



MTC MedTech Programmatic Seed Grant

Submission Period: 14 June to 26 July 17:00

MedTech Manufacturing in Singapore

MedTech manufacturing has grown >3X in production output since 2012

▲ **\$18.7B**
\$5.1B (2012)
Mfg Output

▲ **16,100**
10,000 (2012)
Employment



~20-30% of pacemakers, valves and cardiac monitoring devices



~50% of mass spec systems



~90% of gene chips

Local Precision Engineering Companies Supporting MedTech manufacturing (>20)

High Mix, Low Volume, at Scale Manufacturing



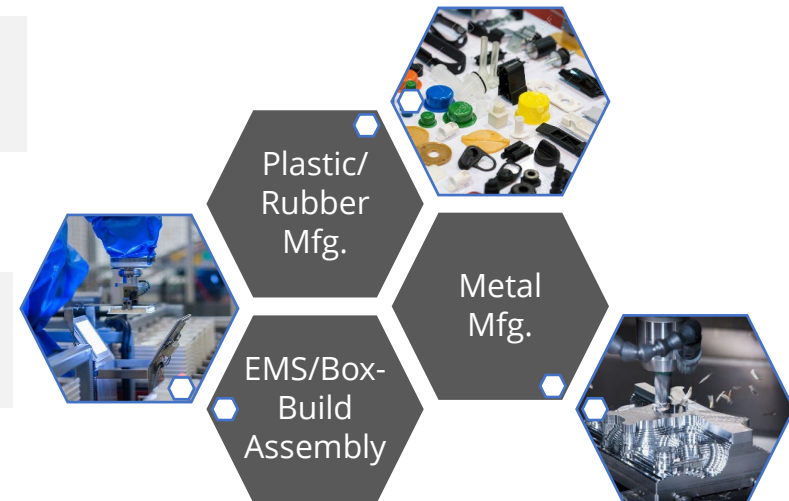
Supporting MedTech R&D/NPI stages



End-to-end manufacturing services



Parts and components suppliers



OFFICIAL (CLOSED)/ NON-SENSITIVE

For public R&D performers in Singapore only

Overview of MedTech Trajectory in Singapore

9X increase in biomedical (MedTech + Digital Health) startup companies over last 10 yrs

40

(2010)



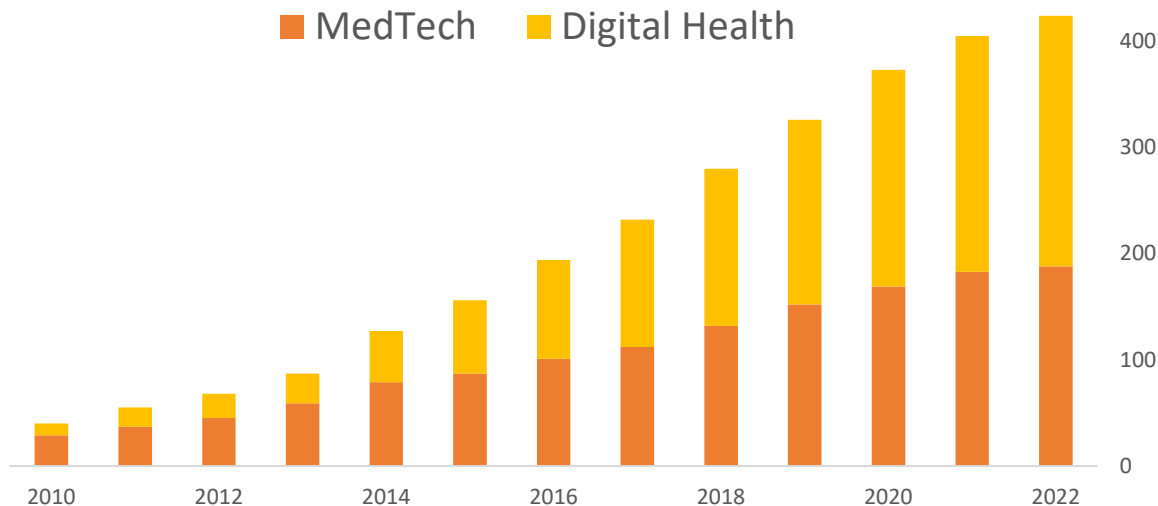
232

(2017)



373

(2020)



3-year CAGR: 10-13% | 5-year CAGR: 14.87%

***What success looks like:
A Vibrant & Self-Sustaining Regional
Biomedical Hub***

mirxes
TO KNOW. TO ACT.

Raised \$50M Series D for precision medicine diagnostics company from platform miRNA tech; IPO listing announced

CURIOX
BIOLOGY AT ITS BEST

IPO-ed on KOSDAQ to expand its global operations and advance new solutions to ensure for cell and protein analysis.

LUCENCE

Raised US\$46M from Parkway Holdings, etc. Dedicated to building sensitive blood-testing technologies to profile cancer.

NalaGenetics

Raised US\$12.6M Series A funding, focused on personalised screening and intervention using genomics

INEX
INNOVATE

Raised \$12M in Series B funding, Asia's first healthcare technology company for women supporting PINT and ovarian cancer screening

viVOSurgical
Beyond Surgery

Raised \$1.25M seed capital, an innovator and manufacturer in surgical technology and robotics

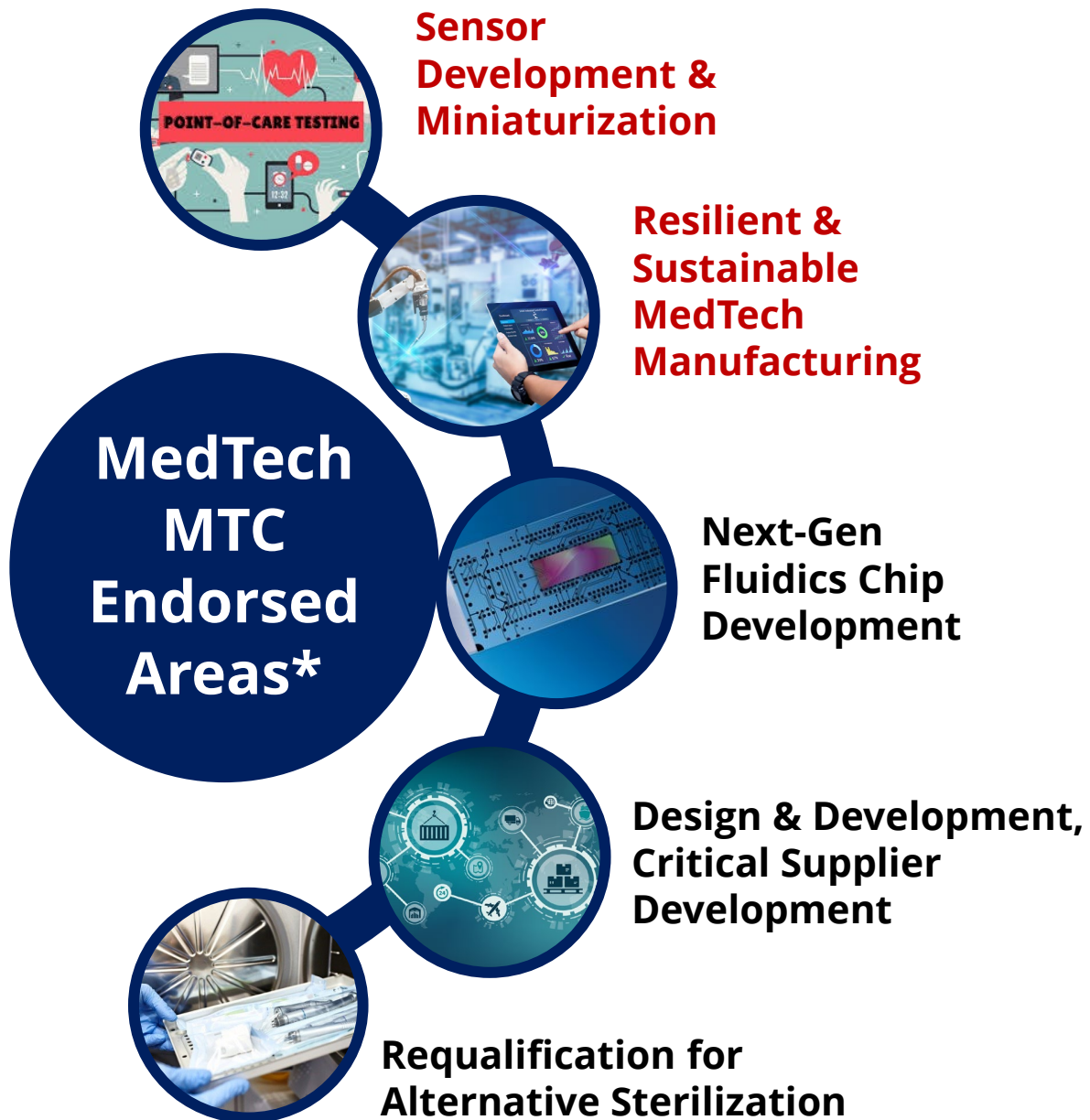
Osteopore™
Empowering Natural Tissue Regeneration

IPO-ed on ASX in 2019 with \$5.25M shares at \$20.2M market cap for 3D-printed implants to promote bone regeneration

Respiree

Raised US\$3.4M seed capital for wearable sensing of cardiopulmonary indications

MTC MedTech Focus Areas and Rationale



Benefits and Advantages to the SG MedTech Ecosystem

- ✓ Build infrastructure and R&D capabilities for **high-value innovative healthcare/MedTech products**
- ✓ Leverage other **RIE domains and MTC deep dives** e.g. Laser & Flat Optics, Advanced manufacturing; for synergies and maximum impact
- ✓ Enable R&D pull-through towards **new spin-offs, and/or growth of existing SMEs and MedTech manufacturing** industry
- ✓ Anchor robust **Public-Private-Partnership** models
- ✓ Increase **resiliency** and enhance **business continuity**

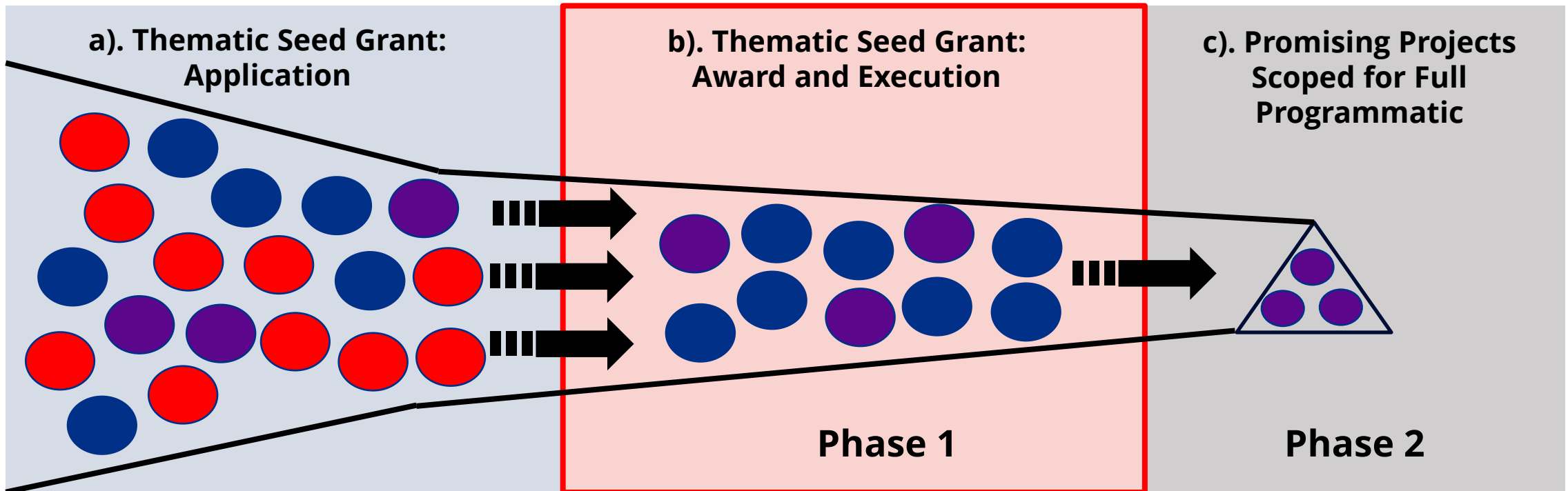
*https://www.a-star.edu.sg/docs/librariesprovider1/default-document-library/research/funding-opportunities/ame-programmatic-funds/mtc-sector-areas-21-nov-2023.pdf?sfvrsn=c889b5e3_2

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Overview of MTC MedTech Programmatic Seed Grant Call

Objective: Provide proof-of-concept funding for developing high-potential technologies within specified strategic themes to optimize resources for subsequent full programmatic grants

- Phase 1: Up to 10 proposals (**TRL 2-4**) per thematic with up to SGD\$350K (including 30% overheads) per proposal for the duration of up to 12 months. Only selected promising projects will be supported for Phase 2.
- Phase 2: Up to SGD\$5 million per proposal for full programmatic funding
- **Thematic #1: Sensor Development & Miniaturization**
- **Thematic #2: Resilient & Sustainable MedTech Manufacturing**



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Thematic #1: Sensor Development & Miniaturization

Background

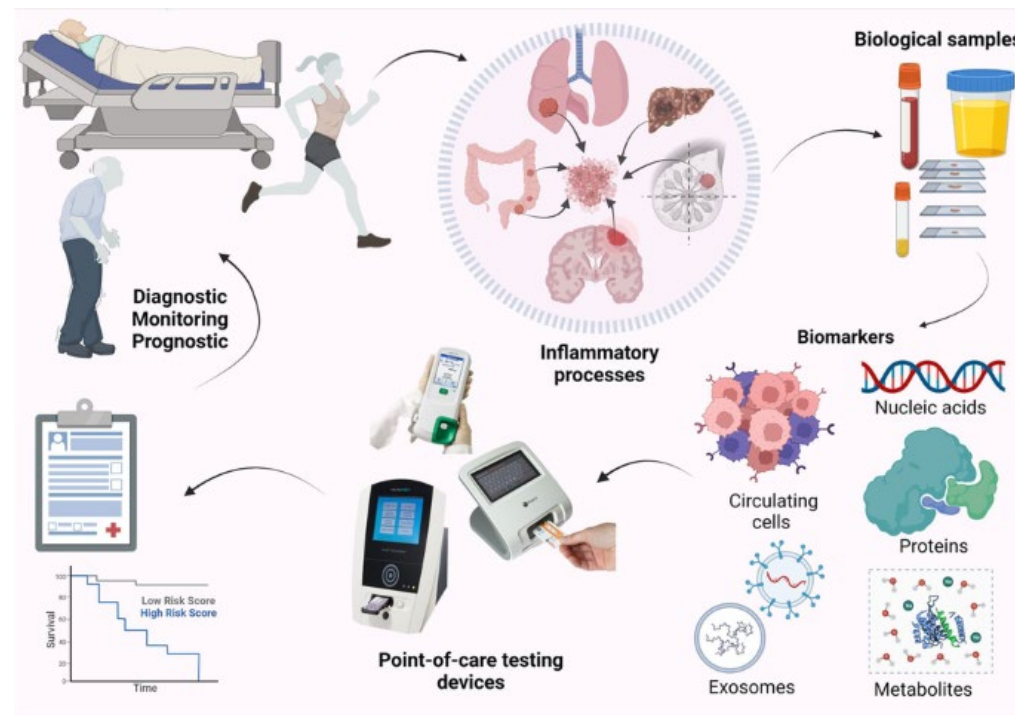
Novel Biochemical Sensors for Non-Invasive Point-of-Care Testing (POCT)

- The COVID-19 pandemic and rise of decentralized healthcare have reinforced the need for **affordable, user-friendly, robust, rapid, low-footprint, and reliable POCT devices** for the mass population
- POCT is moving towards simultaneous **on-site detection of different analytes** from **a single specimen**, with many striving for **multiplex capabilities (≥ 3 analytes)** to better **characterize single/multiple diseases with high accuracy and reproducibility**
- POCT has a market size of **>US\$16.8B in 2023, CAGR 6.8% ('23-'28)**

Scope of Thematic

Definition of Non-Invasive Testing

Does not require inserting an instrument through the skin or into a body opening (except fingerprick –blood)



Novel Technology for
a) Sample Collection
b) Sample Processing
c) Sample Detection
d) Form factor miniaturization
Detection methods should be capable of picking up **biochemical analytes**

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*See annex for examples of problem statements

Thematic #2: Resilient & Sustainable MedTech Manufacturing

Background

"The medtech industry has been bonding together to treat its new patient, the planet."



MedTech MNCs are increasingly committing to ESG goals. **However, 58% of respondents in GlobalData's poll say the industry is still not doing enough.**

Resiliency

- Supply chain challenges are felt mostly at **the point of production**
- Supply chain resiliency is vital amidst **geopolitical tensions and transport disruptions**

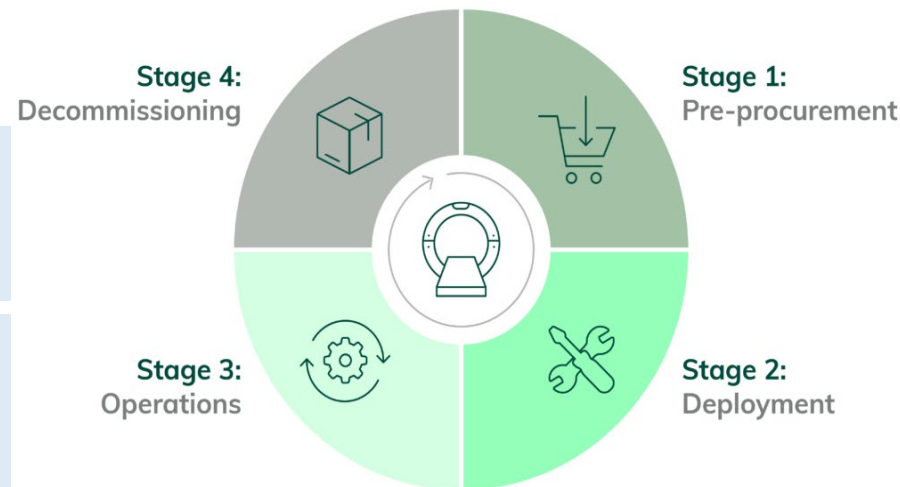
Sustainability

- Healthcare accounts for 5% of global carbon emissions
- Industry is looking to **curb hazardous and excessive medical waste**
- Risk areas are mostly in **packaging, transport & storage** with a market size of **US\$17.8B in 2023, CAGR 9% ('23-'33)**
- Medical device reprocessing** market has a projected growth of **16.8% CAGR ('23-'30)**

Scope of Thematic

d) Design for Retrofitting/Reprocessing
Extending shelf life of devices

c) Excessive & Hazardous Medical Waste Management
Safe disposal, reuse and re/upcycling of MedTech products



Medical Equipment Lifecycle Stages

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a) Material Selection and Critical Supplies:

Sustainable materials for production and alternatives for critical supplies

b) Net-Zero Emissions:

Technologies that enable net-zero MedTech related logistics and supply chain systems, including storage and transportation

*See annex for examples of problem statements

The following examples are out of scope for this grant call:

- Technologies that do not address MedTech-specific problems
- Activities that focus only on implementation and adoption

Thematic #1:

- Invasive/implantable sensors (technology platforms that focus on non-invasive application in this proposal that can later be purposed to wider invasive applications can be accepted)
- Biomarker discovery
- Bioinformatics – data collection, processing and analyses

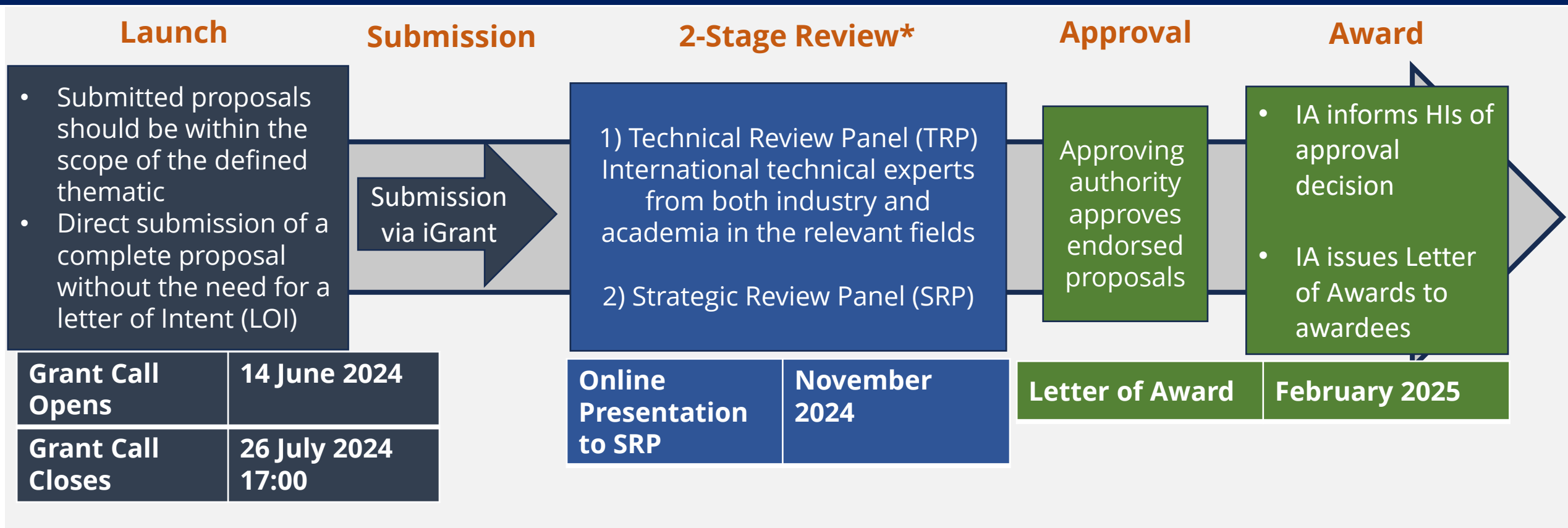
Thematic #2:

- Renewable energy or other generic sustainable technologies that do not serve the unique needs of the MedTech industry
- Ready-to-go technologies that focus on repurposing to MedTech use case with <3 years to commercialization (to consider other downstream translation grants instead)

Key Points to Note

- The Manufacturing , Trade and Connectivity (MTC) MedTech Programmatic Seed Grant Call supports novel R&D investigator-led ideas at TRL 2 - 4 relevant to the 2 thematic areas:
 - Thematic #1: Sensor Development & Miniaturization
 - Thematic #2: Resilient & Sustainable MedTech Manufacturing
- MTC MedTech Programmatic Seed Grant Call is open to **public sector research performers**: local universities, A*STAR research institutes, polytechnics, and non-defense-related public sector agencies (e.g. Ministries, Statutory Boards)
- Applicants may participate in more than one proposal whether as Lead PI or Co-Investigator. Applicants may also submit proposals to either or both themes.
- Proposals should be scoped for up to SGD\$350k (inclusive of 30% indirect costs) over 12 months
- Applications must be endorsed by the Research Office of the Lead PI's institution
- Late submissions or submissions without endorsement from the Host Institution will not be accepted.

Selection Process Workflow and Timelines

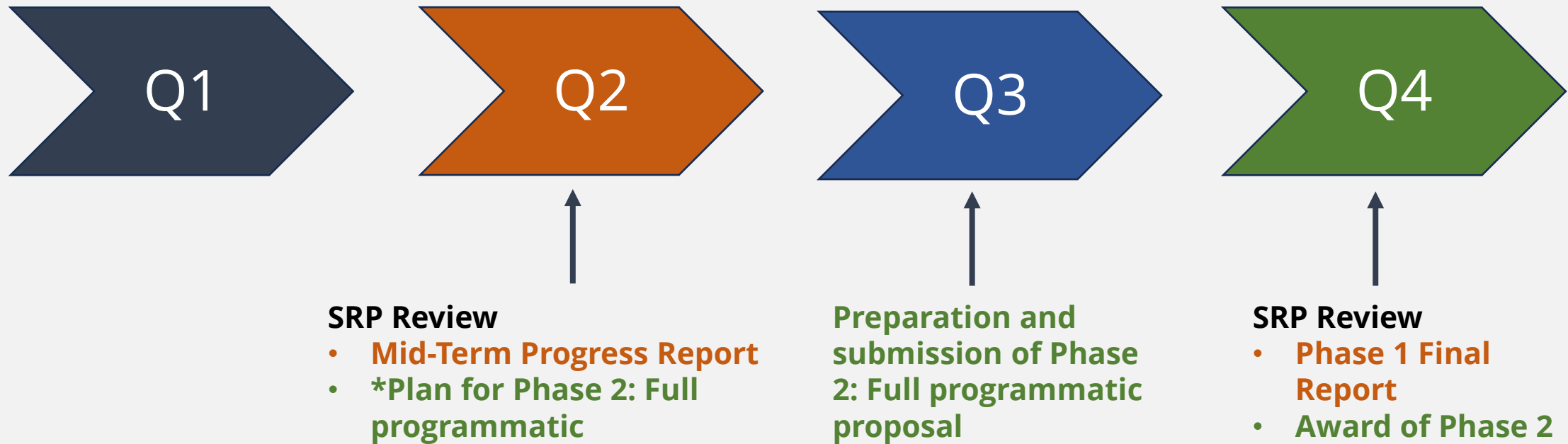


*Evaluation criteria includes, but is not limited to: (i) Alignment with MTC MedTech thematic, (ii) PI's track record, (iii) Intellectual/ Innovative Merit, (iv) Competitive/Comparative Advantage, and (v) Feasibility

Applicants should also state how the proposed solution will provide positive benefits to the MedTech industry in Singapore: (i) Potential to address unmet healthcare and industry needs, (ii) Technology differentiation and competitiveness at regional or global level, (iii) Support MedTech manufacturing value creation and value capture activities in Singapore, (iv) Potential for industry development and economic impact

Post-Award Grant Management and Next Steps for Phase 2

- A*STAR Grants T&Cs and guidelines apply
- Mid-Term Progress Report and Phase 2 Full Programmatic Exec Summary plan submission before end of Q2 for SRP Review
- Final Report and Phase 2 Full Programmatic Full Proposal submission before end of Q4 with SRP Review



Website: [A*STAR Funding Opportunities](#)

Point of Contact: programmatic_mtc@hq.a-star.edu.sg

Thank you!

Thematic information and examples of problem statements

Disclaimer: Problem statements include but are not limited to the listed examples

Thematic #1: Sensor Development & Miniaturization

Background



New Gen POCT

- No clinical appointment necessary
- Eliminates transport and processing steps
- No technician required, simple to use
- Molecular-level accuracy/lab-grade results
- Immediate results facilitates earlier treatment

JABIL

Novel Biochemical Sensors for Non-Invasive Point-of-Care Testing (POCT)

- COVID-19 pandemic and decentralized healthcare has reinforced the need for rapid, cost-effective, and reliable POCT devices for massive population use whether for infectious diseases, early disease detection or chronic disease monitoring
- POCT is the simultaneous on-site detection of different analytes from a single specimen, with many striving for multiplex capabilities (≥ 3 analytes) to better characterize single/multiple diseases at high accuracy and usability
- POCT has a market size of >US\$16.8B in 2023, CAGR 6.8% ('23-'28)

Scope of Thematic

1. Definition of Non-Invasive Testing

- Does not require inserting an instrument through the skin or into a body opening (except fingerprick -blood)
- Technologies that allow access to previously inaccessible biological samples are within scope

2. Novel Technology for i) Sample Collection; ii) Sample Processing iii) Sample Detection and/or iv) Form factor miniaturization



- Detection methods should be capable of picking up **biochemical analytes**

3. Project should demonstrate following outcomes in relation to gold standard

- **Rapid** sample to result
- Ability to test **multiple analytes** simultaneously
- Analytes adequately address single/related diseases
- **High-resolution** and accuracy (sensitivity and specificity)
- **High reproducibility**

Thematic #1: Sensor Development & Miniaturization

Examples of problem statements. Thematic proposals are not limited to addressing these problems only.

Early Screening

- Chronic kidney disease (CKD) has global prevalence of 9.1%
- CKD is asymptomatic in its early stages and linked to obesity, hypertension, and diabetes
- In a high-CKD prevalence area, up to 90% of patients are unaware that they had CKD, and can suffer from a rapid rate of kidney function decline
- Early CKD testing suffers from inaccuracy of tests esp. Glomerular Filtration Rate (GFR), inconvenient blood/urine testing and high costs for mass screening

TABLE 1. CRITERIA FOR CHRONIC KIDNEY DISEASE (EITHER OF THE FOLLOWING PRESENT FOR MORE THAN THREE MONTHS)²

Criterion	Details
Markers of kidney damage (one or more)	• Albuminuria (AER ≥ 30 mg/24 hours; ACR ≥ 30 mg/g [≥ 3 mg/mmol]) • Urine sediment abnormalities • Electrolyte and other abnormalities due to tubular disorders • Abnormalities detected by histological testing • Structural abnormalities detected by imaging • History of kidney transplantation
Decreased GFR	• GFR < 60 mL/min/1.73 m² (GFR categories G3a to G5)

Infectious Disease Detection

- Infections can occur in many systems beyond respiratory system, such as cardiovascular, neurological and urinary systems, that can seriously threaten human health and even lead to death
- Timely diagnosis of pathogens avoids blind medication, curbs disease spread, and improves patients' prognosis
- POCT diagnostics, including lateral-flow assays (LFAs), are widely used by the public and endorsed by policymakers since the COVID-19 pandemic
- However, the current infectious diagnostic products suffer from limitations including low sensitivity, single analyte targeting, and lengthy turnaround times for lab-based tests.

Chronic Disease Monitoring

- According to the World Health Organization (WHO), an estimated 17.9 million deaths caused by Cardiovascular diseases (CVDs) occur each year, making up approximately 31% of all global deaths
- Given that early-stage CVDs demonstrate a high survival rate, predicting CVDs early on is essential
- Despite the existing imaging diagnostic methods, early-stage diagnosis is still challenging due to their complex pathophysiology, vague symptoms, and low expression levels of cardiac biomarkers.
- Moreover, quick and convenient measurements are inadequate in addressing the expanded needs of CVD patients, e.g. myoglobin is only detectable within 1-2 hours of heart attack symptom onset, CK-MB is detectable until 6 hours.

Thematic #2: Resilient & Sustainable MedTech Manufacturing

Background

"The medtech industry has been bonding together to treat its new patient, the planet."



Boston
Scientific

PHILIPS
Healthcare



*MedTech MNCs increasingly committing to ESG goals,
**However....58% of respondents in GlobalData's poll
say the industry is still not doing enough***

Resiliency

- The acceleration of medical services has revealed supply chain challenges mostly at the point of production
- Supply chain resiliency is vital amidst geopolitical tensions, transport disruptions

Sustainability

- Healthcare accounts for 5% of global carbon emissions
- Risk areas mostly in packaging, transport & storage; market size of US\$17.8B in 2023, CAGR 9% ('23-'33)
- Industry is looking to curb hazardous and excessive medical waste
- Reprocessing market has projected growth of 16.8% CAGR

Scope of Thematic

iv) Design for Retrofitting/Reprocessing
Extending shelf life of devices

iii) Excessive & Hazardous Medical Waste Management
Safe disposal, reuse and upcycling of MedTech products

Stage 4:
Decommissioning

Stage 3:
Operations



Stage 1:
Pre-procurement

Stage 2:
Deployment

i) Material Selection and Critical Supplies:

Sustainable materials for production, alternatives for critical supplies

ii) Net-Zero Emissions:

Technologies that enable net-zero MedTech related logistics and supply chain, including storage and transportation

*out of scope: generic technologies that do not address specific needs of the MedTech industry e.g. renewable/clean energy

Medical Equipment Lifecycle Stages

Thematic #2: Resilient & Sustainable MedTech Manufacturing

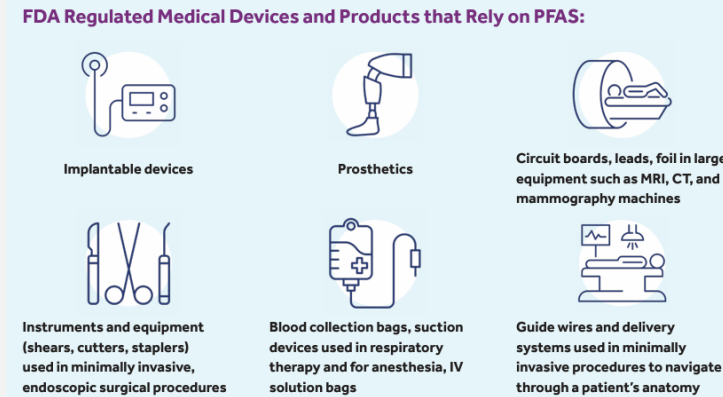
Examples of problem statements. Thematic proposals are not limited to addressing these problems only.

Material Selection & Critical Supplies

Medical device supply disruptions can occur due to:

- Shortage of a raw material, or incident that prevents the manufacturer from operating e.g. petroleum-based plastics, nickel-titanium for metal alloys; restrictions against PFAS
- Unexpected surge in demand of a particular material or product e.g. nitinol, chips
- Proprietary manufacturing and production process limited to skilled technicians e.g. PTFE extrusion

[File Download
\(advamed.org\)](https://advamed.org)



Potential outcomes

- Novel material sources replacing non-renewable materials for medical grade production
- Innovative development that bypasses critical production/manufacturing processes

Net-Zero Life Science Cold-Chain Logistics

- Chemicals, analysis kits, biological samples, single-use material, etc. have strict requirements for storage and transport
- Failure to maintain a cold chain can affect integrity, cause degradation, contamination & alteration of physicochemical properties

\$35B lost annually
within the
biopharma industry
due to failure in
temperature-control

THE COLD CHAIN
is especially
critical within the
healthcare and
life sciences supply chain

- Costly Infrastructure & maintenance cost.
- Need for Trained personnel for product handling
- Strict traceability, measuring & control processes

Potential Outcomes

- Optimized cold chain and/or cold chain-free approaches e.g. alternative reagents/chemicals, product design, packaging, logistics, data-driven software

Thematic #2: Resilient & Sustainable MedTech Manufacturing

Examples of problem statements. Thematic proposals are not limited to addressing these problems only.

Ethylene Oxide (EtO) Emissions from MedTech Sterilization Facilities

- Approximately 50% medical devices sterilized with EtO
- EtO is carcinogenic to human via inhalation and unsafe levels have been found near sterilization facilities

March 14, 2024

EPA Finalizes Rule on Ethylene Oxide Sterilizer Facilities' Emissions

Nearly 14 million people in the US live near facilities that emit one of the most toxic air pollutants regulated by the agency

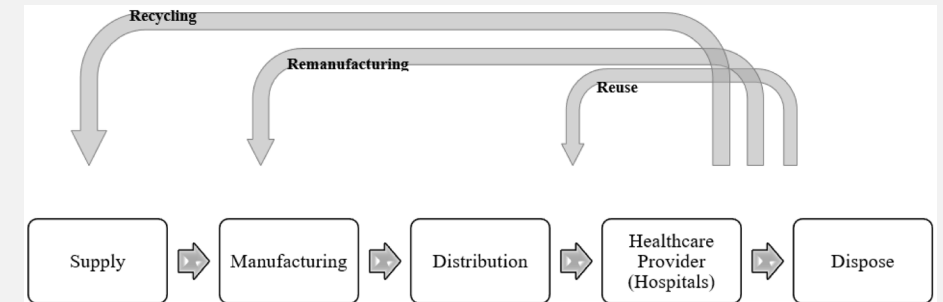
- EPA has imposed air pollution controls and estimate that industry costs would be \$220 million for one-time costs and an additional \$68 million annually

Potential Outcomes

- Optimized maintenance and net-zero emission controls for MedTech and sterilization service providers
- Novel alternative sterilization methods with customized design for MedTech device requirements and seamless, cost-effective integration that meet industry standards

Circular Economy and Waste Control

- 85% of healthcare waste is general, **non-hazardous** waste.
- However, treatment & disposal of healthcare waste may pose health risks indirectly through the release of pathogens and toxic pollutants
- PVC waste (5 – 10% of total medical wastes) e.g. IV bags, oxygen tubing and face masks
- Metal waste e.g. surgical instrument, stainless steel trolley



Potential outcomes

- Sustainable product design & lifecycle management for reuse, refurbishment and upcycling
- Waste segregation for non-hazardous waste and reduction in environmental impact
- Novel methods of reprocessing/retrofitting medical devices to extend shelf life

Thematic #2: Useful Information and Links

[Health-care waste \(who.int\)](#)

[Here's how healthcare can reduce its carbon footprint | World Economic Forum \(weforum.org\)](#)

[Office of Supply Chain Resilience | FDA](#)

[Remanufacturing and Servicing Medical Devices | FDA](#)

[Medtech's Role in Advancing Environmental Sustainability - AdvaMed](#)

[File Download \(oecd.org\)](#) (Securing Medical Supply Chains in a Post-Pandemic World)

[The carbon footprint of products used in five common surgical operations: identifying contributing products and processes - PMC \(nih.gov\)](#)

[The importance of the cold chain in the medical biology laboratory: Experience of the central laboratory of CHU Mohammed VI of Oujda – ScienceDirect](#)

[Innovative Solutions for Ethylene Oxide Mitigation Used in Sterilization Processes \(Direct to Phase II\) | SBIR.gov](#)