model as a non-jargon term that captures the fundamental meaning of CPK.

With the above definition, there is a lot of freedom within the methods, purpose, types of research, and outcomes (Bremer and Meisch 2017; Chambers et al. 2021). The research approaches are best explained through philosophical worldviews (Creswell and Creswell 2018; Mertens and Wilson 2019). To give simplified examples, natural scientists (postpositivist) value hypothesis testing, social scientists (constructivist) value perspectives, and applied researchers (pragmatic) value usability. Then there are those researchers with a transformative worldview that values social justice and equity. Relevant to the Arctic, the Indigenous worldview value Indigenous Knowledge Systems and methodologies (Ellam Yua et al. Preprint; Kovach 2009). Because CPK requires a diversity of these worldviews, there will be communication challenges, interpersonal conflict, and misalignment of goals that require a high level of transparency and negotiation over all aspects of the project (Stokols et al. 2008; Sarkki et al. 2015). It is advised to define and contextualize what CPK means within a project for clear communication (Bremer and Meisch 2017; Dilling and Lemos 2011).

The CPK theory promises an increase in perceived credibility, relevance, and legitimacy, creating usable outcomes (Arnott and Lemos 2021). But evaluating *usability* and success is complicated due to the tensions between worldviews. Indigenous communities could see Indigenous Knowledges as more *credible* than scientific (Ellam Yua et al. Preprint; Daly and Dilling 2019). A case study concluded that solely downscaling had limited *relevance* without understanding the context the community was going to use it in (Daly and Dilling 2019). An example of a *legitimacy* issue within a project is who has decision-making power, the researchers and/or the community partners (Djenontin and Meadow 2018). Often CPK is discussed as a panacea without much focus on the failures that are often rooted in politics and power (Lemos et al. 2018; Turnhout et al. 2020). If partnering with a marginalized community, their context is striving for self-determination within systemic inequity and colonization. Therefore, projects must prioritize transformative research to be relevant and usable, which includes recognizing the politics and power within and outside the project (Turnhout et al. 2020; Daly and Dilling 2019).

Doing CPK with Arctic Indigenous communities adds another layer of complexity with responsible engagement, as shown within Ellam Yua (Preprint) CPK model. Indigenous Peoples have the right to self-determination and sovereignty (UNDRIP 2007), making working with them distinctly different. In the United States, federal agencies are required to have formal Tribal consultation as part of government-to-government relationships (Biden Jr 2021). The UN's Free, Prior, and Informed Consent of Indigenous Peoples (FAO 2016) provides an ethical framework that needs to be considered along with regional/cultural best practices (e.g., ICC (2021) Ethical and Equitable Engagement). The cross-cultural element should also be considered, particularly not normalizing your own worldview, methods, communication styles, and decision-making processes and then inappropriately applying it to Indigenous communities (Brady, Fryberg, and Shoda 2018). Indigenous-led research will lead to more success as the Indigenous leadership will pull from Indigenous methodologies to develop culturally-responsive methods, meetings, and outcomes (Ellam Yua et al. Preprint; Kovach 2009; Latulippe and Klenk 2020).

Prioritizing relationships are what will work for CPK with Arctic Indigenous communities. Relationality is fundamental to the Indigenous worldview (Kovach 2009; Ellam Yua et al. Preprint; Harris and Wasilewski 2004). Trustful relationships with iterative engagement throughout the research process have been shown to create usable outcomes across the science-policy boundaries (Sarkki et al. 2015; Lemos et al. 2018; Mach et al. 2020).

However, systems currently in place generally do not allow for long-term relationships within academia, compounded with the limited capacity with potential community partners (Lemos et al. 2018). Boundary spanners and organizations could aid in overcoming this challenge by facilitating the communication and process (Lemos et al. 2018; Bremer and Meisch 2017), but they are not well supported either (Goodrich et al. 2020). Changes in the funding have been shown to support the emergence of CPK and relationships (Arnott, Neuenfeldt, and Lemos 2020; Wall, Meadow, and Horganic 2017).

In conclusion, CPK partnerships require the consideration of the broader societal context. Using the context of research institutes and scientific worldviews leaves little space for the community's worldviews and knowledges, therefore community-driven projects that fit within their existing community initiatives will have more usable outcomes (Norström et al. 2020; Ellam Yua et al. Preprint; Daly and Dilling 2019; Turnhout et al. 2020). CPK takes time and commitment to maintain partnerships that may not be available (Lemos et al. 2018). Arctic Indigenous Peoples often lack the capacity to do CPK due to lack of resources, limited infrastructure, and overextended staff, so a focus on building capacity should be a prioritized goal of any research project (Ellam Yua et al. Preprint; Latulippe and Klenk 2020). CPK is not a panacea, and each project should assess with communities whether it is most appropriate over other approaches (Lemos et al. 2018). But Arctic observing does and should impact policy decision-making that then impacts Arctic Indigenous Peoples, therefore SAON ROADS should be co-produced.

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