Sophia J. Wang, 1/7/2025

Innotech/Bhutan R&D Center of Excellence (CoE) Framework

Vision

To envisage an R&D Center of Excellence, we must first acknowledge that excellence is an input rather than an output, a fundamental set of values which later drives a desired result. The result we strive towards is "[spearheading] the growth of a dynamic private sector," as stated in the Royal Charter. More vividly, Innotech will act as a collaborative, state-of-the-art hub for application-layer, and later, fundamental technology. Innotech's environment will simultaneously exist as a playground for free thinking and as a diligently tested, disciplined workplace. The pace of R&D should be as quick as it is thoughtful; the thought will lie in the premeditation, the decision to pursue, and the pace will be found in the pursuit itself, the action. The core values of excellence that will act as a driver to the aforementioned are curiosity, ownership, rigor, and interconnection.

Roadmap

A. Funding

Traditional funding models for academic labs call on government grants, cross-university collaborations, and corporate sponsorships. The Media Lab successfully broke this mold with a two-pronged approach: (1) an **explicitly public-facing model** where media demos and public exhibits in non-technical spaces took the place of academic journals and conferences as platforms to share work, in turn attracting non-traditional investors, and (2) a **general funding scheme** where investors funded themes rather than projects or groups.

(1) is a practice of (media) exposure, with collateral benefits of public engagement and setting high, internal standards for presentation. A general funding scheme like (2) relieves the pressure of specificity with investors, especially as fundamental research requires time, creative latitude, and an influx of resources.

B. Standardization

R&D must be standardized in quality. Prior to development, project objectives, design specifications, and milestones should be well-defined to reflect long-term, value-driven investments. During development, design choices will be based on trade studies exploring the complete design space. Milestones undergo design reviews from a panel of experts outside of the immediate team. Importantly, development undergoes iterative, circular

processes such that every milestone maintains core functionality; success is additive and validated throughout, rather than binary at the end of a long R&D process. Testing is completed at every step, from validating parts to quantifying mechanisms. Project tracking documents must be maintained. After development, technical (papers/reports/patents) and public-facing presentations (video demos) should be prepared.

C. Curiosity-driven culture

Within Innotech, the team should be constantly engaged with state-of-the-art trends in technology to have predictive power for long-term R&D projects. Every member of the team must be independently motivated while collaboratively sharing. Internal practices include **biweekly Paper Review Club** for sharing papers, science journalism, maker blogs, and more – a common practice at top Silicon Valley startups – and **internal technical workshops** led by team members *for* team members.

D. Accountability

Every analyst at Innotech must feel project ownership, regardless of rank, to ensure that expertise doesn't stay within managers but trickles throughout the organization. Every member should be assigned expertise to one field (e.g. autonomous robotics, security, energy conversion) and engage with the state-of-the-art to initiate research, collaboration, and sponsorship. This field will be theirs to "own" within Innotech.

E. Network *aka* Seeking Inspiration Everywhere

Exposing Innotech to as many domains as possible, especially those not inherently technical, inspires and opens markets.

- **Innotech residency programs** through domestic and/or international calls for leaders in various disciplines to collaborate carte blanche with Innotech for 1-3 months.
- **Open source development**
- **Conferences and trade shows**

For Bhutan, the founding of a **National Science Academy** and a **National Engineering Academy** connects the current generation of technical and philosophical leaders in an annual, domestic gathering.

Existing Challenges

The pace of R&D is hampered by a slow navigation of the supply chain. Assessing multiple suppliers and forming direct factory relationships can both improve timelines and encourage design for manufacturing practices early in development.

More radically, Bhutan R&D must undergo a mindset shift that (a) transitions from production to design through fundamental expertise and (b) incentivizes independent initiative. Today, there is a lack of domestic expertise in fundamental physics, electronics, and chemistry to produce novel research. Beyond skill-transfer and pace-setting from foreign experts, one answer to both evolutions – a co-evolution – is to emphasize **[C] Curiosity-driven culture** for self-learning and collaborative teaching.

Fundamental approaches must also be applied to our tools, especially those available at Jigme Namgyel Wangchuck Super FabLab (JNWSFL). Understanding the underlying strengths of every machine available enables more informed, Zero to One, research which maximizes a machine's potential beyond production and standard prototyping. Examples:

- A laser cutter's CO2 laser induces graphene for novel wearable devices.
- The Zund's crease/cut mechanism creates ultra-strong, inexpensive Kirigami structures for new construction paradigms.