FILE NO. EMR/2016/000455
SCIENCE & ENGINEERING RESEARCH BOARD

5 & 5A, Lower Ground Floor
Vasant Square Mall
Plot No. A, Community Centre
Sector-B, Pocket-5, Vasant Kunj
New Delhi-110070

Dated: 25-Jul-2016

ORDER

Subject: Financial Sanction of the research project titled "**Design and Analysis of Sensitive Characteristics on Successive Occasions and its Applications** " under the guidance of Dr. Kumari Priyanka, Mathematics, Shivaji College , Ring Road, Raja Garden, New Delhi-110027, New Delhi, Delhi-110027 - Release of 1st grant.

Sanction of **Science and Engineering Research Board (SERB)** is hereby accorded to the above mentioned project at a total cost of **Rs. 1908100/- (Rs.** Nineteen Lakh Eight Thousand One Hundred **Only)** with break-up of **Rs. *117840/-* under Capital (Non-recurring) head** and **Rs.*1790260/-* under General (Recurring) head** for a duration of Three years. The items of expenditure for which the total allocation of **Rs. 1908100/-** has been approved are given below:
The following budget may be considered for **Shivaji College, Ring Road, Raja Garden, New Delhi-110027**

S. No	Head	Total (in Rs.)
A	**Non-recurring**	
1	Equipment -> Computer and Printer -> Statistica Software	117840
A'	*Total (Non-Recurring)*	***117840***
B	**Recurring Items**	
1	Recurring - A : (Manpower, Travel, Contingencies, Other Cost)	1616800
2	Recurring - B : (Overhead Charges)	173460
B'	*Total (Recurring)*	***1790260***
C	**Total cost of the project (A' + B')**	**1908100**

2. Sanction of the **SERB** is also accorded to the payment of
- **Rs. 117840/-** (Rupees One Lakh Seventeen Thousand Eight Hundred and Forty only) under 'Grants for creation of capital assets' and **Rs. 596753/-** (Rupees Five Lakh Ninety Six Thousand Seven Hundred and Fifty Three only) under 'Grants-in-aid General' to **Principal, Shivaji College, Shivaji College, Ring Road, Raja Garden, New Delhi-110027**
  being the first installment of the grant for the year 2016-2017 for implementation of the said research project.

3. The expenditure involved is debitable to **Fund for Science & Engineering Research (FSER)**
This release is being made under Extra Mural Research Funding (Individual Centric). (PAC Mathematical Science)

4. The Sanction has been issued to Shivaji College, Ring Road, Raja Garden, New Delhi-110027 with the approval of the competent authority under delegated powers on **21 July, 2016** and vide Diary No. **SERB/F/2379/2016-17** dated **23 July, 2016**

5. Sanction of the grant is subject to the conditions as detailed in Terms & Conditions available at website (www.serb.gov.in).

6. Overhead expenses are meant for the host Institute towards the cost for providing infrastructural facilities and general administrative support etc. including benefits to the staff employed in the project.

7. While providing operational flexibility among various subheads under head Recurring-A, it should be ensured that not more than Rs. 1.5 lakh each should be spent for travel and contingency.

8. As per rule 211 of GFR, the accounts of project shall be open to inspection by sanctioning authority/audit whenever the institute is called upon to do so.

9. The sanctioned equipment would be procured as per GFR and its disposal of the same would be done with prior approval of SERB.

10. The release amount of **Rs. 714593/-** (Rupees Seven Lakh Fourteen Thousand Five Hundred and Ninety Three only) will be drawn by the Finance & Budget Officer of the SERB and will be disbursed by means of RTGS transaction as per their

Bank details given below:

Account Name	**The Principal**
Account Number	**3068619668**
Bank Name & Branch	**Central Bank of India Central Bank of IndiaShivaji College, Raja Garden, New Delhi-110027**
IFSC/RTGS Code	**CBIN0283942**
Email id of A/C Holder	**shivajicollege.ac@gmail.com**
Email id of PI	**priyanka.ism@gmail.com**

11.The institute will furnish to the SERB, New Delhi, separate Utilization certificate(UCs) financial year wise to the SERB for Recurring (Grants-in-aid General) & Non-Recurring (Grants for creation of capital assets) and an audited statement of accounts pertaining to the grant immediately after the end of each financial year.

12. The institute will maintain separate audited accounts for the project. A part or whole of the grant must be kept in an interest earning bank account which is to be reported to SERB. The interest thus earned will be treated as credit to the institute to be adjusted towards further installment of the grant.

13. The project File no. EMR/2016/000455 may also be mentioned in all research communications arising from the above project with due acknowledgement of SERB.

14. The manpower sanctioned in the project, if any is co-terminus with the duration of the project and SERB will have no liability to meet the fellowship and salary of supporting staff if any. beyond the duration of the project

15. As this is the first grant being released for the project, no previous U/C is required.

16. The institute may refund any unspent balance to SERB by means of a Demand Draft favoring "FUND FOR SCIENCE AND ENGINEERING RESEARCH" payable at New Delhi.

K.K. Magesh

(Dr. Magesh K K)
Scientist C
ms_ms@serbonline.in

To,
Finance & Budget Officer
SERB, New Delhi
Copy forwarded for information and necessary action to: -

1.	The Principal Director of Audit, A.G.C.R.Building, IIIrd Floor I.P. Estate, Delhi-110002
2.	Sanction Folder, SERB , New Delhi.
3.	File Copy
4.	**Dr. Kumari Priyanka** **Mathematics** **Shivaji College , Ring Road, Raja Garden, New Delhi-110027, New Delhi, Delhi-110027** **Email: priyanka.ism@gmail.com** **Mobile: 919968619556** (Start date of the project may be intimated by name to the undersigned. For guidance, terms & Conditions etc. Please visit www.serb.gov.in.)
5.	**Principal, Shivaji College,** **Shivaji College, Ring Road, Raja Garden, New Delhi-110027** (Receipt of Grant may be intimated by name to the undersigned)

K.K. Magesh

(Dr. Magesh K K)
Scientist C
ms_ms@serbonline.in

Annexure-IX

PROJECT COMPLETION REPORT

1. Title of the project: **Design and Analysis of Sensitive Characteristics on Successive Occasions and its Applications**

2. Principal Investigator: **Dr Kumari Priyanka**

3. Implementing Institution: **Shivaji College**
   (University of Delhi)
   New Delhi-110027

4. Date of commencement:**18/08/2016**

5. Planned date of completion:**17/08/2019**

6. Actual date of completion:**17/08/2019**

7. Objectives as stated in the project proposal:
   - Identification of different sensitive parameters, which are changing by time.
   - Selection/proposition of relevant randomised response techniques confirming the anonymity of respondents and confidentiality of responses are protected.
   - Suitable sample selection mechanism, survey frequency, rotation design and estimation procedure will be investigated to handle sensitive issues.
   - For each rotation scheme developed the optimum replacement strategies will be discussed. The properties (in terms of bias, variance/ mean squared error) minimum variance etc., will be analysed and results will be tested on real data (data may be collected or published data may be used).
   - Target specific simulation techniques will be designed and computer program will be developed to show the working version of the different proposed estimators on successive occasions for sensitive characters.
   - The proposed estimators will be compared with different recent literature (very few available) in the field to show its performance compared to other and thereby reducing what is often a hindrance to the use of surveys repeated over time on controversial topics.

8. Deviation made from original objectives if any, while implementing the project and reasons thereof: **Project work is implemented as per the original objectives.**

9. Experimental work giving full details of experimental set up, methods adopted, data collected supported by necessary table, charts, diagrams & photographs:

   In order to validate the theoretical results, published real data have been utilized. Simulation algorithms have been designed for each problem and is implemented on the data using MATLAB software.

Kumari Priyanka

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Principal Investigator
SERB, DST Sanctioned MRP No. (EMR/2016/000455)
Title: "Design and ... and its applications"
... Mathematics
... of Delhi)

10. Detailed analysis of results indicating contributions made towards increasing the state of knowledge in the subject:

Several social and cultural reforms take place from the learnings of past experiences related to morally challenging issues. People stigmatized of the socially unaccepted behaviour leads to underrate or overrate the real existing status of such issues. Therefore, need for apt methodologies arises to observe such tangible characters over a span of period when changes emerge in the society and culture. For example, there are many sensitive issues such as induced abortion, plagiarism, negligence of government rules, domestic violence, incidence of ragging in institutions, eve teasing, drug addiction, HIV infection status, use of plastics, incidence of molestation/rape, absence in voting, exploitation of natural resources, spreading pollution etc., which are prevailing in society and affects directly or indirectly the quality of living and surrounding of human beings. So the address and analysis of these sensitive issues become an important problem.

For analysis of sensitive issues, the related data pertaining to sensitive issues are required but as the issues are sensitive in nature, the collection of related data becomes extremely difficult. Many respondents either refuse to participate or give false or evasive responses. Even if some people respond, then there may be chances of social desirability bias in the response, as the people wish to respond the socially desirable answer. Hence, in such situations the method that protect anonymity are solutions. A big challenge to deal with sensitive issues is the degree of privacy protection provided by the mechanism adopted, as respondents are not interested in what technique are being used to get information on sensitive issues, they are more concerned about the protection of their privacy.

But, any how the issues need to be addressed and analysed and the corrective measures need to be taken. If the sensitive issues also changes over time, then it is required to monitor the sensitive issues continuously at different intervals of time, so that reflection of actual scenario in society related to the sensitive issues as well as changed level of sensitivity of issues with respect to time may be understood in a better way. These can be accomplished by successive or repetitive sampling. If the character under study changes by time, then we go for successive sampling. But, to collect response related to sensitive issues, the interviewer has to make strenuous effort to get the true response from the respondents over successive points of time. Therefore, the way out is indirect questioning technique, which may help to get the honest response ; increase the anonymity of survey process and ensures the protection of

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IST general class of estimator is more efficient than the other two. Further the idea of utilising additional multi auxiliary information in IST successive sampling frame work is implemented by proposing IST calibration estimators. General sampling design under IST setup has been used with calibration technique to estimate sensitive population mean in successive sampling. Possible estimators of successive sampling designs have been explored under IST set up.

The detail properties for these newly developed estimators have been discussed. Optimum replacement policies have been analysed. Privacy protection have also been explored. The effectiveness of different models has been discussed while comparing it with the direct questioning methods. Relevant simulation studies have been designed and implemented using MATLAB software for each newly developed estimators. Extensive numerical studies have been carried out to substantiate the theoretical results. All the research work carried out under the project added new and effective literature and hence increase the state of knowledge in the subject.

11. Conclusions summarizing the achievements and indication of scope for future work:

From the research work carried out under the project, following conclusions can be drawn:

I. The estimation of sensitive population mean in successive sampling is feasible.
II. The Randomized Response Technique(RRT) and Scrambled Response Technique(SRT) and the Item Sum Technique(IST) can be applied in successive sampling to estimate sensitive population mean.
III. The new proposed scrambled response model is proved to be more efficient model as it do not involve any unknown constant than the existing models, modified to work for sensitive population mean estimation in successive sampling.
IV. Out of the three techniques RRT,SRT and IST, the IST is more user friendly technique and protect the privacy of respondents to a great extent.
V. The IST calibration estimators under general sampling design is also feasible in successive sampling which provides a wider application of IST.
VI. Estimators involving indirect methods (RRT, SRT, IST) when compared with corresponding direct method. Then some amount of percent relative loss is observed. But

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Principal Investigator

we need to tolerate this loss as the issues are sensitive, hence if direct method is applied, then we may not get true response.

Future Scope:

More indirect questioning techniques may be investigated to deal with sensitive issues in successive Sampling. More realistic measures that protect the privacy of respondents can be investigated. The proposed estimators can be modified for other cases like two phase sampling, cluster sampling, Stratified random sampling etc.

Despite of all efforts, if there occurs some non- response, then these techniques may be modified to deal with non-response while estimating sensitive issues changing over time.

12. S&T benefits accrued:

i. List of Research publications

S.No	Authors	Title of paper	Name of the Journal	Volume	Pages	Year
1.	Priyanka, K., Trisandhya, P., and Mittal, R.	Dealing Sensitive Characters on Successive Occasions through a General Class of Estimators using Scrambled Response Techniques.	**METRON**	76(2)	203-230	2018
2.	Priyanka, K., and Trisandhya, P.	A composite class of estimators using scrambled response mechanism for sensitive population mean in successive sampling.	**Communications in Statistics- Theory and Methods.**	48(4)	1009-1152	2019
3.	Priyanka, K., Kumar, A. and Trisandhya, P.	Modelling Sensitive Issues on Successive Waves.	**Statistics in Transition-New Series**	20(1), DOI: 10.21307/stattrans-2019-003.	41-65	2019
4.	Priyanka, K., Kumar, A. and Trisandhya, P.	Some classes of estimators for sensitive population mean on successive moves.	**Journal of statistical Theory and Practice**	13(1)	9	2019

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5.	Priyanka, K., and Trisandhya, P	The Item Sum Techniques for Quantitative Sensitive Estimation on Successive Occasions.	**Communications for Statistical Applications and Methods**	26(2)	1-15	2019
6.	Priyanka, K., Trisandhya, P. and Mittal,R.	Scrambled Response Techniques in Two Wave Rotation Sampling for Estimating Population Mean of Sensitive Characteristics with Case Study	**Journal of Indian Society of Agricultural Statistics**	73(1)	47-59	2019
7.	Priyanka, K., Kumar,A. and Trisandhya, P.	Calibration Estimators for Quantitative Sensitive Mean Estimation Under Successive Sampling.	**Communications in Statistics- Theory and Methods.**	DOI:10.1080/03610926.2019.1649430	-	2019
8	Priyanka, K., andTrisandhya, P.	Incredibly Efficient Procedures for estimating sensitive issues on Successive Occasions.	**Statistica** (Under Consideration. Manuscript No:8561).			2019
9	Trisandhya, P., Priyanka,K. andKumar,A.	Estimation of Quantitative Sensitive Mean by Item Sum Technique in Successive Sampling	**Communications in Statistics-Simulation and Computation** (Under Consideration. Manuscript No:LSSP-2019-0472).			2019

ii.

a) Manpower trained on the project: **JRF (01)**

b) No. of Ph.D. produced: **01(On going)**

c) Other Technical Personnel trained: **Nil**

iii. Patents taken, if any: **Nil**

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