Innovation Management Directorate
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH
Anusandhan Bhavan, Rafi Marg, New Delhi – 110001

OFFICE MEMORANDUM

No.6/10/Reorient CSIR/2021/1 **September 29, 2021**

Sub: Implementation of Stage-Gate Model for Technology Development in CSIR

OM No: 6/10/Reorient CSIR/2021/1 dated 7th September, 2021 is hereby withdrawn. In place of the said OM, the present OM is issued.

1.0 Background:

The Council of Scientific & Industrial Research (CSIR) is a globally renowned public-funded research organization with many significant accomplishments and accolades over its nearly 8 decades of existence. Having a pan-India presence, CSIR has a dynamic network of 37 National Laboratories, 39 Outreach Centers, 3 Innovation Complexes, and 5 Units. CSIR covers a wide spectrum of science and technology – from radio and space physics, oceanography, geophysics, chemicals, drugs, genomics, biotechnology, and nanotechnology to mining, aeronautics, instrumentation, environmental engineering, and information technology. It provides significant technological intervention in many areas with regard to societal efforts which include environment, health, drinking water, food, housing, energy, farm, and non-farm sectors. Further, CSIR has played a major role in S&T human resource development in the country. This diversity and heterogeneity of CSIR have been crucial not only for its success but also for providing the required flexibility for CSIR to respond instantly during unforeseen circumstances.

CSIR is a dynamic organization. Typically, for any dynamic institution, periodical evolution becomes naturally a part of its growth. Majorly, this is triggered by internal factors such as effective articulation of manpower, rigidity observed in matured organizations, change in leadership, etc., and external factors such as dynamic market demands, stringent funding, post-pandemic strategy, economic recession, etc. In response to the above mentioned, it has become evident that the evolution of CSIR as a Next Generation organization is highly required. A next-generation organization can majorly be defined as a dynamic organization that adapts itself to the next generation's needs. It not only targets the improved outcome but also focuses on achieving an efficient internal process of the organization.

CSIR has been instrumental in steering Indian research and development in a wide spectrum of sciences and has reported several radical technologies, inventions, and discoveries since its inception. The existing model of technology development has served well but due to changing circumstances and market dynamics, CSIR needs to move towards more structured model such as Stage-Gate Model.

CSIR Reorientation Committee has also recommended the adoption of the Stage-Gate Model for Technology Development in CSIR.

2.0 Stage-Gate Model:

A stage/phase-gate process is a project management technique in which an initiative or project shall be divided into distinct stages or phases, separated by decision points known as gates. The stage-gate model provides a structured plan for implementing new projects. For organizations such as CSIR, which is completely driven by R&D projects, implementing a stage-gate model will not only be effective but also provides numerous advantages as listed below:

- Provides structured creativity/innovation;
- Guides the projects and tunes/align them so that it sticks to the original goal or set new goals as appropriate; and
- Saves efforts, as resources can be flexibly reallocated away from underperforming projects, which will be identified and can potentially be taken care of at the earliest by either providing recommendations to realign for success at a particular stage or by closing ("killing") the project early and preventing the release of further funds where chances of success appear low.

2.1 Stage gate model framework:

The typical stage-gate model is a process flow of alternating Stage (activity period) and Gate (milestone) blocks arranged successively. As a project progresses through successive stages and clears gates, the risk of failure decreases, and the project commitment and cost increase. A stage mentions activities of the corresponding project phase and the expected deliverables corresponding to that stage are given as input to the corresponding gate review – each gate is a critical decision-making block. The following are the parameters related to the gate block *(Ref: https://en.wikipedia.org/wiki/Stage–gate_model):*

- *"Input - What the Principal Investigator (PI) and team deliver as Outcomes (not just Outputs) to the decision point. These deliverables are decided at the review of the previous gate and are based on a standard menu of deliverables for each gate*

- *Criteria - Questions or metrics on which the project is judged in order to determine a result (go/conditional go/kill/hold/recycle) and make a prioritization decision. This criterion has to be listed for each gate. The criteria can be classified as follows-*

    - *Must meet criteria - Mandatory*
    - *Should meet criteria - Desirable*
    - *Qualitative criteria such as Quality execution, Business Rationale, Action Plan*
    - *Quantitative criteria such as properly benchmarked and unambiguously measurable parameters from SMART goals, etc.*

- *Output - Results of the Gate Review - a decision (go/conditional go kill/hold/recycle), along with an approved action plan for the next gate, and a list of deliverables and dates for the next stage until the next gate."*

Depending on the nature of the project the stage-gate model can have 2-16 stages and gates. However, the traditional stage-gate model has six stages followed by respective gates – Ideation, Scoping, Building business case and plan, Development, Testing and validation, and Launch. It is to be noted that there is a gate followed by each stage that decides the project continuation. Also, depending on the project progress there is an equal probability for the project to be allowed to continue or the project getting terminated. This helps in identifying and choosing only those potential projects that are likely to reach the completion stage within an agreed timeframe, thereby saving cost and improving manpower efficiency

2.2 Components for each stage:

Since CSIR works on a wide spectrum of scientific and engineering problems, the following are the generic guidelines that require to be followed in each stage -

Stage I – Ideation

- Brainstorming for proposing an innovative as well as market potential idea
- PI/Co-PI & team identification
- State of the art review along with detailed IP landscape
- Communicating with the end users/suppliers to fine tune the specifications
- Typically, TRL 0-1, aligned to PI & team capability and some initial data based on own experiments or preliminary literature survey
- Documentation

Stage II – Scoping

- National and International status of the proposed project
- Potential IP
- Market survey - competitors
- Identifying Industrial partners / End users
- Critically evaluate the strength and weaknesses (SWOT analysis) of the project & project teams (get external / internal people with right skills / expertise if necessary)
- Risk analysis
- Documentation

Stage III – Building Business Case and Plan

- Understanding the IP, safety, environmental impact, health considerations
- Stating the potential risk and its mitigation during the project execution
- Designing a detail development plan indicating the following –
    - Planning the entire research and Defining the sub-stages of the development. Modularizing the research into various sub-stages with clearly defined qualitative/quantitative deliverables.
    - Also recommended to provide a clear indication of the expected TRL in each sub-stage
    - Defining the SMART goals
    - Defining time-bound milestones to evaluate the project

Stage IV – Development

- Development of the proposed technology as defined in the previous stage
- Improving the business potential by collaborating with the stakeholders

Stage V – Testing and Validation

- Lab testing and defining metrics to evaluate
- Interaction with the end-user and obtaining their critical feedback
- Obtaining the regulatory approval, certification such as EMI/EMC (for electronic), FSSAI (for food products), BIS, CDSCO (for pharmaceutical drugs), PESO (for flammable, explosive or high pressure materials to be stored) etc.
- Targeting the innovators and early-adopters
- Documentation for technology transfer as per standard format

Stage VI – Launch

- Defining the initial market acceptance
- Working on the post-launch review and tuning the product specifications accordingly

After every stage, there will be Gate-meetings that decide the future of the project. The financial support for the successive project stage will be utilized only after the approval from the gatekeepers based on the gate meetings of the previous stage. There would be an equal probability for all the projects to be continued or killed based on their progress. This will increase the organisational focus on winning propositions resulting into significant increase in the development of robust and relevant technologies / products.

Thus, from the above definition of stages, from the idea conceptualization till the launch of the product, there will be continuous guidance from the Monitoring Committee who will also act as Gate Keepers. This would ensure structured R&D with definite planning of even minor events thereby significantly reducing not only the rigidity in the product development process but also the risk of failure.

In view of the foregoing, the following would come into effect.

2.3 Implementation of the stage-gate model:

Based on the above premises, CSIR has decided to implement the stage-gate model for all translational projects sponsored by CSIR such as those under FTT, FTC, Mission Mode, NMITLI and technology development projects of the labs initiated after the date of this OM. The following steps will be followed to implement the stage-gate model in CSIR –

2.3.1 Defining the roles and responsibilities:

Implementing the stage-gate will directly change the mode of project execution and indirectly the organization's culture. Consequently, successful implementation of the process demands support from many people at many levels. Hence, it is necessary

to delineate the roles and responsibilities of the building blocks of the team. The following are the three major categories in the team for implementing the stage-gate model-

- Executive Team (ET, in CSIR Hqrs) – To formulate, implement and guide the project teams across all the laboratories. The Executive Team comprises of Director of the Laboratory (Nodal), Theme Director, Head of concerned Directorate at CSIR Hqrs, and Coordinating Scientist at CSIR Hqrs. This team will also do portfolio management for CSIR.

- Gate Keepers (GK) – Expert team in the relevant areas who are the decision-makers. Domain Expert Group and Monitoring Committee shall act as Gate Keepers. The Coordinating Scientist at CSIR Hqrs will be the nominee of the ET to the GK group.

- Principal Investigator (PI), Co-PI, and the team members who propose the project take advice of the Executive team and implement the project accordingly in line with the stage-gate model. A nominee of the Theme Director will be involved in the process to minimize overlap and duplication across CSIR laboratories.

2.3.2 Aptly designed and customized process suiting the organization's requirements:

A customized stage-gate model with clearly defined stages incorporating the learning from the present model for a particular project has to be developed. Obtaining a customized plan will require multiple interactions between the executive team and PI and Co-PI including team members. The outcome of this exercise will refine further the definition of stages mentioned in section 2.2 customized to the existing themes/project modes (FTT, FTC, Mission Mode, NMITLI, etc.).

2.3.3 Definite Launch plan

2.3.3.1 Clear Communication and Continuous Guidance – While introducing a new process in the system, a dedicated team-Executive team, which possesses the complete knowledge of the stage-gate model, would provide continuous guidance to all the project team so as to align them with the new model. The entire formulation should be clear and crisp so that the targeted point reaches all the audience seamlessly i.e. the information flow needs to be flawless. Also, guidance is required from the stage of ideation till the submission of the post-launch review.

2.3.3.2 Addressing the impact of the implementation – Also, it has to be understood that implementing a new process in any organization will have both positive and negative reception. Both of them have to be handled in such a way that it propels the implementation rather than impeding it. The executive team has to be ready with the answers for all potential negative reception and make the team understand the long-term positive effect for the organization.

2.3.3.3 Defining Performance Metrics – Feedback is crucial in any sustainable and stable system. As a mode of feedback, the overall performance of the model

implementation can be tracked by means of some predefined metrics such as – a percentage of projects in a stage-gate model, frequency and the decisions in the gate-meetings, total project budget saved at different stages of the projects, time taken to technology transfers, the success rate of the projects as measured by generated revenues and customer satisfaction surveys.

2.4 Bill of Materials, Standard of Preparation and Supply Chain:

A bill of material or BOM is a list of all manufactured and raw materials needed to build a product. It serves as the core of any manufacturing process because it lays out all information required to assemble a product. Not only does a BOM outline what manufactured and raw materials are needed to build a product, but it also includes the equipment and tools needed to build the product. *(Ref: https: // www.globalshopsolutions.com /blog / what-is-a-bom-and-why-is-it-important/)*. A standard of preparation for the product shall be documented as a drawings, process sheets, quality assurance, etc.

Because of its importance, Principal Investigators need to make sure that they have generated an accurate and reliable BOM so that the manufacturing process isn't hindered because of inaccurate information. The BOM impacts purchase of raw material, available inventory, and the process of assembly on the shop floor. The accuracy in information helps in making better decisions about manufacturing the product efficiently and cost-effectively.*(Ref: https://www.globalshopsolutions.com/blog/ what-is-a-bom-and-why-is-it-important/)*.

After adapting to Stage-Gate Model, all the technologies/products developed by CSIR and ready to transfer to industries for commercial production shall be complete with BOM, Supply Chain information (such as whether any items are single-source, imported, hazardous to store, perishable etc), and Logistics (mode and cost of transportation and storage).

2.5 Performance Monitoring

Periodic evaluation of the Stage-Gate process implementation is vital in tracking its success. Hence, the following steps will be carried out for performance monitoring of the Stage Gate mechanism. Initially, the number of projects implemented and the feedback from PI, ET and GK, via an online survey will be consolidated. However, after 2 years, in addition to the above, the performance metrics mentioned earlier will also be compiled and submitted to DG, CSIR for further evaluation. This exercise will be carried out biannually and the executive team will submit a detailed report to DG, CSIR for his comments. Based on DG's suggestion, further tuning of the stage-gate model will be carried out.

Considering the nature and credibility of the stage-gate model, implementing the same in CSIR will undoubtedly provide a significant leap in the organization's culture and performance. This mode of project execution provides - continuous evaluation, quicker response to unforeseen circumstances, and reduction in risks as the project progresses, structured and responsible R&D – which ultimately aid in successfully propelling an R&D project to the state-of-the-art technology. Thus, this exercise will

act as a stepping stone for leveraging CSIR to face the next generation R&D problems and establishing a brand impact in society.

2.5 Applicability:

Stage-Gate Model shall come into effect with the date of issue of this OM. All new projects under the category of FTT, FTC, Mission Mode, NMITLI, and technology/product-oriented MLP shall be implemented following this model. However, it shall not apply to basic research projects, FBR, NCP, CSIR-FIRST and all ongoing projects under any category. Refer Annexure I for Stage Gate Model process flow.

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29.09.21

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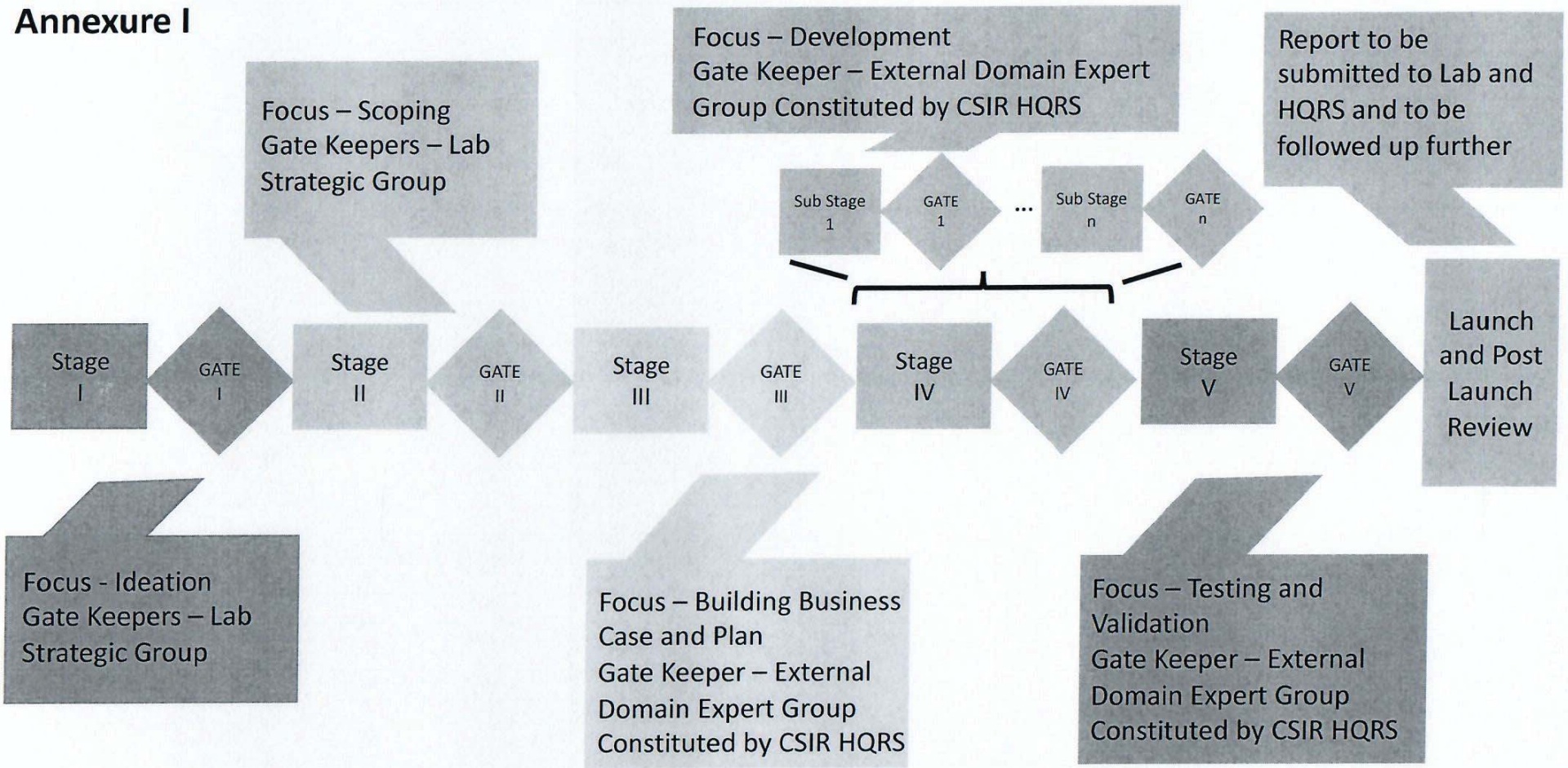
Annexure I



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