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E-Governance Initiative for Effective Training Management and Knowledge Sharing in Large Scale Organization

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SUMMARY

Indian Council of Agricultural Research (ICAR) under National Agricultural Research and Education System (NARES) carries out training programs popularly known as Capacity Building Program (CBP) for its vast manpower engaged in teaching, research and extension. To support in training management, efficiency and knowledge sharing an e-governance initiative was taken up by ICAR and a web based system was developed and implemented (http://cbp.icar.gov.in). The system was designed in modular approach with built in support for document integration and in-built work flows for identified users (Course Directors, Participants and Managers). The work flows in system deals with various stages of training management starting with proposal submission, approval, financials, participant application to feedback submission and training report upload at the end of the training program. System also provides a platform for knowledge sharing in the form of e-books which is spontaneously generated from the lecture notes uploaded for the training programs. The information base of the system enables the managers in taking policy level decisions for training planning, management and consolidating the future requirements of the human resources. At present, the system has a databank of 12570 users, 1190 training proposals and about 225 e-books (e-resources) which will go long way with the system usage.

Keywords: Human Resource Development, Indian Council of Agricultural Research, National Agricultural Research and Education System, Training Management, e-books in Agriculture.

1. INTRODUCTION

The National Agricultural Research and Education system (NARES) is one of the largest national agricultural research systems in the world with more than 100 Indian Council of Agricultural Research (ICAR) institutions, 72 State Agricultural Universities (SAU) along with more than 200 Affiliated and Constituent colleges, 643 Krishi Vigyan Kendra (KVK) spanning across India (http://www.icar.org.in). NARES has approximately 30000 manpower engaged in research, teaching and extension activities. Therefore, it is imperative to update the professional skills of teachers, researchers and extension specialists with the latest knowledge and techniques in the field of their specialization to bring about the desired qualitative improvement and necessary orientation to contemporary problems to make research and education more relevant. ICAR addresses capacity building in deficient areas of contemporary relevance and anticipated future by sponsoring training program through Agricultural Education Division, ICAR (http://www.icar.org.in/en/agricultural-education.htm). These programs have been supporting the NARES manpower in the cutting edge areas of agriculture to meet the capacity-building demands in terms of teaching, research, training and extension.

Agricultural Education Division sponsors three types of training programs; Summer-Winter School (SWS- 21 days), Short courses (SC- 10 days) and Centre for Advanced Faculty Training (CAFT -21 days). Approximately 500 request for training proposals are received and Agricultural Education Division, ICAR approves on an average 160 training programs in different categories each year (April to

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March). In the manual system, managers faced the problems in trainings management like postal delays in receiving the proposals, duplication of efforts in compilation of training proposals, sending them further for evaluation to experts, financial approvals and communication of approved program. Apart from these problems, readiness of long term data on trainings provided, cost incurred, participant information, information on training effectiveness, non-approved trainings and users who could not attend training, was not readily available in the manual process. Moreover, it was difficult to track the interest of the users, some users were attending more trainings and some users were not getting any chance to attend the training programs. Good amount of knowledge is generated in the form of lecture notes which remain in a manual format and limited to participants attended the training program. In manual process, it becomes complex task to manage all the information efficiently and utilize the same for making informed decision and policy planning. To overcome this challenge, an e-governance initiative was taken and a web based system for Capacity Building Program (CBP) was developed to facilitate the online management and creation of knowledge repository of all the training programs. This system effectively takes care of the challenges faced in the manual system. The system has been designed and developed at Indian Agricultural Statistics Research Institute (IASRI) with the support from the Agricultural Education Division, ICAR. It provides end to end solution for training management starting from proposal submission for training, approval, financials, participant application approval, feedback submission and providing access to training reports. System has role based access for users, in-built work flows, document integration and auto creation of e-books along with customized reports at every stage.

This paper provides details of the CBP system that provides an enterprise solution for an effective online training management and knowledge sharing in an organization. It covers design, architecture, key functionalities highlighting work flow based solution and knowledge sharing. The rest of the paper is organized as follows. Section 2 presents various steps of software development life cycle of the CBP system. Section 3 provides functionality of the system followed by conclusion in Section 4.

2. MATERIALS AND METHODS

2.1 System Architecture

The CBP system was designed as a web application in a three-layer architecture. User interface layer was implemented using HTML, JavaScript and JQuery (Rao *et al*. 2014, Flanagan 2006). It consisted of forms designed using HTML for accepting information from the user and validation was done using JavaScript and JQuery. Application layer was implemented using ASP. NET framework with C# as a programming language (Macdonald 2008, Liberty and Xie 2007). The CBP system was hosted using the Internet Information Server. The Database layer was implemented using Sql Server 2012 which is a powerful database management system based on relational approach.

2.2 System Design

The system was designed in a modular approach with in-built work flows for identified users as depicted in Fig. 1. Mainly three types of users (Managers, Course Directors and Participants) were identified for the system. Interaction among the modules and the sequence of action to be performed as per responsibility of each user in the CBP system is presented using a sequence diagram (Fig. 2). Deputy Director General (DDG) and Additional Director General (ADG) level users comes under Managers category. These users are responsible for inviting training proposals, its evaluation and final sanction with financial grants. User can apply for conduct of training program in their institution for Summer/Winter and Short course after creating the login credentials in the CBP system. These training proposals are submitted to managers (ADG, DDG) for evaluation based on specified criteria in a work flow manner. After evaluation, some training programs are approved. Users of approved training program are termed as Course Director in the system. Some institutions of ICAR and some SAU's are pre-identified as Center for Advanced Faculty Training (CAFT). Head of CAFT center is known as CAFT Director. CAFT training programs are through invitation from identified 31 CAFT centres and other training programs are organised by any of the ICAR institutions and State Agricultural Universities. Once training is approved in the system then user can apply online in the training programs. User who got selected in a training program are termed as Participants. Admin

is mainly responsible for updating master values and overall management of the system.

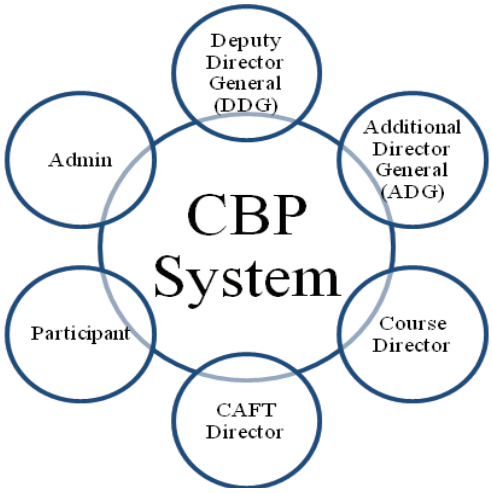


Fig. 1. System users

Role based different access rights had been provided to system users. System ensures that the individuals responsible for the next task are notified and receive the data they need to execute at their stage of process.

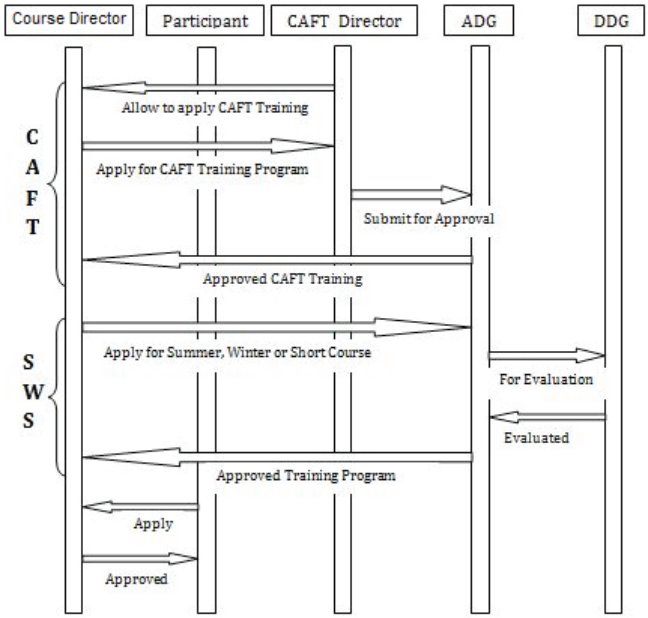


Fig. 2. Sequence diagram

An iterative and incremental agile software development methodology, Scrum was used for system design and development (Goswami *et al*. 2010, Sommerville 2011). Requirements of all modules were not crystal clear in the beginning, hence scrum model was used to facilitate incorporation of future requirements during development phase. Prioritized wish list was created on the basis of module identified for implementation. In first iteration, Course Director module was developed. In the next iteration, the Participant module along with ADG, DDG modules were developed. In the next iteration, functionality for CAFT Director was done along with module for e-books creation and reports in all the modules.

2.3 Database Design

The CBP system had huge amount of information regarding users, training program proposed, approved, participant, training files, lecture files, etc. Therefore, the relational approach was used for database design and normalization was done up to the third normal form, which is a desirable characteristic of the database (Elmasri and Navathe 2010). Object-Oriented design approach was adopted for CBP, because it simplifies the evolution of the system and object are, potentially, reusable component. Enhanced Entity-relationship (EER) model was used to define the logical form of the data processed by the system. An abstract representation of the EER diagram of the database is shown in Fig. 3.

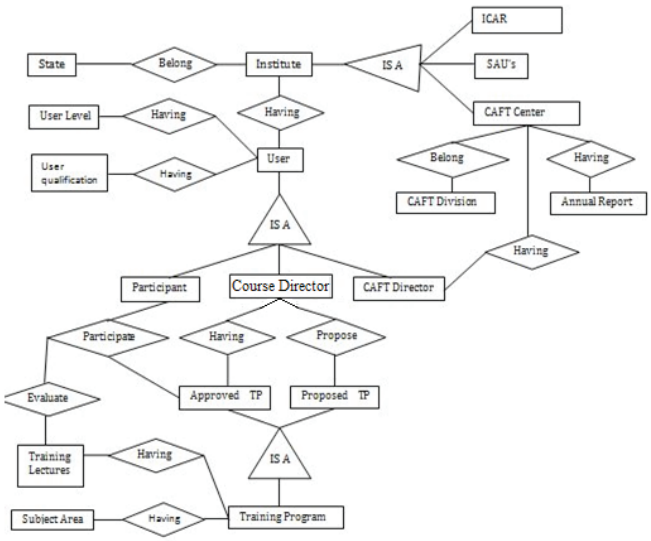


Fig. 3. Enhanced entity relationship diagram

2.4 Testing and Implementation

Modules identified in the system design was integrated using bottom-up approach. White box and black box testing was done for each module covering

functional and non-functional requirements. An integration testing was carried out for each sub-module and module. Alpha and beta testing was carried out before the CBP system was made operational.

The system was made operational in July 2014 and till starting of 2016-17 financial year,1190 training proposals were received online. Out of these, 546 training programs were approved.

Approximately 12570 users applied in various training programs. In total 7000 personnel members attended various training programs organised till March 2016. As per Google analytics, the system was visited by 1,22,946 users till March 2016 since inception.

3. FUNCTIONALITY OF CBP

The system is accessible through the URL http://cbp.icar.gov.in or of the link Capacity Building Program at http://icar.org.in.The home page of the system is depicted in Fig. 4. The CBP system was designed to cater different types of users [Fig. 1]. Major features available in each module is depicted in responsibility diagram [Fig. 5].

Fig.4. Home page

3.1 Course Director /CAFT Director Module

These modules facilitate for effective training management tasks in workflow manner. Functionalities available with Course Director are depicted in Fig. 6. Starting from proposal preparation, submission and to its tracking till approval are dealt in the initial phase of training proposal submission. Once training is approved then other training related task are performed in the system. Information related to different topics covered in the training are stored in the Time Table. User apply online for registration

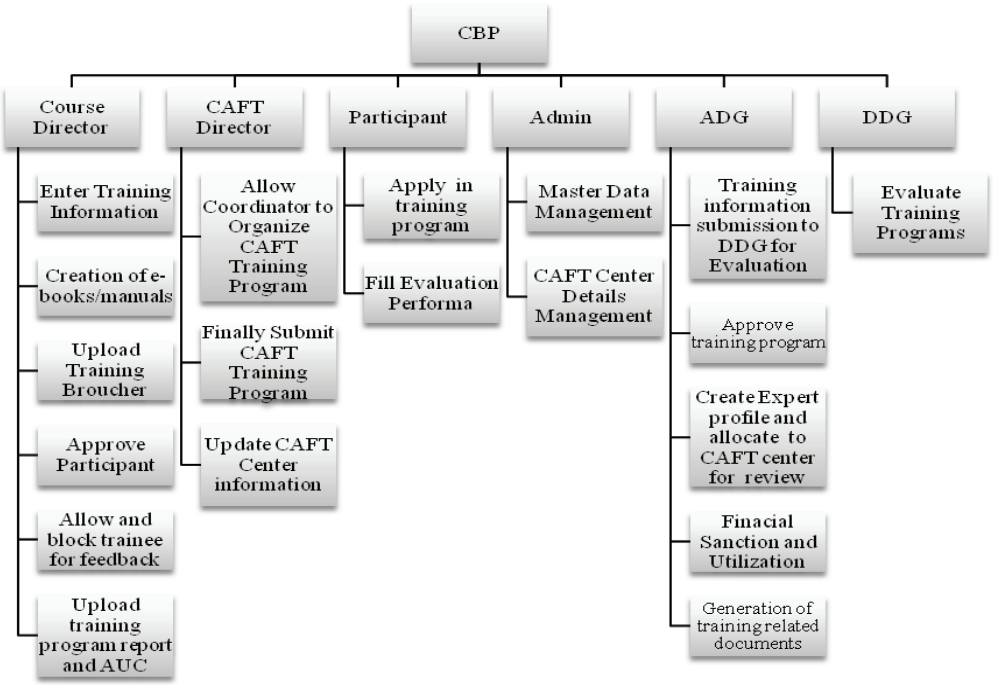


Fig. 5. User responsibility diagram

in the courses. Course Director selects the users and they are notified by the system generated mails. While course is conducted in the institute, Course Director can create the knowledge repository by adding lecture files in the system. A predefined template is created in the system for generating E-book of the training. During the course of the training, Course Director allows participants to fill the Evaluation Performa generated in the system on the basis of topics listed in the training. Training evaluation report is generated for the Course Director. Evaluation report presents summarized opinion of participants about the training program and at the same time provides details about participants on different criteria (State, Male/ Female, etc.) (Fig.7). After completion of the training program, audit utilization report and training reports are uploaded in the system for further use.

Apart from training management task available with Course Director, the CAFT Director has additional functionalities for creation and updating of web page for every CAFT center. CAFT Director can upload the previous training and participant information.

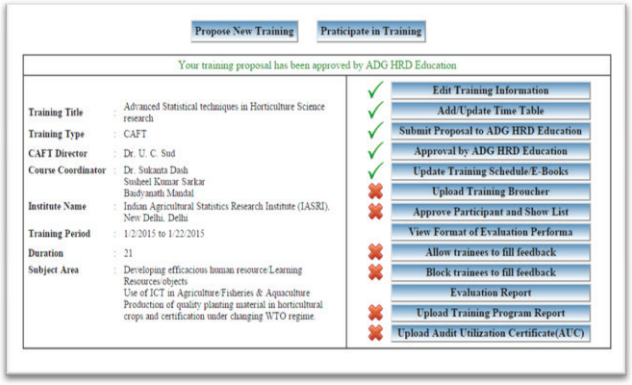


Fig. 6. Functionality in course director module

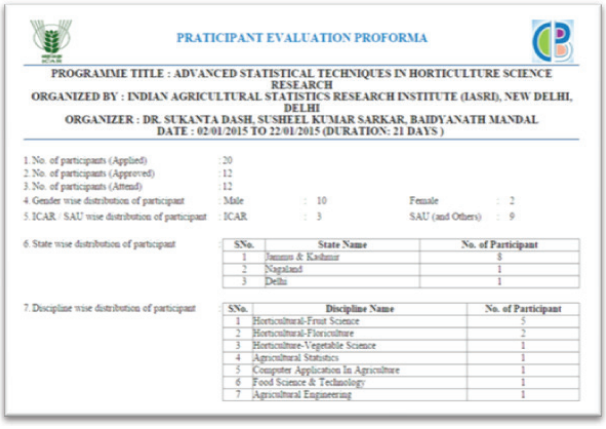


Fig. 7. Training evaluation report

3.2 Participant Module

User can apply into an approved training program using the login credentials. The steps for the candidates are as follows:

Step1: Fill online form consisting of personal, qualification, research, experience and other details. Advance application form will be generated from the system based on filled in value.

Step2: Take print out of advance form. Get it approved by authorities and upload the duly approved form in the system.

Step3: When user is selected for the training program then approval notification is received from the system.

Step4: User can send the confirmation of participation through the system.

Step5: When user attend the training program, then training evaluation form is filled online (Fig. 8).

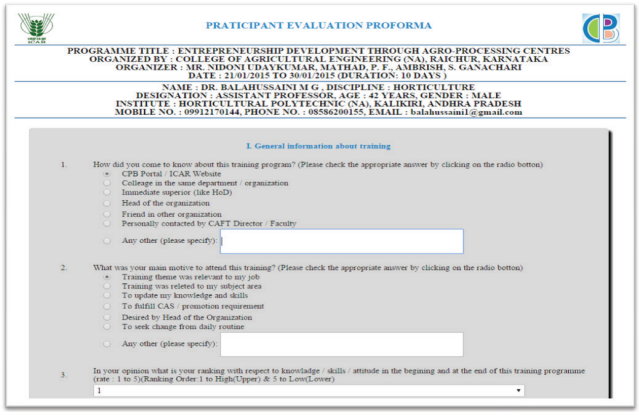
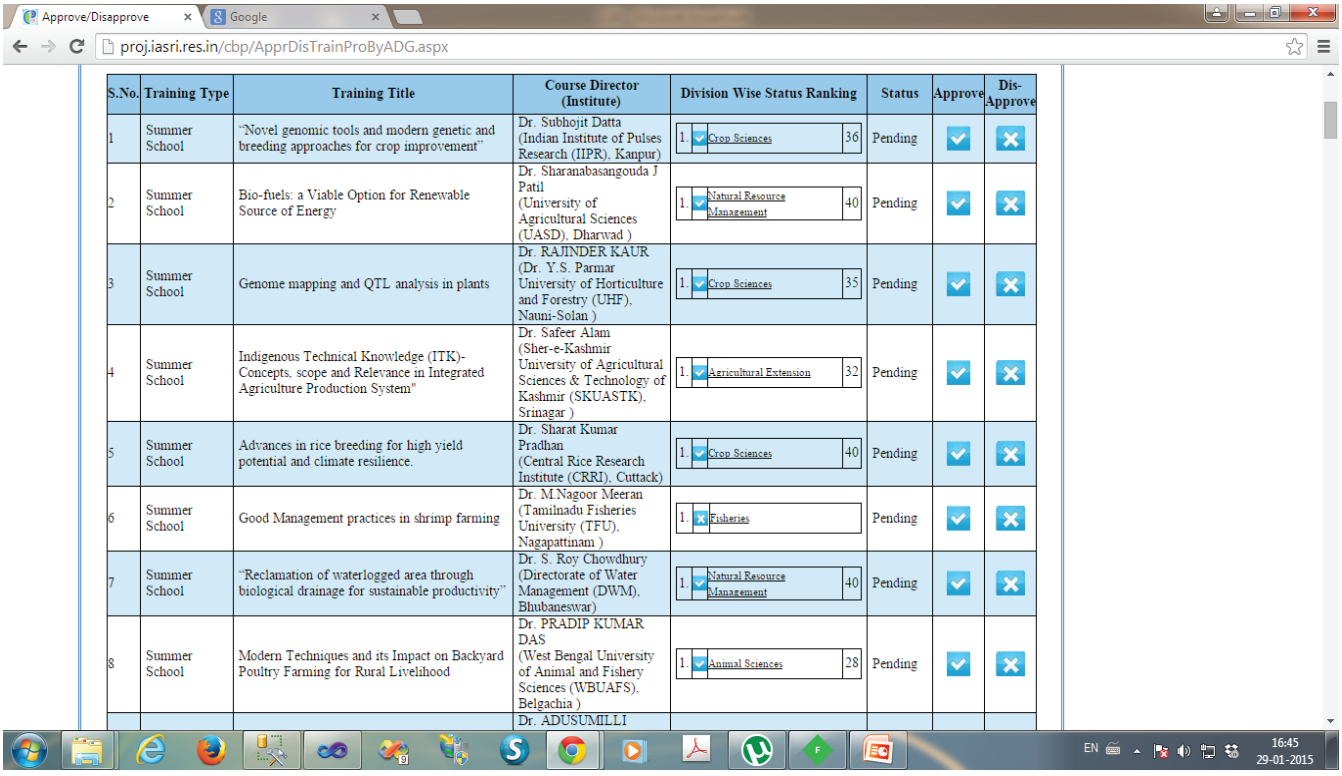


Fig. 8. Training evaluation form

3.3 ADG Module/ DDG Module

Managers are mainly involved in training proposal invitation, evaluation and approval. These processes are done in the system in a work flow manner (Fig.9). In ADG module, all the training proposals received is reflected in different subject matter areas. In DDG module, they can view the training proposal in respective subject areas. These proposals are evaluated online on defined parameters. Combined report of all the approved training programs are reflected in the ADG module. Once the training programs are



S.No.	Training Type	Training Title	Course Director (Institute)	Division Wise Status Ranking	Status	Approve	Dis-Approve
1	Summer School	"Novel genomic tools and modern genetic and breeding approaches for crop improvement"	Dr. Subhojit Datta (Indian Institute of Pulses Research (IIPR), Kanpur)	1. Crop Sciences 36	Pending		
2	Summer School	Bio-fuels: a Viable Option for Renewable Source of Energy	Dr. Sharanabasangouda J Patil (University of Agricultural Sciences (UASD), Dharwad)	1. Natural Resource Management 40	Pending		
3	Summer School	Genome mapping and QTL analysis in plants	Dr. RAJINDER KAUR (Dr. Y.S. Parmar University of Horticulture and Forestry (UHF), Nauni-Solan)	1. Crop Sciences 35	Pending		
4	Summer School	Indigenous Technical Knowledge (ITK)-Concepts, scope and Relevance in Integrated Agriculture Production System"	Dr. Safeer Alam (Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir (SKUASTK), Srinagar)	1. Agricultural Extension 32	Pending		
5	Summer School	Advances in rice breeding for high yield potential and climate resilience.	Dr. Sharat Kumar Pradhan (Central Rice Research Institute (CRRI), Cuttack)	1. Crop Sciences 40	Pending		
6	Summer School	Good Management practices in shrimp farming	Dr. M.Nagoor Meeran (Tamilnadu Fisheries University (TFU), Nagapattinam)	1. Fisheries	Pending		
7	Summer School	"Reclamation of waterlogged area through biological drainage for sustainable productivity"	Dr. S. Roy Chowdhury (Directorate of Water Management (DWM), Bhubaneswar)	1. Natural Resource Management 40	Pending		
8	Summer School	Modern Techniques and its Impact on Backyard Poultry Farming for Rural Livelihood	Dr. PRADIP KUMAR DAS (West Bengal University of Animal and Fishery Sciences (WBUAFS), Belgachia)	1. Animal Sciences 28	Pending		
			Dr. ADUSUMILLI				

Fig. 9. Training approval by managers

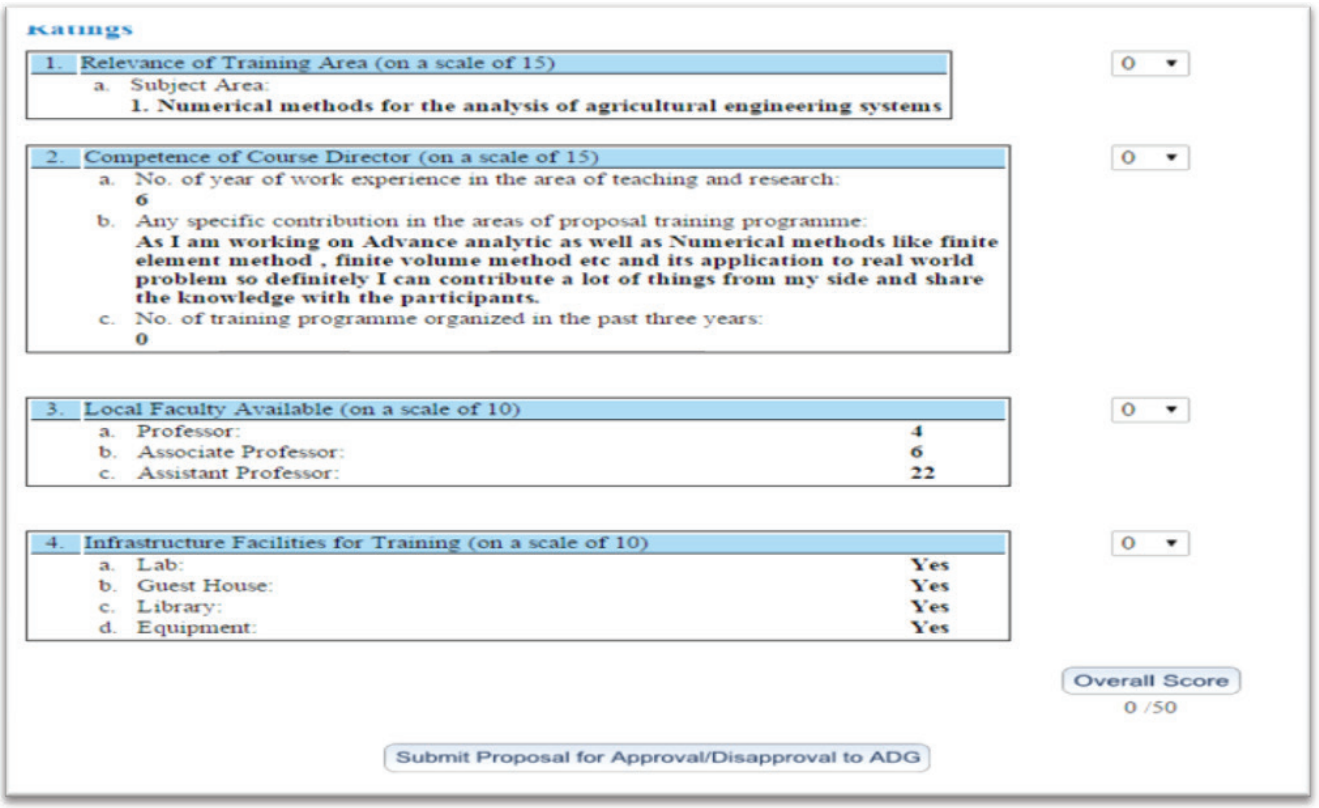


Fig. 10. Training evaluation by managers

officially approved then online communication is send through system to the Course Directors. ADG module has the features for generating training related documents (approval, financial sanction etc.). This module has data management features for uploading circulars, CAFT center details and photos etc.

Analytical reports were developed for this module ranging from report on single training to compiled reports for all the trainings and participants. These reports provide information on various parameters for different training programs (State, Discipline and Institute Wise participation). Reports are available on feedback of training programs on different criteria. There are reports on proposal submitted in various areas cutting across subject domain. Such reports aids in taking policy level decisions for inviting proposal for the next year. Results from the report can be exported to PDF and Excel formats for further analysis.

3.4 General Reports

Reports are part of all the modules as per user requirements. Some reports are available on the home page of the system for generic users.

- Report on approved training programs (CAFT, Summer-Winter Schools, Short Courses).
- Report on participants of the training program.
- E-books/ E-resourcesof training programs.
- CAFT Centers Information.

E-resources Module

The system has a good database of e-resources/ training manuals created in the training programs. Every Course Director has the responsibility to upload lecture files (in pdf or word format) on training topics. The CBP system automatically creates an e-book consisting of collection of lecture files uploaded by the Course Director. The title of the e-book is same as the training title. Approximately 225 e-books were created in the CBP system cutting across 86 subject matter areas of agriculture (Fig. 11). Approximately 7750 lecture files are part of these e-books. E-resources are in open access and are available to all visitors of the system.

Fig. 11. E-resources in CBP Vortal

4. CONCLUSION

The e-governance initiative taken by Education Division, ICAR is effectively contributing towards computerization of all of its training related activities and sharing of knowledge created across different subject areas of agriculture. Online system provides role based access to system users to ensure system control, right access and security. System has inbuilt work flows and document integration features at each stage which ensures adherence of defined process and availability of decisions and related documents / artifacts to right users. The Course Directors are able to manage all training related task from its submission to approval; participant approval, knowledge management, training management, feedback and financial submission in a predefined work flow. Participants are able to track their submission, read the training content and perform other training related task online. Large amount of knowledge in the form of e-books have been made available in open access through this system. The managers are using the system as a tool for policy planning as it provides real-time information of the training data. System provides instantaneous information of funds utilization which aid in planning /re-appropriation of funds for trainings. The databank of participants can be utilized by manager for planning the current and

future needs of human resources in NARES. Modular interface and database design provides flexibility in system to incorporate future requirements. Google analytics shows the solution is being used across by large number of users and contributing towards the human resource development effectively. System usage has resulted in timeliness, reliability of data and at the same time saving of cost and paper. Continuous updating and addition of new reports and modules in the system will go a long way in providing improved decision support to managers in the ICAR.

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