Report of the Committee

For defining technologies, products, models, methods, processes and Review the functioning and constitution of PME and develop guidelines for verification of publications, documentation and research activities of the scientists in ICAR Institutes

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Chapter 1: Introduction

Agricultural Research and development is very a complex process. Lot of work is done in multidisciplinary mode in agriculture. In such a complex world, it is difficult to understand the process of development from single subject perspective. The technological assets of ICAR that include a number of high yielding and resilient crop varieties, animal and poultry breeds and fish strains, packages of improved crop and animal husbandry practices, natural resource management technologies, improved tools, equipment and farm machinery, improved dairy, poultry and fisheries technologies, post-harvest technology, computer software and data sets, and several other processes and products of agriculture and the allied sectors. Besides Intellectual Asset developed through soft skill development, policy issue advocacy, data management systems and its analytical tool are also very important. Agricultural science has been the engine of growth and led to quantum jumps in productivity in the past. Combined use of above has increased agricultural output and farm incomes besides increasing efficiency in the agri-value chain. These technology packages have been the major contributors to the green, white and blue revolutions that brought out spectacular gains in Indian agriculture.

Defining research output in agriculture was not deemed to be necessary all these years due to subjective evaluation of many of the Human Resources (HR) traits of the personnel engaged in these. The prevailing ethos was to place technologies in the public domain for access by all and analyse an combined outcome. Now the thrust is on to be more transparent in different aspects of understanding the intellect assets and giving it an objective value so as to differentiate the competing human resources for different benefits from the agricultural research system. These benefits may include promotions, recognition, and awards etc. First step in this area was taken by National Academy of Agricultural Sciences (NAAS) an think tank for agricultural research and policy, it has brought the research publications score card. ASRB, has brought scoring for both promotions through CAS or direct selection. Besides for Institute ranking ICAR again has adopted more objective scoring system.

Prioritization, Monitoring and Evaluation (PME) cell has been entrusted to document and reproduce these objective indicators in an institute. It is basically the tool for research management effectiveness which is expected to provide future outlooks and tech landscaping in the mandated area of the institute. After its implementation, lot of definitional problems start emerging from different institutes. It was possible not to recognize technology in one institute, simultaneously other institute recognizes same or similar work as technology. There are difficulties to differentiate between two works as innovative or substantial improvement over existing one. Social science studies, policy analysis, development of some methodology, process for improving efficiency of agriculture research, education and extension need to be given proper scoring so as to compare them with other fields of sciences. An effective understanding of these would have in-built incentive for scientists/ innovators to engage in knowledge creation. Besides it will be easier for PME section to assess all scientists' intellectual assets more objectively. This would lead to greater professional recognition for them. Strict Literary definition of IA in the form of technology may not serve the purpose given the diversity, complexity and the variability of these among 100+ ICAR institutions' outputs. While the meaning/understanding about technology & product are clear to the majority, we may need to specify what 'model', 'method/methodology', and 'process' mean. Therefore, there is need to define and classify into technology/product/process/concept based on wisdom. A committee was constituted and entrusted to look into all these issues.

The terms of reference of the Committee are:

- To clarify define various research/scientific output especially different technologies, products models, methods, processes etc.

- To review the whole process of functioning and constitution of PME and develop clear guidelines for verification of publications, documentation and research activities of the scientists in ICAR Institutes
- The committee shall submit it report to the Director General, ICAR on priority basis

The constitution of the committee is

1.	Dr. SK Chaudhari, DDG(NRM)	Chairman
2.	Dr. A.K. Singh, Director, ICAR-IARI, New Delhi	Member
3.	Dr. Himanshu Pathak, Director, ICAR-NIASM, Baramati	Member
4.	Dr. Ravisankar, Director, ICAR-CIFE, Mumbai	Member
5.	Dr. B.N.S. Murthy, Director, ICAR-IIHR, Bengaluru	Member
6.	Dr. C.R. Mehta. Director, ICAR-CIAE, Bhopal	Member
7.	Dr. V.K. Saxena, ADG(AP&B)	Member
8.	Dr. P.S. Pandey, ADG(EPHS)	Member
9.	Dr. K. Srinivas, ADG(IPTM)	Member
10.	Dr. Rajender Parsad, Director, ICAR-IASRI	Member Secretary

Dr. Debi Sharma and Dr Sanjay, Director, ICAR-IIHR also contributed as Director, ICAR-IIHR after the tenure of Dr B.N.S. Murthy.

Chapter 2: Defining Research /Scientific Output

TOR I: To clearly define various outputs especially different technologies, products, models, methods, processes, etc.

2.1. Definition of technology, products models, methods, processes etc.

2.1.1 TECHNOLOGY

As per Oxford Dictionary, technology is derived from Greek *tekhnologia* 'systematic treatment', from *tekhnē* 'art, craft' + *-logia.* The technology may also be referred as: "the application of scientific knowledge for practical purposes, especially in industry' Machinery and equipment developed from the application of scientific knowledge and The branch of knowledge dealing with engineering or applied sciences."

Britanica defines Technology as: "The application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment."

As per Wikipedia "Technology is the **continually developing result of accumulated knowledge** and application in all techniques, skills, **methods, and processes** used in industrial production and scientific research. Technology is embedded in the operation of all machines, with or without detailed knowledge of their function, for the intended purpose of an organization."

Many others definitions of Technology are:

- Applying a systematic technique, method or approach to solve a problem. Much of today's technology implies the use of computers.
- The use of scientific knowledge to solve practical problems, especially in industry and commerce.
- The specific methods, materials, and devices used to solve practical problems.
- Electronic or digital products and systems considered as a group.
- The definition of technology is science or knowledge put into practical use to solve problems or invent useful tools.
- The system by which a society provides its members with those things needed or desired.
- Applied science.
- The terms used in a science, etc.; technical terminology.
- A method, process, etc. for handling a specific technical problem.
- The science or study of the practical or industrial arts, applied sciences, etc.
- From the Greek *tekhnologia*, meaning systematic treatment or science of craft. Applied science. Practical arts. The application of scientific devices, machines, and techniques for manufacturing and other productive processes.

As per ICAR IPM&TTC guidelines (2018), the technological assets of ICAR include a number of high yielding and resilient crop varieties, animal and poultry breeds and fish strains, packages of improved crop and animal husbandry practices, natural resource management technologies, improved tools, equipment and farm machinery, improved dairy, poultry and fisheries technologies, post-harvest technology, computer software and data sets, and several other processes and products of agriculture and the allied sectors.

2.2 Based on these the committee deliberated on following definitions of :

2.2.1 Technology: Development of practical and effective solutions, based on scientific knowledge, in a systematic way by application in all available techniques, skills, methods, and processes used in

agriculture value chain and research and/or Development of technical skills, methods, and processes for development of practical and effective solutions (intermediary). Research findings that become sustainable practices among the stakeholders. These include methods of pest management, methods of resource management, methods of farming system models, water harvesting and conservation methods, post-harvest technologies, institutional innovations, livestock and poultry, improvement and innovative extension efforts leading to large scale diffusion and adoption of technologies.

2.2.2 Product: All outcomes, tangible or intangible, by using the technology, for the effective use in the agriculture value chain applications and final consumption by the stakeholder is a PRODUCT. This includes variety, unique germplasm, genetic stock, chemical and biochemical formulation, diagnostics, vaccines, drug formulation, feed formulation, waste utilization, models of institutional innovations (Strategy and management issues), programming, simulation or statistical models and computer software, including extension software such as expert systems and interactive multimedia, new pest and pathogen identified, new machines/equipment or major modifications in them and development of new value-added products that have been economically evaluated and adopted or have the potential to be adopted on a wide scale. In the case of social sciences, it may include New extension models/concepts/methodologies/strategy/policy intervention developed, special reports, etc. with evidences of influence on research priorities, economic policies and programmes.

2.2.3 Models: A model is an informative representation of an object, process, person or system. Models can be divided into physical models (a three dimensional representation of any object in small format) and Conceptual models (mathematical or statistical expressions, software, data models, predictive systems, ANN, etc. describing behavioural patterns of an event, multiple events, humans though process and actions).

2.2.4 Methodology: The term refer to the methods themselves or to the philosophical discussion of associated background assumptions. A methodology is a defined system for bringing about a certain goal or objective. From the context of research objective/goal is usually to discover new knowledge or to verify pre-existing knowledge claims. Various steps are involved, like defining and selection of a sample, collection of data, analysis using appropriate tools, and interpreting results. The most discussed distinction among types of methodologies is between the quantitative and the qualitative approach.

2.2.5 Concepts: Concepts are defined as abstract ideas. They are understood to be the fundamental building blocks of the concept behind principles, thoughts and beliefs. They play an important role in all aspects of cognition. As such, concepts are studied by several disciplines, such as linguistics, psychology, and philosophy, and these disciplines are interested in the logical and psychological structure of concepts, and how they are put together to form thoughts and sentences. The study of concepts has served as an important flagship of an emerging interdisciplinary approach called cognitive science.

2.2.6 Processes: A process is a series or set of activities that interact to produce a result; it may occur once-only or be recurrent or periodic. For example business processes, manufacturing processes, Legal processes, purposeful sequencing of tasks that combine resources to produce a desired output in scientific studies, Biology process, Chemical process, Computing process,

2.3 Institutes in different SMDs had their own way of objectivising these parameters

2.3.1 Animal Husbandry: In the area of breed registration/genetic improvement it was told that this is being piloted in ICAR. NBAGR is under process to do this. Once done it will become an indicator in the process of objectivising the Intellectual assess/technology asset. Besides development

of vaccines, immunization kits, disease and other features detecting kits and product developments that has commercial values are considered to include these aspects for objective assessment.

2.3.2 Crop Sciences: Varieties are the main technologies of the crop science institutes. They provide weightage to varieties released by either state or central varietal recommendation committee. Not much weightage on its commercialization aspects. They also consider the patented innovation as substantial technology. Besides some weightage is also given to policy documents and software development.

2.3.3 Horticulture Sciences: Presently following indicators are taken as an alternative to technologies/products/processes etc. For varieties it was mandated that before releasing a variety, a variety has to be tested URT/IET/AVT-I/AVT-II/AVT-II repeat which takes more in some annuals. At times good hybrids and varieties are not identified in AICRPs. There are many examples where the current popular hybrids were not identified in AICRPs. Contrary to it private seed companies are releasing cultivars with their own MLTs and selling seeds as TLs. This is creating disparity intime required to release varieties. Certain crops are very specific to locations & many stations will not come forward to test. For example, minor fruits, spices, Crossandra, Capsicum, Ivygourd, Avocado, Mangosteen. etc.

2.3.4 Agriculture Engineering and Fisheries: Indicative proforma for research output submission to SMD and guidelines for consideration of SMD level Committee need to be prepared which may further be customized by SMD. For example, proforma from ICAR-CIAE Bhopal and Fisheries Sciences is given in Table 1.

Recommendations

The discussions were held on Technology defining procedures. A technology/methodology/product is one that the organization shares with its stakeholders. All relevant documents from Institute Ranking Proforma, National Academy of Agricultural Sciences, ASRB Score Card, the procedures followed by different Institutes for cross learning may be collected to define various research/scientific output especially different technologies, products, models, methods, processes etc. and have been referred.

Given the diversity, complexity and the variability, strict Literary definition of technology may not serve the purpose. There is need to define and classify into technology/product/process/concept based on wisdom. It would be difficult to have common definition across sectors. Therefore, sector-wise, subject group wise, the technology/product/processes/protocols/methodology/policy strategies/models may be defined to account for subject diversity.

1. Well established AICRP system exists for variety identification and release. Therefore, for varieties, the release notification from AICRP/State level release committees may be taken up as proof of variety.
2. Some states like Maharashtra, Punjab have state level Technology/Equipment Release Committee. Wherever such mechanism exists may be followed up as such.
3. As far as feasible all technologies to be tested through multi-location trials (MLT). However, it may not be possible for all technologies, products, processes, methodologies, concepts, etc. to have MLT, therefore **SMD level committees involving outside experts may be constituted with the following Composition**.

- Chairman: Deputy Director General of respective SMDs
- Members: 3 Experts (2 experts in the relevant field and one expert outside ICAR)
- Member Secretary: Assistant Director General (one among the ADGs of respective SMD

– Invitees: Directors' of the Concerned Institutes submitted technologies/methodologies/ products/ processes/concepts/policy for identification/release.

4. Proposals of methodologies/ technologies/ product/ process/ concepts/policies/ strategies identified by Institute Level Committee (ITMC, ITRC or Committee constituted for the specific purpose) may be sent to SMD level committees. SMD level Committee should **mandatorily meet twice a year**. Technology relevant to a particular area say NRM should be submitted to NRM division irrespective of parent SMD of the Institute. This system would be applicable on prospective. However, outcomes for last 4-5 years or earlier may also be submitted along with documentary proof. Research output can be from RPP III of project, student research or any other ad-hoc research studies within the mandate and approval of the Institute. For output as concept, the research paper with high impact factor may be considered as proof. If there are more than one similar technologies/product/processes are submitted, than SMD level committees may also identify better technology from similar technologies for promotion to stakeholders. SMD Level Committee may approve and assign a unique identifier, or recommend for multi-location trial or may ask for more information.
5. Depending upon the urgency, the Institutes may go ahead for commercialization after certification from Institute Technology Management Committee (ITMC). If commercialized/patented through AgriInnovate it will be treated as technology/product, etc. Further, a relevant output identified by Institute level committees may also be shared with stakeholders in case of outbreak/emergent situation. Later on this output along with other research outputs may be submitted to SMD Level Committee. If the research output needs IP protection in the form of Patent/Copyright/Registration with PPVFRA, the research output can be submitted for IP protection after clearance from ITMC and SMD can be informed about IPR while submitting the output to SMD.
6. New gene isolated/new germplasm registration should also be considered as registered output.
6. A mechanism of good record keeping be made by all Institutes and the information on real time basis may be kept in Central Repositories. ICAR Technology repository is for proven technologies/methodologies/products, etc. ICAR IPR Repository is a central repository for all intellectual property assets (Copyrights, Patents, Varieties registered with PPVFRA, etc.) of the Council. The information on varieties released for crop and horticultural sciences may be uploaded on Variety Information System.
7. The provision of Young Professionals in PME/ITMU should be made for record keeping of all publications. Implementable guidelines from earlier available documents may be prepared.
8. Indicative proforma for research output submission to SMD and guidelines for consideration of SMD level Committee has been prepared which may further be customized by SMD. An indicative proforma at SMD Level, at Institute Level ITMC proforma may be followed, is given in sequel in Table 2.1.

Table 2.1: Indicative PROFORMA for Release of New technology at SMD Level

S#	Item	
1	Name and Address of the Institute (Submitting the Proposal)	
2	Institution(s) responsible for developing/ evaluating/identifying/ technology (with full address) including collaborators, if any	

3	Source of Research Output (Tick one: Research Project/Student Research/Any other asd-hoc research study)	
4	Period of Development/Evaluation/Validation	
5	Developers (Lead and Associate(s))	
6	Name of the Research Output (Technology /Methodology/Model/Product including equipment /Process/Concept/Policy etc.)	
7	Is it a new technology? (Yes/No). If no, is it modified version of existing technology? If so, provide the details of the technology being modified	
8	IPR involved, if any (Patent / Copyright/ Industrial Design Registration/Variety/germplasm registration)	
9	Validation Procedure (within Institute, Collaborators), followed if any	
10	Whether it has been tested in multi-location/multi-site testing. Please submit details	
11	Brief description of research output/technology including salient features and performance parameters such as yield, saving of water, conservation of soil, capacity, efficiency, etc.	
12	Details of relevant data generated during the development/validation	
13	Expected Stakeholders	
14	Expected Socio-Economic/Ecological Benefits including B:C Ratio	
15	Commercial potential details, if any (If yes, whether ready for immediate commercialization)	
16	Video clipping / Good quality photos of operation/product/Research Papers	
17	Any Other information, not covered above	
18	Recommendations of ITMC along with complete proforma	
19	Specific recommendations of the Director	

SMD may further add more fields in the proforma as per specific requirements. ITMC may devise their own proforma depending upon specific requirements in the Institute. Two different indicative proforma for ITMC are given in Table 2.2 and Table 2.3.

Table 2.2: Indicative Proforma 1 for Identification of Research Output at ITMC level

Sl. No.	**Item**	
1	Name of the technology /equipment /product /process	
2	Name of Division, if any	

3	Institute project No. and title in which the technology was developed, if part of project/Provide details	
4	Period of technology development	
5	Is it a new technology? Or modified version of existing technology?	
6	Cost of technology development	
7	Type of IPR protection (Patent / Industrial Design Registration)	
8	Investigators involved (PI & Co-PIs)	
9	Was the technology developed fully by Institute or through collaborative mode or through externally funded project	
10	Whether validation done by same or other Institutes has been done or whether it has been tested in multi-location/multi-site testing. Please submit details	
11	Is there any IPR issue, if involved?, if yes has the PI taken initiative to protect it through submission in ITMC agenda	
12	Brief description of technology, specifications, capacity, efficiency etc	
13	Salient features of the developed technology	
14	Unique feature of the technology over existing. Technology which makes it superior to the presently available technologies could be highlighted for commercialization and in the publicity material.	
15	Technology readiness/stage of technology development, concept, lab level, research prototype, commercial prototype, license stage or any other. From these options, what is the proposal of the PI/Head for further course of action for this technology?	
16	Likely major takers of the technology.	
17	Has the technology been demonstrated to concerned Head/PC/Director or any other scientific group	
18	Has the technology trials been done at farmers/village level through OFT/FLD or ORP or any other similar extension programmes, if yes, data collected and the feedback? How many hours/seasons it has been tested. Any changes were made after its testing and feedback? If not, why it should not be first field tested/refined before its release.	
19	Does the technology require refinement before release?	
20	Opinion, comments, suggestions and Recommendations of the Head of the Division	
21	Video clipping of live demonstration/testing of the equipment, if available or to be made	

22	Good quality photos Functional/operational photo of operating machine, product photograph	
23	Any other information that PI may like to provide	

Table 2.3: Indicative Proforma 2 for Identification of Research Output at ITMC level

1	Name of the crop	
2	Name and brief description of the technology tested in the AICRP trials	
3	Sponsoring Institute(s)	
	a) Institution/Agency responsible for developing/ evaluating/identifying/ technology (with full address)	
	b) Person(s) name who developed/evaluated/identified the technology	
	c) Co-Developers	
	d) Collaborators	
4.	a) Summary of the Technology (not more than 1 page):	
	b) Passport data of the technology like product/ Process/ Method/ microbes/insects /botanicals /nutrients/ chemical/etc.,	
	c) Objective of the technology	
	d) Detailed methodology of the proposed technology	
	e) Any other relevant information:	
5	Salient Features and Uniqueness of the technology in comparison to similar existing Process/ Method/ technology/ etc., (Demonstrated superiority in terms of increase in yield/ grain quality/ efficiency/ cost effectiveness etc.)	
6	Recommended production ecology (rain fed/ irrigated/ hilly; season)	
7	Specific area of its adaptation (zones and states for which technology is proposed for release) and the recommended production ecology.	
8	Detailed description of the technology	
	a) Product / Process/ Method/ Concept/ Microbes/ Insects / botanicals / nutrients/ chemical/any others	
	b) Distinguishing characteristics	
	c) Production process/methods	
	d) Effect of the technology on incidence of common diseases under field e) and controlled conditions	

	f) Effect of the technology on incidence of major insect pests under field and controlled conditions	
	g) Impact of the technology on physiological and morphological traits of the variety/crop if any (e.g., resistance to lodging, shattering, fertilizers responsiveness, suitability to early or late sown conditions, seed rate, etc.)	
	h) Impact of the technology on yield in the coordinated trials (to be attached)	
	i) Impact of technology on grain and fodder quality	
	j) Impact/ Effect of technology under varied soil conditions.	
	k) Impact of technology on weeds.	
	l) Others	
9	Agency responsible for large scale production/distribution of the technology/ Method/ Process/ Concept	
10.	Custodian(s) of technology.	
11	Vivid presentation (field view and close up view of the effect of the technology, IDM/IPM practices, symptoms, damages, recovery along with attainable yield levels	
12	Benefit cost (B:C) ratio of the technology	
13	Anticipated socio-economic and ecological benefits	
14	Any other pertinent information	

Signature of all contributors

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4
5
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Signature of the Head of the Institution

TOR 2: To review the whole process of functioning and constitution of PME and develop clear guidelines for verification of publications, documentation and research activities of the scientists in ICAR Institutes

2.4 Publications

For publications of research papers, ICAR Guidelines for Internal Evaluation and Forwarding Research Papers to Scientific Journals **and data Management in ICAR Institutes, 2014** may be followed.

Documentation and research activities are to be done as per Madan Committee and its evaluation to be done as per PME manual developed by International Food and Policy Research Institute (IFPRI)/ National Academy of Agricultural Sciences (NAAS)/ National Academy of Agricultural Research Management (NAARM) as given in the sequel.

2.5 PME Cells

Prior to the implementation of the World Bank supported National Agricultural Technology Project (NATP), Directors of Institutes were assisted by Technical Cells in managing their respective Institute research activities. Either the Scientists or the Technical Staff were made In-charge of these Cells. In order to make these Cells more competent to provide necessary technical support towards making the Priority Setting, Monitoring and Evaluation (PME) functions more effective, an idea was mooted to create PME Cells equipped with Scientists having technical expertise and PME skills in the ICAR Institutes. As a result, more than 30 such PME Cells were piloted in both ICAR Institutes and State Agricultural Universities (SAUs) with NATP funding.

2.5.1 The central role of PME cells. In the ICAR System, the mechanism for Priority Setting, Monitoring and Evaluation (PME) has evolved over years of experimentation and experience.

While the ICAR has its Vision documents beginning with 8th Five Year Plan indicating the research priorities at the national level, each Institute has developed individual Vision documents orienting its activities and mandate in tune with the ICAR Vision. Keeping in view the Vision and mandate of the Institute they serve, as well as the ICAR Vision, the scientists develop project proposals based on the information collected through: i) field visits and interaction with various stakeholders to identify the problems and research gaps; and ii) literature search to understand the existing research gap.

Prioritization, Monitoring and Evaluation (PME) cells have been institutionalized and operationalized in ICAR institutes with the aim to bring about proper and judicious allocation of research resources, thereby bringing in accountability, transparency and objectivity in the system. The underlying principle in PME cells is that these must be fully integrated with research decision making at the institute level; wherein formulation, evaluation and implementation of project proposals of all kinds have to be appropriately integrated. **The PME cells are aimed at providing the single window mechanism for initiation of action on the possible requirements of the outside client, including all professional service functions executed through ZTMC/ABI/ITMU.** Through PME cell, the system is expected to project the IAs or core competencies of individual institutes to the outside community, with the singular objective of improving visibility of the professional strengths, contributions and role of each Institute. It is, therefore, expected to be always in ready possession the updated information on all such IAs of the Institute(s) to provide the requisite information on Institute's strengths to the outside client.

The proposals are submitted to the PME Cell in their Institutes, and they are critically examined in terms of their relevance, scientific merit and feasibility by the Project Monitoring and Evaluation Committee (PMC) chaired by the Institute Director and all the Heads of Division acting as Members (vide ICAR letter no. 30(8)/2010/PME Cells/NAIP/O&M). In matters related to technology transfer/professional service functions/IP protection, proposals are to be submitted through ZTMC/ITMU to PME. In large Institutes, they are discussed at the Division level and approved by Institute Technology Management Committee (ITMC) before submitted to the PME Cell. While the PME Cell in the Institute acts like a 'Facilitation Unit', the PMC is the actual decision making body in the Institute.

All the information generated and recommendations emerged from the IRC meetings in respect of new projects approved (RPP-I), monitoring of ongoing projects (RPP-II) and evaluation of completed

projects (RPP-III) are documented and stored in the Institute PME Cell. All these are submitted to the Research Advisory Committee (RAC), which comprises outside experts with the Institute Director as one of the Members, for information and advice, if any. All the information pertaining to the entire research activities of the Institute undertaken during the preceding five years are also submitted to the ICAR appointed Quinquennial Review Team (QRT) comprising external experts and Director as one of the members during the performance evaluation of the Institute undertaken by the Team once in five years.

The PME mechanism has well laid out structure and functioning, and it now looks for guidance to make it more open, transparent, objective, effective and most importantly, acceptable to the scientists to make them accountable and also acceptable to funding agencies.

Creation of a nodal point in PME cell along with a monitoring and review system for ICAR.
Under the earlier rules and guidelines for training, consultancy, contract research and contract service in ICAR system, procedures were suggested to facilitate these tasks **including establishment of Consultancy Processing Cells. As per ICAR guidelines for Intellectual Property Management and Technology Transfer/Commercializ**ation, Institute Technology Management Units (ITMUs) were designated/established at the level of ICAR institutions. These units were given the responsibility for IP protection, management and technology transfer/commercialization with internal capabilities as well as external legal and business experts wherever required. Selected ITMUs at national/central institutions in different zones were designated as Zonal Technology Management Centres (ZTMCs). So the PME mechanism to operate these guidelines, shall be therefore through the existing institutionalized Units/Committees like CPC, ZTMC/ITMU, or assistance through a specific task-based Committee, with required internal and external expertise, depending upon the quantum of work and available manpower and resources at the Institute.

The mechanism to operate these guidelines, therefore, shall be through the existing institutionalized Units/Committees, or assistance through a specific task based Committee, with required internal and external expertise, depending upon the quantum of work and available manpower and resources at the Institute.

The activities would, however, converge in the PME cell, which will be the nodal point. The mechanism established should ensure that the proposal is in line with the mandate of the Institute/ICAR and in conformity with the extant rules and guidelines. Transparency has to be maintained in the decision making process and a faithful record of the proceedings of such Committee meetings which lead to decisions and orders by the Competent Authority will be necessary and maintained.

2.5.2 General Principles of Policy Framework: In order to execute the professional activities, the Project Leader or the Coordinator and the team of other consultants/resource persons should be proposed in the context of the work and the capability of the persons through PME cell in consultation with the concerned Project Leader/Coordinator and approved by Director of the Institute. While assigning the work to a scientist/staff member, due cognizance shall be taken of his/her workload, qualifications and experience vis-à-vis the specific requirements of the project, monetary benefits likely to be accrued from the project etc. The team of persons executing the work should also have the confidence of the client and in case the client indicates preference for a particular person(s), the request may be given due consideration.

Chapter 3 Way Forward

To manage research in agriculture sector Indian Council of Agricultural Research (ICAR), very unique institutional arrangements are made. On the top Research Advisory Committee which basically gives broader perspective of research direction to the institution. The constitution of this committee is done at the council level in consultation with the institute. Most of the members are experts in the area where the institution has mandate. This committee is facilitated by a senior member of the institution or the PME cell. This Terms of reference of this committee is to broadly prioritize the research, monitor and evaluate (Fig1). The committee tries to be bridge between past work of the institution, and present/future demand from the society/stake holders. RAC suggestions are basically subject to technological resources, expertise present in the institution and budget availability. Next level institutional arrangement for Research management is Institute Research Council (IRC). This body is expected to be the most important committee of the institute where all the three functions i.e. prioritization, monitoring and evaluation takes place (Fig 1). This committee decides the projects to be taken up in light of RACs recommendation of prioritized area. Even the details of project in terms of methodology, relevance, expected outcomes in terms of knowledge/technology/advisory etc., are discussed. The Director of the institution is the chairman of IRC and all scientific manpower are the members of IRC. PME cell Incharge is normally the member secretary.

The role of PME cell is to **keep the records of deliberations** of RAC/PME besides the research, in the form of RPP-I, RPP-2, RPP-3 and if required RPP-4. With recent introduction of score-card system in ASRB, the directors are fully dependent on PME cell to certify the claims of the scientist.

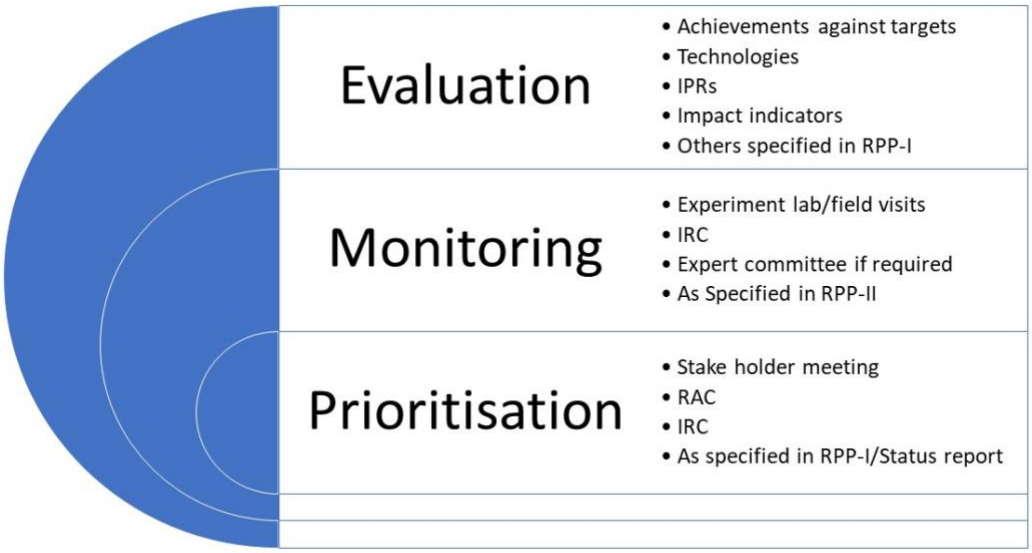


Fig 3.1: PME and its mandate

It, therefore, became more important. Based on RPPs, PME is expected to identify and certify technologies. However, lot of issues have also arisen while dealing with these certificates. There has been discrepancies observed within and among the institutions with respect to issuing of the certificate. Sometimes, PME in-charge feel so powerful as he is issuing certificates. Decisions are taken individually. Though there is provision of PMC, but most of the institute did not constitute the PMCs. Besides in the Zonal Technology Management Unit (ZTMC)/ Institute Technology Management Committee (ITMC)/ Institute Technology Management Unit (ITMU)/ Agri-Business

Incubation (ABI) also identifies the technologies which can be licensed/commercialized, which sometimes are not taken into consideration by PME. These units are constituted under NAIF scheme and IPTM Unit keeps all records in this respect. A complete dossier of the technology, whether IP filed or not and its commercialization details are kept in these units.

To mitigate the issue that has arisen that PME cell of the institute should issue the certificates with respect to identification of technology development, following steps are suggested.

3.1 A committee at Institute level MUST be constituted or ITMC/PMEC should, if already there, be revamped where the Director should be chairing the committee. The senior members of institute (HoD/Station in charge/Pr Scientist/Sr Scientist, whichever is applicable at institute level) should be the part of committee representing all divisions. For very big institutes, JD(R) may be the chairman of this committee. ZTMC/ITMU/ABI in-charge MUST be the member of the committee, as the custodian of technology/IPR depository and transfer of it. Besides he/she is the nodal point for tech commercialization and in touch with Agri-Innovate for this purpose as per IPTM&TTC guidelines 2018. (Fig 3.2)

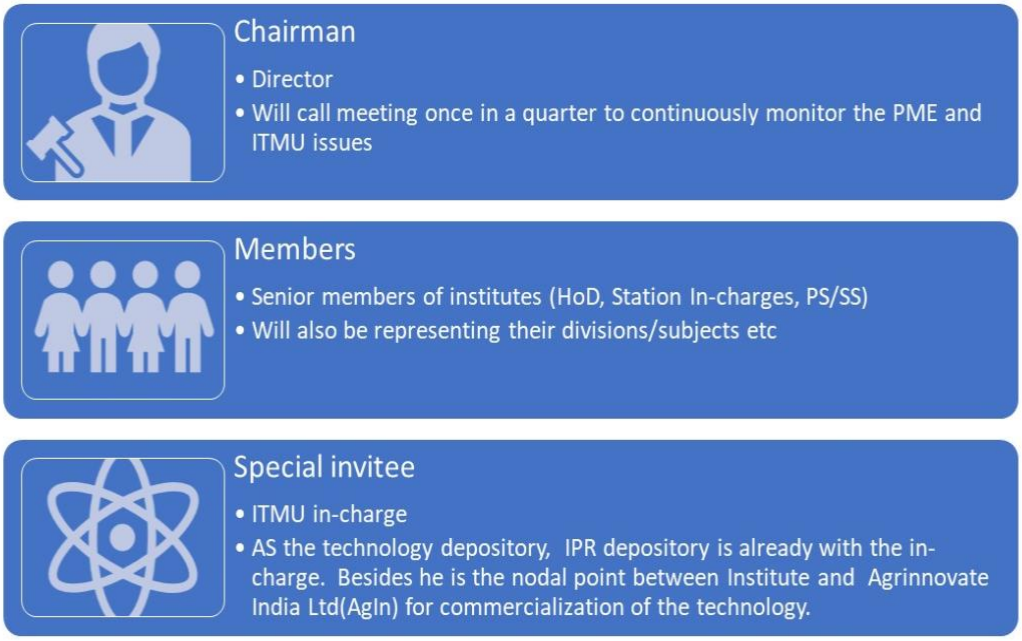


Fig 3.2: Revised PMC

3.2 The committee should meet compulsorily at least once in a quarter to identify the technology, which otherwise may not be deem as technology.

3.3 Prioritization, Monitoring and Evaluation cell may be renamed as Monitoring, Verification and Reporting Cell. The constitution of this cell as per existing ICAR guidelines of 2011 is not adequate to meet the expectation of the institute from PME. It should have scientists to look after following major activities in addition to I/c PME Cell such as (i) Professional Service Function issues (Consultancies, collaborative/contract/sponsored/institutional research and training aspect as per the PSF guidelines, 2014); (ii) HRD of scientists and other staff; (iii) Publication and technology repository of institute and (iv) IRC, Institute seminar, etc

3.4 The constitution in terms of number of persons in PMEC and PME unit should be within the powers of the Director. PME Cell In charge tenure should also be 3-5 years **and should be rotated among senior staff.**

3.5 The flow of the technology/product/process certifications goes as per the chart given below (Fig 3).

1

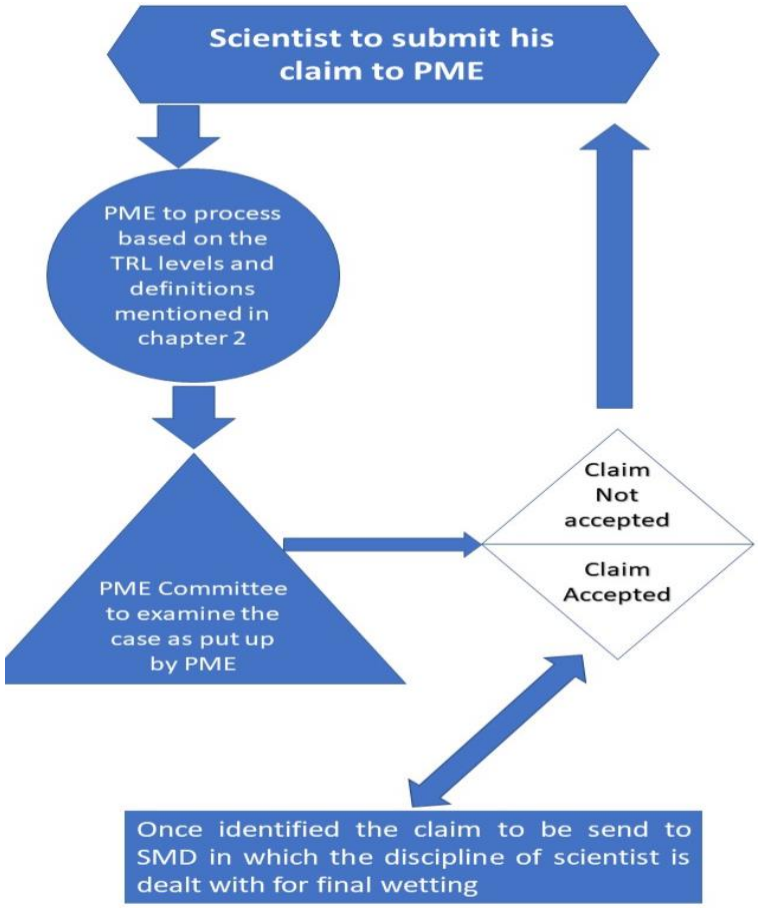


Fig 3: Flow chart of work

3.6 Scientist(s) should submit his proposal through proper channel, for getting it identified as technology, process, products etc. to ITMC/**PME cell along with the RPP-2 or RPP-3 whichever is applicable.** Preferably it should be discussed in IRC with minutes as proof. Information in the proposal should be as indicated in annexure XXX.

3.7 The proposal should come for discussion in PMEC, and identify the technologies based on the outcomes from IRC deliberation. If the proposal has not been discussed in IRC due to some reasons it can be discussed here for immediate disposal of proposal from scientist. Later it should be put up in IRC. It should discuss, whether particular claim by the scientist can have some IP issues and commercialization prospects.

3.8 If the proposal is not accepted **unanimously**, it should be returned to the proposer with **proper detailed justification of rejecting it**. If there is diverse opinion about the claim in the committee, it should be referred to relevant SMD.

3.9 If the proposal is agreed to be identified as technology, a brief description should be prepared and a proposal should be made for discussion/vetting at relevant SMD.

3.10 The proposals should be sent to relevant SMDs, which may not be necessary the same administrative SMD. For example, if an soil scientist is working in crop science institute or horticulture institute, which otherwise do not have expert at SMD level, they should send the

proposal to NRM SMD where this subject is dealt. Likewise, social science proposals except extension to come to Education Division. All extension proposals to come to Extension division.

3.11 At SMD level, a small committee may be formed to discuss these proposals to accept the claim or not made by the scientist. At SMD level this meeting should be held six monthly.

3.12 SMDs can call external experts both from public/private industry/Agri-innovate to understand the implication of the claims.

3.13 If there is acceptance in this regard, then the institute should certify the claim made by the scientist.

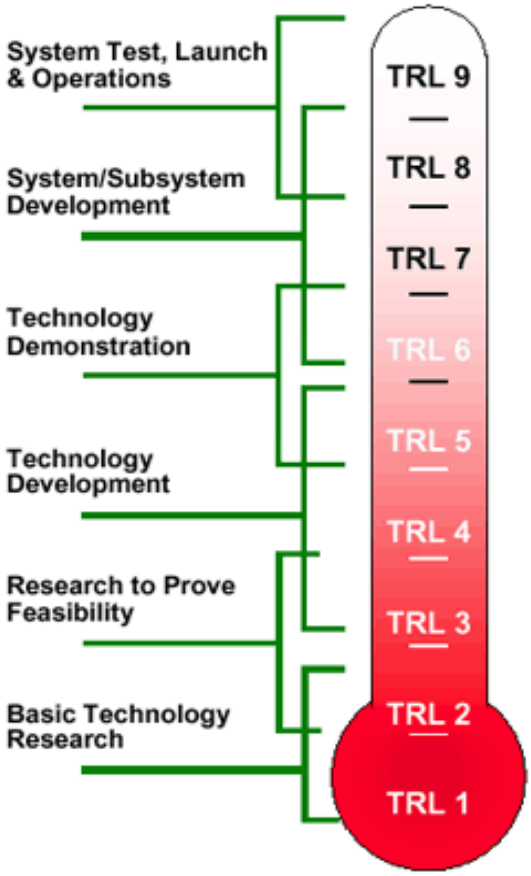
3.14 Consultancy Processing Committee is an important committee which provides valuable inputs along with monitoring related to consultancy and contract research. As per guidelines in Professional Service functions, this has been merged with PME. This committee may be retained in the national level Institutes if required, with PME Incharge as one of its Members.

3.15 For better coordination, ITMU should also be integrated with PME with one member of PME also as one member of ITMU. There should be provision of contractual manpower in PME and ITMU.

ANNEXURE-3.1: Information to be provided by the scientist(s) for consideration in PMEC

- Name of institute
- Name of Scientist (s) / Team With their contribution in detail. Contributions should be substantive
- Title of the proposal
- Project detail (Institute project/consultancy project/collaborative project/joint project/sponsored project etc.
- Description of technology with distinctive feature of the technology
- Whether external licensing was done to develop this technology
- Technology readiness level (See annexure XXXa)
- IP protection issues (Done/in the process/no IP protection to be done etc) including PPVFR points.
- Has the technology been demonstrated to concerned Head/PC/Director or any other scientific group OR Has the technology trials been done at farmers/village.
- Has commercial potential (Licensing through AgIn) or can be released through public agencies for adoption (without any charges) (Mostly knowledge resources)
- In case of commercial potential, who are the end user of the technology
- Any other information scientist(s) want to furnish to substantiate their claims

Annexure 3.1a



Questions to be asked to get TRL levels

TRL 1 Achieved if Basic principles observed and reported.
Do rough calculations support the concept?
Do basic principles (physical, chemical, mathematical) support the concept?
Do paper studies confirm basic scientific principles of new technology?
Has a scientific methodology or approach been developed?

TRL 2 Achieved if Technology concept and/or application formulated.
Has potential system or component applications been identified?
Have paper studies confirmed system or component application feasibility?
Has an apparent design solution been identified?
Have the basic components of the technology been identified?
Have technology or system components been at least partially characterized?
Have performance predictions been documented for each component?
Has a functional requirements generation process been initiated?
Does preliminary analysis confirm basic scientific principles?
Are basic scientific principles confirmed with calculation based analytical studies?

TRL 3 Achieved if Analytical and experimental critical function and/or characteristic proof-of-concept.
Have calculated predictions of components of technology capability been validated?
Can all science applicable to the technology be modeled or simulated?
Do experiments or modeling and simulation (M&S) validate performance predictions of technology capability?
Do experiments verify feasibility of application of technology?
Do paper studies indicate that technology or system components can be integrated?
Are the technology or system performance metrics established?
Has scientific feasibility of proposed technology been fully demonstrated?
Does analysis of present technologies show that proposed technology or system fills a capability gap?

TRL 4 Achieved: Component and/or breadboard validation in laboratory environment.
Has acceptance testing of individual components been performed?
Has performance of components and interfaces between components been demonstrated?
Does draft system architecture plan exist?
Have end user technology/system requirements been documented?
Has component compatibility been demonstrated?
Does technology demonstrate basic functionality in simplified environment?
Have performance characteristics been demonstrated in a laboratory environment?
Have low-fidelity assessments of system integration and engineering been completed?

TRL 5 Achieved if System/subsystem model or prototype demonstration in a laboratory environment.
Have internal system interface requirements been documented?
Has analysis of internal interface requirements been completed?
Can all system specifications be simulated and validated within a laboratory environment?
Is the laboratory environment high-fidelity?
Have individual component functions been verified through testing?
Have objective and threshold operational requirements been developed?
Has a Product Breakdown Structure been developed?

TRL 6 Achieved if System/subsystem model or prototype demonstration in a relevant environment.
Have system integration issues been addressed?
Is the operational environment fully known?
Have performance characteristics been verified in a simulated operational environment?
Has prototype been tested in a simulated operational environment?
Has system been tested in realistic environment outside the laboratory?

Has engineering feasibility been fully demonstrated?

TRL 7 Achieved if System prototype demonstration in an operational environment.
Have all interfaces been tested individually under stressed and anomalous conditions?
Has technology or system been tested in a relevant environment?
Are available components representative of production components?
Has operational testing of technology/system in relevant environment been completed?
Has fully integrated prototype been demonstrated in actual or simulated operational environment?

TRL 8 Achieved if Actual system completed and qualified through test and demonstration.
Are all technology/system components form, fit, and function compatible?
Is technology/system form, fit, and function compatible with operational environment?
Has technology/system form, fit, and function been demonstrated in operational environment?
Is technical Developmental Test and Evaluation (DT&E) successfully completed?

TRL 9 Achieved if Actual system proven through successful mission operations.
Does technology/system function as defined in Operational Concept document?
Has technology/system has been deployed in intended operational environment?
Has technology/system been fully demonstrated?
Has Operational Test and Evaluation (OT&E) been successfully completed?