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#### Mitho Pimachesowin through Capacity Building

### Indigineering: Engineering Through Indigenous Knowledge and Mino Pimachisowin

### Nehinaw Osihcikewin: Nehinaw Kiskenitamowin Eyapatak Mena Mino Pimachisowin

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**Abstract:** This article explores the concept of “Indigineering,” a combination of Indigenous and engineering; my hope is that this concept can help to Indigenize the latter. Many Indigenous communities in Canada have infrastructural needs and there is an opportunity for the engineering profession to assist those needs. However, there is an access gap that exists between the profession and Indigenous communities. This is reflected in the poor Indigenous representation in the profession and in post-secondary engineering programs across the country. In response, the concept of Indigineering, or integrating the code of ethics from the engineering profession and the cultural values of Indigenous Peoples, such as the Cree concepts of *wahkohtowin* (relations, being related), *mino wicheitowin* (having or possessing good relations), and *tapwewin* (speaking the truth, or speaking with precision and accuracy), would help to Indigenize the profession and make it more accessible to Indigenous people, as well as advance the field of engineering. Practising engineering through this lens would serve to ensure an Indigineer’s ability to achieve *mino pimachisowin*—the ability to live a good life, make a good living—and to better engage the greater public, which includes the Indigenous population. This article is a chapter in the open textbook *Indigenous Self-Determination through Mitho Pimachesowin (Ability to Make a Good Living)* developed for the University of Saskatchewan course Indigenous Studies 410/810, and hosted by the *Northern Review*.

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## Introduction

This article explores the concept of “Indigineering” or the “Indigineer.” The word is a combination of Indigenous and engineering, and my hope is that this concept can help to Indigenize the latter. Engineers are known to be problem solvers and are a self-regulating profession with clear codes of practice. These codes reflect the duties to protect the best interests of people and the environment. In turn, Indigineering could be considered performing engineering while incorporating Indigenous virtues that help to secure the ability for *mino pimachisowin*—the Cree concept meaning the ability to live a good life, make a good living.<sup>1</sup> Currently, many Indigenous communities in Canada are struggling with infrastructure and engineering-related issues and could use help. However, access to engineers is limited because the profession is not representative of the Indigenous community as a result of barriers due to lack of inclusion and awareness. In response, I assert that Indigineering through the practice of *mino pimachisowin* would help to build a pathway between the Indigenous community and engineers, and further develop the concept of Indigineering.

This article begins by examining the infrastructural needs of Indigenous communities in Canada, and how the engineering profession can assist those needs and the access gap that exists between the profession and Indigenous communities. Access to capital is not the focus here, or at least not explored. The focus is on increasing the level of service through *mino pimachisowin* and maximizing capital investment when utilizing existing services. Next, the article elaborates on the concept of Indigineering, especially how the code of ethics from the engineering profession can fit well with the cultural values of Indigenous Peoples. Integrating Cree concepts, such as *wahkohtowin*, *mino wicheitowin*, and *tapwewin*, into engineering would help to Indigenize the profession and make it more accessible to Indigenous people, and also make it better for everyone. Finally, the article proposes some strategies for the engineering profession to start moving in this direction.

## Background

I am from the historic community of Cumberland House, Saskatchewan, and I consider myself a very proud Cree Indigenous northerner. I grew up immersed in a rich culture shared by those who call my community “home.” The culture of the community represented a rich way of life, revolving around traditional Indigenous practices of living off the land for sustenance and well-being. The community itself is in the heart of the Saskatchewan River Delta and represents a rich ecosystem that allowed local populations to thrive in generations past. The identity of the

community is intimately tied to the Saskatchewan River Delta and the community continues to depend on the delta to the extent it can still provide sustenance.

## Indigenous People Need Engineers

The *Hamilton Spectator* reported that, as of April 25, 2016, there were twenty-eight states of emergency in effect in Ontario communities (Woods, 2016). As set out in the Canadian federal Emergencies Act (1985), a state of emergency is described as a “national emergency,” which is defined in s. 3 as follows:

3. For the purposes of this Act, a *national emergency* is an urgent and critical situation of a temporary nature that
  - (a) seriously endangers the lives, health or safety of Canadians and is of such proportions or nature as to exceed the capacity or authority of a province to deal with it, or
  - (b) seriously threatens the ability of the Government of Canada to preserve the sovereignty, security and territorial integrity of Canadaand that cannot be effectively dealt with under any other law of Canada.

In other words, this term is reserved for important and serious situations. Interestingly, amongst the states of emergency documented across First Nations in Canada by Woods (2016), many pertain to infrastructure and infrastructure-related issues like water quality and quantity, which the engineering profession can impact.

The issue of water quality is of particular importance as water quality is a basic human right that is recognized internationally by the United Nations. Resolution 64/292 of the United Nations General Assembly (28 July 2010) explicitly recognizes the human right to water and sanitation and acknowledges that clean drinking water and sanitation are essential to the realization of all human rights (UNDESA, 2014). As of November 1, 2020, sixty long-term drinking water advisories were in effect in forty-one First Nations communities in Canada (Office of the Auditor General of Canada, 2021). By this measure, Canada is failing to deliver this basic right to First Nations. Water is life, and is tied to the identity of Indigenous People. Compromising this connection to the Earth does have an effect on Indigenous well-being, both mentally and physically. Engineers are trained to solve problems, and the water quality issues in some Indigenous communities are among many very large engineering problems facing Indigenous People.

## Engineering Needs to Indigenize

Making engineers, and engineering, accessible to Indigenous communities is not as easy as it might seem. The language and practice of engineering has not been viewed as very accessible to most people and this is especially true for Indigenous people. This is reflected in the poor representation of Indigenous people in the profession and in the post-secondary education programs across the country. The Association of Professional Engineers and Geoscientists of Saskatchewan (APEGS) reported in 2019 that just 1.2% of engineers identify as Indigenous (APEGS, 2019). In comparison, Indigenous people are about 16.3% of the total Saskatchewan population (Statistics Canada, 2017) and 5% nationally (Statistics Canada, 2022). A healthy profession is one that is representative of the demographic it seeks to serve, ensuring that the perspectives, values, wants, and needs are reflective of the membership.

This idea to increase Indigenous representation in the field of engineering is not new, and this view is shared with APEGS leadership. Past APEGS president Andrew Loken said, “We do not have enough Aboriginal geoscientists and engineers in Saskatchewan. This is not based upon statistics but my own feeling as I meet members of our professions throughout the province. As hard as it is for an engineer to admit, sometimes numbers and statistics are less meaningful than feelings for a problem as wide-ranging as this” (2014). As Loken suggested, the engineering community at large already feels that the profession is unrepresentative of Indigenous people, and that there is a societal need to increase this representation.

The field of engineering is not exclusive to Western science practitioners and the gap is not as wide as we might think. Indigenous Peoples are resilient and have been problem solving for generations. The birchbark canoe, perfected by Indigenous people in Canada, is an example of a design that is hard to improve on and is known to be versatile and strong (Canadian Museum of History [CMH], 2016). The canoe is strong, but light enough to be lifted and transported between waterways (Monk, 1999). Another example is the snowshoe, which allowed Indigenous people to travel efficiently over snow-covered terrain (CMH, 2016). The tipi, travois (type of sledge), and wigwam are other common iconic designs developed to address problems in housing and travel in their current context. These forms of designs are examples of ways that Indigenous Peoples used their knowledge of the land, the resources, and ways of knowing to develop innovative solutions to real problems that affected their ability to live a good life. This holistic ingenuity could be called “Indigineering”—engineering from an Indigenous perspective.

## Elements of Indigineering

All practising engineers commit to a code of ethics. The formality of engineering ethics, and responsibility to people, goes back 100 years. In Canada, this progression to formal ethics is related to the Quebec Bridge Disaster of 1907, an engineering disaster where a bridge collapsed during construction, killing seventy-five workers of which thirty-three were Mohawk from Kahnawake (Kahnawake, 2006). This example helped to inform the development of the Canadian engineering ritual “The Calling of An Engineer” and the iron ring. The iron ring is a symbol that all engineers wear on their working hand to remind them of their moral commitment to professionalism (The Corporation of the Seven Wardens Inc., 2016). The intent of the code is to provide engineers with what APEGS sets out as a Code of Ethics:

All members ... shall recognize this code as a set of enduring principles guiding their conduct and way of life and shall conduct themselves in an honourable and ethical manner, upholding the values of truth, honesty, and trustworthiness, and shall safeguard human life and welfare and the environment. (APEGS Regulatory Bylaws, section 20(1), 2016)

As presented in Table 1, section 20(2) sets out the principles that members and licensees shall adhere to.

Section 20(1) is a very powerful statement, and the code of ethics is a very powerful set of ethical standards of conduct. It is hard to imagine that any work overseen by any professional engineer would fail the people and environment it was designed to serve.

Table 1 further presents the *mino pimachisowin* code of ethics, as described by Cardinal and Hildebrandt (2013). Indigenous codes of conduct are holistic and about culture, virtues, and behaviours like listening and kindness to each other (Mainville, 2010). For instance, the values of *manatisiwin*, the inner capacity of respect, and *kisewatisiwin*, the inner capacity to be kind, are important to the Cree community and the kinship networks found in them. The virtues help to ensure that we develop empathy for our fellow persons, which is a critical skill in understanding those you work with and engage. The virtues of *kakayiwatisiwin*, the ability to develop an inner sense of industriousness or inner ability or desire to be hard working; *astoskewimabcihowin*, the inner desire or need to work; and *waskawiwiniwin*, the inner energy to move or develop an inner sense of personal initiative, are all related and are important in the sense that Cree always have and continue to value work ethic, innovation, and being productive. This is an important point; contrary to popular mainstream viewpoints, Indigenous people were never lazy, and always strove to be productive members of society. Four

virtues reflect the commitment to develop faculties that seek to increase the quality and ability of our engagements: *nahihitamowin*, the ability to develop keen sense of hearing; *nahasiwin*, the ability to develop alert and discerning faculties; *nistohtamowin*, the ability to develop understanding; and *iyinisiwin*, the ability to develop a keen mind. This demonstrates the importance of ensuring that we are sincerely and effectively listening to our audience and everything around us, and try to know as they know, see as they see. Mino pimachisowin is a holistic concept, one that cannot be separated into exclusively physical or spiritual. It is not simply “doing,” but also “being.”

An important difference between the mino pimachisowin code and the engineering code is that one could be considered duty ethics, and the other, virtue ethics. Fleddermann (2012) distinguishes duty ethics as ethical actions performed through duties (p. 42), while virtue ethics are ethics related to the type of people we should be (p. 44). The engineering code of ethics is a form of duty ethics and outlines the engineer’s responsibilities to people and the environment. Meanwhile, the mino pimachisowin code of ethics is virtue ethics and outlines the virtues or traits that people should strive to have in order to make a living and live a good life.

A good engineer will understand and practice their ethical responsibilities to people and the environment. A great engineer will strive to be a better person and develop those characteristics that make them virtuous. The mino pimachisowin code of ethics is a great place to start in practising virtue ethics and becoming that great engineer: The Indigineer.

Achieving mino pimachisowin or the ability to make a good living is affected by many things. It is what Cardinal and Hildebrandt (2013) describe as “holistic ... includes a spiritual as well as physical dimension” (p. 43), which is a connectedness with our living Earth and the people around us. Critical to ensuring mino pimachisowin are many core values, two of which are *wahkohtowin* (connectedness and kinship) and, through that, *mino wicheitowin* (good relations).

The ability for an engineer to succeed in terms of the responsibilities as outlined by the profession, requires due diligence to people and the environment, and fully understanding the social impacts of engineering. This means ensuring the health and welfare of both people and the environment. Executing on a successful project means that the engineer has met project specifications while minimizing adverse impacts. It would be a struggle to achieve this without the necessary relationships and trust of stakeholders.

Table 1. Outline of the Code of Ethics, Section 20(2) of the Engineering Profession and the Mino Pimachisowin Code of Ethics

APEGS Code of Ethics Section 20(2)	Mino Pimachisowin Code of Ethics
(a) hold paramount the safety, health and welfare of the public and the protection of the environment and promote health and safety within the workplace;	iyinisiwin: The ability to develop a keen mind
(b) offer services, advise on or undertake professional assignments only in areas of their competence and practise in a careful and diligent manner;	nahihitamowin: The ability to develop keen sense of hearing
(c) act as faithful agents of their clients or employers, maintain confidentiality and avoid conflicts of interest;	nahasiwin: the ability to develop alert and discerning faculties
(d) keep themselves informed in order to maintain their competence, strive to advance the body of knowledge within which they practise and provide opportunities for professional development of their subordinates;	nistohtamowin: The ability to develop understanding
(e) conduct themselves with fairness, courtesy and good faith towards clients, colleagues, employees and others; give credit where it is due and accept, as well as give, honest and fair professional criticism;	kakayiwatisiwin: The ability to develop an inner sense of industriousness or inner ability or desire to be hard working
(f) present clearly to employers and clients the possible consequences if professional decisions or judgments are overruled or disregarded;	astoskewimahcihowin: The inner desire or need to work
(g) report to the Association any alleged illegal practices, professional incompetence or professional misconduct by members;	waskawisiwin: Inner energy to move or develop an inner sense of personal initiative
(h) be aware of, and ensure that clients and employers are made aware of, societal and environmental consequences of actions or projects, and endeavour to interpret professional issues to the public in an objective and truthful manner;	manatisiwin: The inner capacity of respect
(i) build their reputations and offer their services on the basis of merit and compete fairly with others considering all relevant factors, not just fees.	kisewatisiwin: The inner capacity to be kind

Source: APEGS Regulatory Bylaws, 2016; Hildebrandt & Cardinal, 2013

To establish those good respectful relationships, *mino wичitowin* is necessary. Engineers need to respect the identity and culture of Indigenous Peoples to establish mutually beneficial relationships built on a mutual respect. To establish trust requires the use of another concept, *tapwewin*—or as Cardinal and Hildebrandt (2013) describe it, “Speaking the truth or speaking with precision or accuracy” (p. 45). Knowledge or any other relevant information should be shared or gathered by engineers with integrity, credibility, honesty, respect, and humility. This includes sources of knowledge that are traditional and sacred to Indigenous People, knowledge that has allowed them to persevere through adversity.

The *mino pimachisowin* code of ethics also serves as a valuable tool in building confidence for the aspiring Indigineer, or any Indigenous person for that matter. The behaviours listed in the code emphasize a sense of work ethic and responsibility to oneself and community. This would help to guide young Indigenous people in achieving their own *mino-pimachisowin*.

Just as engineering is not exclusive to non-Indigenous people, Indigineering could be performed by anyone. It could include the Indigenous engineer who performs their duties with their inherent Indigenous identity and ways of knowing, or it could be the non-Indigenous engineer who strives for a greater holistic understanding of the application of their profession through the Indigenous lens. Either way, both would serve to add value to the profession through adding a softer dimension to a perceived rigid profession. Anyone could adopt the *mino pimachisowin* code of ethics and practise Indigineering, and in fact it should be encouraged.

### **Indigineering Education—An Opportunity for Cultural Sensitivity**

Engineering is not new to Indigenous Peoples, as shown earlier by the several historical examples of ingenuity and resilience. What is relatively new is the Western application of engineering and the ethics taught in engineering education programs to Indigenous students. Although efforts to study Indigenous engineering education have been made as far back as 1975 (Leonard et al., 1975), there has been marginal success in furthering Indigenous engineering awareness and participation.

Concurrently, the need for engineers to work across diverse teams is becoming more of a necessity as people migrate all over the world for work. Access to engineering is also now easier across borders with the development of technology and the establishment of international engineering corporations. An engineering education should address this need for cultural awareness and sensitivity.

Engineering education should ideally start before post-secondary, but there are issues to be addressed first. The problem is that Indigenous students are

often alienated by science because it does not reflect their way of knowing or their identity (Aikenhead, 2001). Reimagining the science behind engineering principles from an Indigenous cultural lens is the basis for Indigineering. Efforts are being made to implement Indigenous and Western ways of knowing, through two-eyed seeing, and more attention must be paid to bring these two worlds together to increase Indigenous participation in science and start to address issues such as care for water (Stefanelli et al., 2017; Lane et al., 2014).

At a post-secondary level, there have been many efforts to increase participation and inclusion of Indigenous people and concepts. Outreach programs, access programs, and earnest efforts to research the value of Indigenous Knowledge from an engineering lens have been made (Hess & Strobel, 2013). Teaching Indigenous concepts is critical in an inclusive education. The concept of biocultural diversity is an academic concept helping to instruct non-Indigenous people about the inseparability of culture and the ecosystem (Droz, 2015). First-year post-secondary education is the place to start implementing any kind of cultural sensitivity or humility education. Groll (2013) states, “Viewing cultural humility from a communicative and relational perspective offers promise for helping students learn to structure negotiations of cultural difference toward building sustainable mutually beneficial relationships with not only other students but with faculty and staff” (p. 135). Engineering education programs would be best served by including this type of training, and an Indigineering education would be an ideal start in Canada.

In addition, developing a national organization of “Indigineers” would serve the Indigenous community well, and would help to address the many engineering and infrastructure issues faced. This group could be incubated at the secondary and post-secondary levels, building on existing efforts to include and engage Indigenous students in science and engineering.

### **Conclusion**

Engineers solve problems, and they are known to be good at it; but good problem-solving is not unique to the engineering profession. Re-imagining engineering as an inclusive profession that had Indigenous people practising (Indigineers) and effectively solving problems prior to Western contact would be a pathway to increase Indigenous participation and awareness in the engineering profession.

Indigineering—engineering from the Indigenous perspective—offers a pathway to increasing participation and awareness of engineering. The profession acknowledges that it does not reflect the views and values of Indigenous People because it has poor representation. The profession is making efforts to address this issue. This acknowledgement is a doorway for change and demonstrates that

there is a capacity and appetite for change. Indigineering is a concept that could facilitate that change.

Change, or improving on the profession, would mean that a considerable amount of effort would have to be communicated in hopes of persuading the engineering profession that change is for the better. A good strategy would be to take those perspective improvements and frame them in the context of the profession's existing responsibilities to people and the environment. This change is Indigineering: a blend of duty and virtue ethics that would appeal to engineers who wish to satisfy their personal values. Moreover, practising Indigineering is not exclusive to Indigenous people and could be practised by anyone. Indigineering is an opportunity for cross-cultural learning and achieving social justice in the Indigenous community.

## Notes

1. Cree (Algonquian language family) has five dialects generally associated with geographical areas, and three of these are found in Saskatchewan. Swampy Cree, in northeastern Saskatchewan, speak with the “n” dialect, as in “mino” (good). Variant spellings of pimachisowin include pimachesowin and pimâchisowin.

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