CPEIA Draft Proposal:

Wearables and Smart Textile Manufacturing Institute

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May 24, 2017

CANADIAN PRINTABLE ELECTRONICS INDUSTRY ASSOCIATION

The united voice of Canada's Printable Electronics sector

Smart Textile and Wearables Manufacturing Institute

The Vision

- An industry-driven open innovation centre to aggregate the technical resources required to advance wearable and smart textile technologies from a Manufacturing Readiness Level (MRL) of 4 to MRL 8 for manufacturing scaleup (see Appendix).
- Demonstrate how people can interact with their environment through smart textiles and wearable technology – show key applications such as health care, mining, emergency response etc.
- Promote cluster development for wearables and smart textiles through industry consultation and road-mapping exercises.

The Need

- This emerging industry sector lacks a cohesive manufacturing and prototyping centre to support commercialization and scale up
- SMEs lack internal resources and access to the manufacturing and prototyping capabilities to scale
- There are over 150 SMEs and many large corporate players in this space across Canada.

Manufacturing Technologies Covered

- Wearable devices for health and wellness with functionality added on textile
- Electronic functionality embedded through conductive yarns into fabrics, apparel,
- Interconnects, communications

Funding Target and Sources

- $100 million over 5 years: 40% industry, 40% federal government and 20% provincial governments
- Co-funding initiatives between industry, academic research partners, federal and provincial funding programs.

Governance

- Industry-led board of directors with senior executive academic and government members as options based on their co-investments.
- Recruit high-profile industry executive with global name recognition as chief executive.
- All projects will be aligned with recognized industry tech road maps such OE-A, modified to Canadian needs and capabilities.

- All projects will be collaborative, proposed and led by a Canada-based industrial member and including other industrial, academic and government R&D partners.
- Proposals will be solicited in a 2-stage process and approved by the investment committee and the board of directors.
- Any resulting intellectual property will be commercialized by the industrial companies taking part.
- If a U.S.-based or international company takes part, their commitment of funds must be spent/used within Canada. Their in-kind contribution can be provided from staff external to Canada.
- Any industrial company's contribution will be subject to the terms and conditions of the government funding partner(s).

Operations

- Cooperative model comparable to the Flemish-Belgian-Dutch Holst Centre – a partnership model with industry and academia based around specific technology roadmaps and programs.
- Housed at a Canadian university with in-house R&D and manufacturing staff.
- Operate as an open hub for wearables/smart textiles R&D and manufacturing facility.
- Project-based funding based on a proposals process that aims to demonstrate scale-up commercial production with multi-partnered projects: tech SMEs, end users, academics and multinationals.
- Project proposals will be judged based on advanced criteria that include technical and business, reviewed by industry experts and approved by the investment committee and then the board of directors.
- Investment will be up to 50% of the project costs, with the project partners contributing the rest of the funds in cash and in-kind.
- Milestone-based project reviews and disbursements

Partners and Participants

- 100 Industrial companies at all phases of growth.
- 15-20 University academic research teams across Canada.
- 3-4 College-based technology access centres across Canada.
- 3-4 Government funding partners.

Appendix: What is Manufacturing Readiness Level?

(Source: Wikipedia) Manufacturing Readiness Level (MRL) is a measure developed by the United States Department of Defense (DOD) to assess the maturity of manufacturing readiness, similar to how the Technology Readiness Levels (TRL) developed by NASA are used for technology readiness. They can be used in general industry assessments, or for more specific application in assessing capabilities of possible suppliers.

MRLs are quantitative measures used to assess the maturity of a given technology, component or system from a manufacturing perspective. They are used to provide decision makers at all levels with a common understanding of the relative maturity and attendant risks associated with manufacturing technologies, products, and processes being considered. Manufacturing risk identification and management must begin at the earliest stages of technology development, and continue vigorously throughout each stage of a program's life cycles.

Phase	Leading to	MRL	Definition	Description
Material Solutions Analysis	Material Development Decision review	1	Basic manufacturing implications identified	Basic research expands scientific principles that may have manufacturing implications. The focus is on a high level assessment of manufacturing opportunities. The research is unfettered.
		2	Manufacturing concepts identified	Invention begins. Manufacturing science and/or concept described in application context. Identification of material and process approaches are limited to paper studies and analysis. Initial manufacturing feasibility and issues are emerging.
		3	Manufacturing proof of concept developed	Conduct analytical or laboratory experiments to validate paper studies. Experimental hardware or processes have been created, but are not yet integrated or representative. Materials and/or processes have been characterized for manufacturability and availability but further evaluation and demonstration is required.
	Milestone A decision	4	Capability to produce the technology in a laboratory environment.	Required investments, such as manufacturing technology development identified. Processes to ensure manufacturability, producibility and quality are in place and are sufficient to produce technology

				demonstrators. Manufacturing risks identified for prototype build. Manufacturing cost drivers identified. Producibility assessments of design concepts have been completed. Key design performance parameters identified. Special needs identified for tooling, facilities, material handling and skills.
Technology Development	Milestone B decision	5	Capability to produce prototype components in a production relevant environment.	Manufacturing strategy refined and integrated with Risk Management Plan. Identification of enabling/critical technologies and components is complete. Prototype materials, tooling and test equipment, as well as personnel skills, have been demonstrated on components in a production relevant environment, but many manufacturing processes and procedures are still in development. Manufacturing technology development efforts initiated or ongoing. Producibility assessments of key technologies and components ongoing. Cost model based upon detailed end-to-end value stream map.
		6	Capability to produce a prototype system or subsystem in a production relevant environment.	Initial manufacturing approach developed. Majority of manufacturing processes have been defined and characterized, but there are still significant engineering/design changes. Preliminary design of critical components completed. Producibility assessments of key technologies complete. Prototype materials, tooling and test equipment, as well as personnel skills have been demonstrated on subsystems/ systems in a production relevant environment. Detailed cost analysis include design trades. Cost targets allocated. Producibility considerations shape system development plans. Long lead and key supply chain elements identified. Industrial Capabilities Assessment for Milestone B completed.
Engineering and Manufacturing	post-CDR (Critical design	7	Capability to produce systems, subsystems or	Detailed design is underway. Material specifications are approved. Materials available to meet planned pilot line

Development	review) Assessment		components in a production representative environment.	build schedule. Manufacturing processes and procedures demonstrated in a production representative environment. Detailed producibility trade studies and risk assessments underway. Cost models updated with detailed designs, rolled up to system level and tracked against targets. Unit cost reduction efforts underway. Supply chain and supplier Quality Assurance assessed. Long lead procurement plans in place. Production tooling and test equipment design and development initiated.
	Milestone C decision	8	Pilot line capability demonstrated. Ready to begin low rate production.	Detailed system design essentially complete and sufficiently stable to enter low rate production. All materials are available to meet planned low rate production schedule. Manufacturing and quality processes and procedures proven in a pilot line environment, under control and ready for low rate production. Known producibility risks pose no significant risk for low rate production. Engineering cost model driven by detailed design and validated. Supply chain established and stable. Industrial Capabilities Assessment for Milestone C completed.
Production and Deployment	Full Rate Production decision	9	Low Rate Production demonstrated. Capability in place to begin Full Rate Production.	Major system design features are stable and proven in test and evaluation. Materials are available to meet planned rate production schedules. Manufacturing processes and procedures are established and controlled to three-sigma or some other appropriate quality level to meet design key characteristic tolerances in a low rate production environment. Production risk monitoring ongoing. LRIP cost goals met, learning curve validated. Actual cost model developed for Full Rate Production environment, with impact of Continuous improvement.
Operations and Support	N/A	10	Full Rate Production demonstrated and lean production	This is the highest level of production readiness. Engineering/design changes are few and generally limited to quality and cost improvements. System,

			practices in place.	components or items are in rate production and meet all engineering, performance, quality and reliability requirements. All materials, manufacturing processes and procedures, inspection and test equipment are in production and controlled to six-sigma or some other appropriate quality level. Full Rate Production unit cost meets goal, and funding is sufficient for production at required rates. Lean practices well established and continuous process improvements ongoing.