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Agricultural Extension in South Asia

NEW ADVANCES IN EXTENSION RESEARCH METHODOLOGIES-Part 1

To improve the rigour of extension research, one should use new and effective research methodologies. This is the first in a two-part blog series by Dr P Sethuraman Sivakumar who discusses some of these new approaches.

INTRODUCTION

Extension is a multi-disciplinary science engaged in solving complex problems in agriculture. With increasing complexities in farming, environment and social system, extension has to achieve multiple development goals ranging from sustainability to increasing farm income and enhancing sector competitiveness. In other words, extension in the current context must reinvent itself from its primary goal of "stretching out" the university science to generation, adaptation and application of new knowledge.

Extension research is the backbone of the "extension discipline". As a "field-oriented" professional discipline, the extension research has relied heavily on exploration, facilitation and appraisal/assessment by employing qualitative and quasi-quantitative methods. The extension researchers' perception of a "field oriented discipline" has largely affected his/her selection and use of methods, resulting in "less significant" outputs. Though the extension research was envisaged to develop sound methods and models to help the field functionaries for effective delivery of extension services, very little progress has been made in the past six decades. Absence of a "rigorous approach" for advancing the extension science is the primary reason for these lacunae and there is an urgent need to look into the "mechanics" of conducting extension research.

The purpose of this blog is to assess the existing research approaches in extension with a focus on its methods, tools and techniques so as to suggest new and effective alternatives to derive quality research outputs. The approach followed in this blog is based on the following assumptions:

- Extension is an applied social science with a structured way to address the needs of stakeholders
- Extension research focuses on development of methods to improve field extension
- Most extension research problems are multi-dimensional in nature

- Generalizing results is the key for advancement of any professional discipline
- A systematic, empirical approach can help to produce tangible outcome while advancing theory

CURRENT STATE OF EXTENSION RESEARCH IN INDIA

Narrow focus on the research problem

Most extension problems are multi-dimensional in nature, caused by the interplay of physical, chemical, biological and human factors. For example, non-adoption of a rice variety by a specific group of farmers could be due to its disease susceptibility, consumer dislike of taste/texture or high milling cost. The extension research is expected to use a variety of methods from cultural anthropology (e.g. Participatory Rural Appraisal (PRA), consumer psychology (e.g. hedonic testing), agricultural engineering (e.g. milling studies) and economics (e.g. Benefit-cost analysis) to solve this issue. However, the existing research on adoption focuses only on identifying the problems and assess their relative importance using extension research methods – PRA and adoption indices, without integrating methods from other sciences to establish the cause-effect relationship in an objective way .

Little or no utility to the significant stakeholders

The outcomes of extension research benefits a diverse user group comprising of farmers, small scale industries, traders, input and marketing agencies, academicians, scientists and students besides helping policymakers to decide on critical policy issues. However, the current extension research is often confined to academic journals and professional groups without benefiting its intended users (Prasad, 2014). For example, the attitude scales developed at the academic and research institutions offer little help to the extension field functionaries and policy makers to improve their decision-making.

Heavy reliance on exploratory approaches

The extension research is considered as largely “ex-post facto”. Experimental or hypothesis testing approaches were often viewed as luxury by academicians and scientists. In a field-oriented discipline, this absence of the “manipulative capacity” produces results with limited ability to generalise. For example, the impact assessment of technology or educational interventions is often conducted “ex-post facto” without assessing the situation prevailing before the intervention. Though extension interventions are primarily “experimental” in nature, which are implemented using a specific combination of actions to produce desirable outcomes, using the “post-assessment” approach may not produce accurate results.

Inappropriate methods and techniques

Choosing a “right” research method for a specific research problem is a concern in the extension science. The academic research constitutes over 60% of the total extension research output delivered in a calendar year, in terms of the research papers published in peer reviewed journals. As the PhD and MSc research is time-bound and conducted in a limited resource environment, they follow a tested and popular research approach with limited scope for experimentation. Using similar methods for a variety of research problems may bring inappropriate results. For example, the marketing behaviour studies employ same methods for studies across a variety of field and horticultural crops, livestock etc. Though the crops differ in terms of duration, method of cultivation and methods of marketing, the researchers follow same tests, scales and schedules for all these studies. Besides, there is tendency among innovative and enthusiastic researchers to rush into innovative research areas or using new methods without gaining adequate insights into the

requirements and assumptions of these methods, resulting in a misfit into the research problem and reporting spurious relationships in a subjective way.

In view of the above problems or lacunae, there is a need to analyse the research approaches to identify sound alternatives to improve the quality of research outcomes

ADVANCED METHODS

Assessing the technology performance and effects

Assessing the technology performance and effect is crucial for extension managers, scientists and policymakers. The assessment helps in (1) deciding the effect of agricultural technologies on the target population, (2) setting research and development priorities and (3) formulating strategies and policy decisions to facilitate innovations and technology. The technology performance is often assessed through diffusion paradigm by quantifying technology adoption at different stages, while the effects are quantified by impact assessment.

Roger's Classical Normal Distribution Model

The adoption and diffusion research in extension has focused mostly on the Classical Normal Distribution Model following s-shaped curve proposed by Rogers (Rogers 1983). A large number of extension research studies were conducted on the communication channels (e.g. development of communication strategy – audio-visual aids, mass media and interpersonal channels, and testing their effectiveness), innovation (e.g. assessment of suitability), and effects on the social system (e.g. adoption and impact). Though past studies have fostered the understanding of innovation diffusion in agriculture, several research gaps remain. Very few research works focused on the technology diffusion over time linking the innovation diffusion with new technology performance. Besides, the Roger's model is simplified representations of the reality of diffusion processes (Roling, 1988) which has little ability to predict future adoption of innovations (Mahajan et al., 1990). Research studies conducted on high-tech products (Moore, 1991), environmentally sound manufacturing technologies (Sroufe et al, 2000) and classroom response systems (Towns, 2010) reported the presence of a "chasm" between early adopters of the technology and rest of the adopter groups.

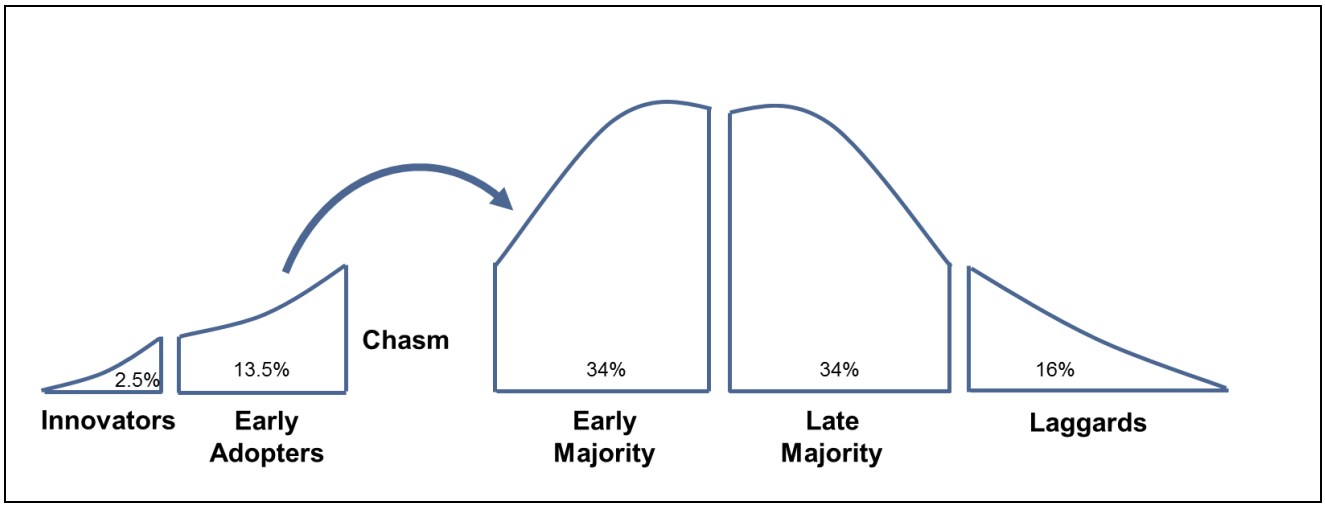

Figure 1. Chasm in the diffusion process (Source: http://eavoices.com/)

Despite all limitations, Roger's model is widely used in the diffusion of innovations research. Using a longitudinal research design with a cohort approach helps to assess the technology adoption

across time. An IFPRI research on long-term impacts of vegetable and polyculture fish production technologies on a variety of measures of household and individual well-being in Bangladesh is a classic example of this approach (Kumar and Quisumbing, 2010).

Alternate adoption models

Few alternative adoption/diffusion models (described in Table 1) provide wide options to enrich conceptual clarity and methodological rigor to extension research. These methods provide flexibility to assess adoption through cross-sectional approach.

Table 1. Alternate models to study diffusion and adoption of agricultural innovations

Theory or model	Proposed by	Features	Applications
Concerns-Based Adoption Model (CBAM)	Hall and Loucks (1978)	Explains how an individual's concerns influence his or her integration of an innovation in a classroom or work setting	Teachers' use of action research (Khoboli and O'toole, 2012); technology change and adoption (Davis and Roblyer, 2005).
Technology Acceptance Model (TAM)	Davis et al. (1989)	An information systems theory that models how users come to accept and use a technology.	ICT Adoption Behavior of Rural Young Entrepreneurs (Zaremohzzabieh et al., 2015)
Bass model	Bass (1969)	Cumulative adoption model based on S curve Assumes that the speed and timing of adoption depends on innovators' or imitators' degree of innovativeness and the degree of imitation among adopters	Adoption of pesticide use by Nigerian cocoa growers Akinola (1986). Agricultural change at farm and regional level (Wossink, 1993)

Assessment of effects of extension intervention

Assessing effect of an intervention on the target group is a crucial component for establishing the utility of an intervention. According to World Bank, impact assessment is intended to determine more broadly whether the program had the desired effects (positive and negative) on individuals, households, and institutions and whether those effects are attributable to the program intervention (Baker, 2000). In the National Agricultural Research and Education System (NARES), the impact assessment is used to assess the socio-economic effects of an intervention, problems associated with technologies and user systems, and setting research and development priorities. While the agricultural economists followed a quantitative scientific statistical approach, the extension professionals focused on the "social and behavioural effects" of the intervention. The common impact assessment paradigms followed in social sciences are displayed in Box 1.

An innovative impact assessment approach developed by Ms. Susanne Neubert of German Development Institute, Germany, MAPP (Method for Impact Assessment of Poverty Alleviation Projects, 1998) combines a quantitative approach with participatory assessment to derive tangible results to address the needs of managers and policy makers. In this method, the impact is assessed through a series of workshops with stakeholder representatives. It has wide applications to analyse complex development goals like poverty reduction, democratization, good governance, economic and sustainable development. A detailed description of various impact assessment methods used in socio-economic research can be found at http://are.berkeley.edu/~sadoulet/papers/deJanvryetal2011.pdf

Box 1: Impact assessment paradigms in extension research (Spath, 2004)

A quantitative or "scientific" statistical method
Addresses a fundamental question: *What would the situation have been if the intervention had not taken place?*
Uses and experimental approach - Comparing program participants (treatment group) with a control or comparison group.
Weaknesses – Quantification of impact without exploring the reasons; high cost and requires specialised expert skills

Qualitative method
Inductive approach derived from sociology and anthropology
Using qualitative tools like key informant interviews, participants' observations, case studies, focus group discussions, etc
The results are location-specific and cannot be generalised.

Participatory learning and action method
Involves stakeholders in all stages of the evaluation or assessment, such as determining the objectives of the study, identifying and selecting indicators to be used, and participating in data collection and analysis etc
Assume that the beneficiaries are empowered through the research process itself
Methods and tools - participatory appraisals, action learning methods, etc.

Prediction and forecasting

Predicting the future of a technology using the forecasting procedures helps in (1) assessing the demand of the technology at specific time period, (2) understanding the impact created or expected by the stakeholders and (3) identifying the need for developing and refining technology. In general, a prediction is deriving an outcome based on deductive logic or beliefs while forecast is a means to validating a prediction based on an analysis of varying factors and patterns. Though the prediction and forecasting are largely quantitative, conducted mostly by economists, they are equally important for extension science as well.

There are many overlapping forms of forecasting technology developments and their impacts, including technology intelligence, forecasting, road mapping, assessment, and foresight. Several technology forecasting methods have been developed over the years and it is essential for any forecaster to match the method with the purpose with logic and commonsense to derive accurate estimates. The forecaster has to judiciously select a technique or a combination of techniques depending upon the methodology and end objective in view. The technology forecasting techniques traditionally used to derive technology performance estimates are summarised in Figure 2.

The Massachusetts Institute of Technology (Firat et al., 2008) identified nine families of forecasting methods (Box 2). Though many methods are quantitative in nature which demands high-level mathematical/statistical skills, few of them are relatively easy to understand and use. A few prediction and forecasting tools that are relevant for extension professionals are discussed below.

Judgemental forecasting

The judgemental forecasting methods including Delphi and scenario analysis can be effectively used in extension research. These forecasting methods are used in ambiguous situations where

the information on past performance of a technology or a service is not available. For example, if a food technologist wishes to assess the market demand for a novel food like gluten-free pasta, where the data on the market demand of pasta is either not available or not accessible, the extension professional can help to estimate the approximate demand by using the judgemental methods. These methods rely on expert opinion who uses incorporate intuitive judgement and opinions to derive subjective probability estimates.

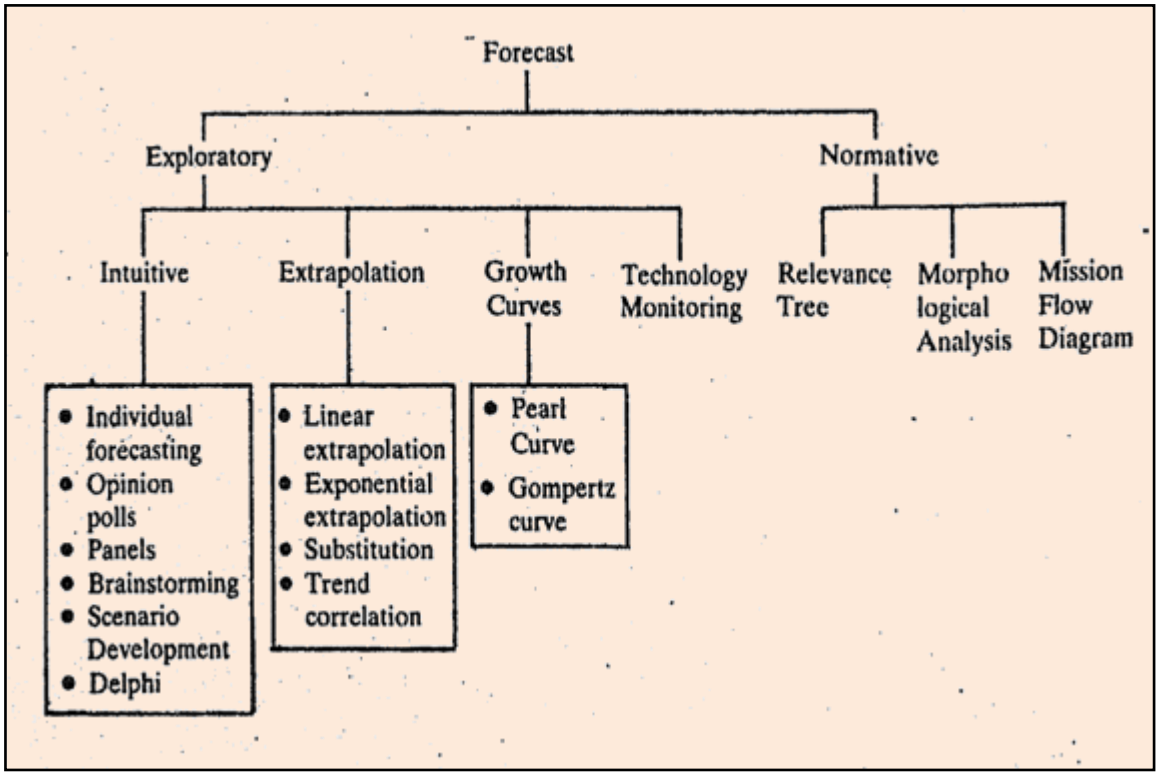

Figure 2. Summary of technology forecasting methods

Delphi method

Delphi is a popular judgemental method, developed by RAND Corporation in Santa Monica, USA during 1950s. The Delphi uses a convergent approach to develop expert estimate on a particular aspect (e.g. demand of a technology, price, cost of a project, etc) using a two or three stages assessment, where experts' opinions are collected and information is combined, and then returned to the experts for re-evaluation A classic example of Delphi study is the USDA forecasts for soybean and corn prices (Isengildina et al, 2004). Delphi method was also used for strategic planning (Rikkonen et al., 2006), identify locations for Agricultural Service Center (Zangeneha et al., 2015) and need assessment for crisis communication (McGuire et al., 2012).

Recently, the computer based real time or almost real time Delphi is gaining popularity owing to its cost and time saving processes. The dissensus-based Delphi, an exploratory variant of the classical Delphi, focuses on divergent approach where a variety of opinions or estimates are derived through expert consultation on a particular issue for on a bipolar distribution (e.g. high to low, good to bad) (Steinert, 2009). This method was developed by Turoff in 1970 which is widely used in policy analysis. Two examples of dissensus delphi are argument Delphi (Kuusi, 1999) and disaggregative Policy Delphi (Tapio, 2003).

Box 2: Family of forecasting methods

1) Expert Opinion
- Delphi (iterative survey)
- Focus Groups [panels, workshops]
- Interviews
- Participatory Techniques

2) Trend Analysis
- Trend Extrapolation [Growth Curve Fitting]
- Trend Impact Analysis
- Precursor Analysis
- Long Wave Analysis

3) Monitoring and Intelligence Methods
- Monitoring [environmental scanning, technology watch]
- Bibliometrics [research profiling; patent analysis, text mining]

4) Statistical Methods
- Correlation Analysis
- Demographics
- Cross Impact Analysis
- Risk Analysis
- Bibliometrics [research profiling; patent analysis, text mining]

5) Modeling and Simulation
- Agent Modeling
- Cross Impact Analysis
- Sustainability Analysis [life cycle analysis]
- Causal Models
- Diffusion Modeling
- Complex Adaptive System Modeling (CAS) [Chaos]
- Systems Simulation [System Dynamics, KSIM]
- Technological Substitution
- Scenario-simulation [gaming; interactive scenarios]
- Economic base modeling [input-output analysis]
- Technology Assessment

6) Scenarios
- Scenarios [scenarios with consistency checks; scenario management]
- Scenario-simulation [gaming; interactive scenarios]
- Field Anomaly Relaxation Method [FAR]

7) Valuing/Decision/Economics Methods
- Relevance Trees [futures wheel]
- Action [options] Analysis
- Cost-benefit analysis
- Decision analysis [utility analyses]
- Economic base modelling [input-output analysis]

8) Descriptive and Matrices Methods
- Analogies
- Backcasting
- Checklist for Impact Identification
- Innovation System Modeling
- Institutional Analysis
- Mitigation Analysis
- Morphological Analysis
- Road mapping [product-technology road mapping]
- Social Impact Assessment
- Multiple perspectives assessment
- Organizational analysis
- Requirements Analysis [needs analysis]

9) Creativity
- Brainstorming [brain writing; nominal group process (NGP)]
- Creativity Workshops [future workshops]
- TRIZ
- Vision Generation
- • Science Fiction Analysis

Scenario analysis

Scenario analysis is a process of analyzing possible future events by considering alternative possible outcomes. It is useful to generate a combination of an optimistic, a pessimistic, and a most likely scenario of any commodity or aspect. This is an important tool in the world of finance

and economics, and is used extensively to make projections for the future. “Scenario planning” was developed in the 1950s (Kahn and Wiener 1967) and it has been used in the area of sustainable development (Rotmans et al. 2000). The scenario analysis is used successfully to assess the impact of water and agriculture policy scenarios on irrigated farming systems in Italy (Bartolini et al., 2007) and participatory water management planning in France (Graveline et al., 2014).

Scenarios are arrived at by a team composed of key decision makers, experts, and stakeholder representatives during two or three one-day workshops held over a period of weeks or months. The flowchart depicting the steps in scenario analysis is given in Figure 3. Scenario analysis involves *constructing or developing scenarios* (steps 1-4 below), and *integrating the content of scenarios into decision making* (steps 5-8 below).

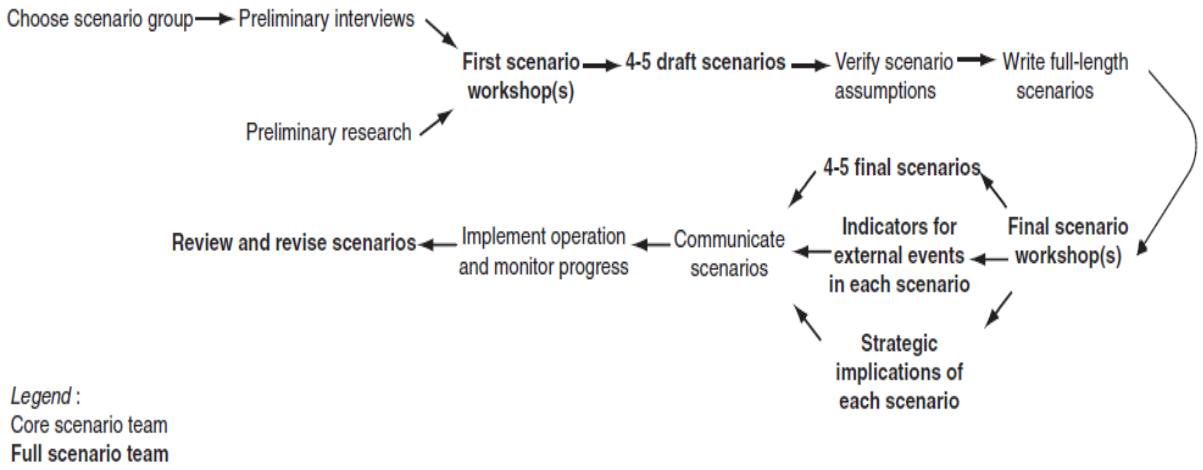

Figure 3. Steps in scenario analysis

CONCLUSIONS

The quality of extension research depends on its methodological rigor and ability to produce results that can be generalised across the similar socio-economic systems. Though the current extension research focused on diverse areas with a variety of research methods, they are inadequate to deliver results that are significant, tangible with wide applicability.

The first part of this blog paper has discussed about the weaknesses and limitations in the existing research approaches in general, with an emphasis on methodologies and suggested alternative methods for adoption and diffusion research, impact assessment and forecasting. In the second part of this blog series, I will discuss the recent developments in the scale construction and questionnaire optimisation, perception/preference measurement, ICT/communication research and consumer studies.

Integrating new methods into the existing extension research paradigm requires a strategic approach comprising of organising capacity building programmes at the university or research institute level (to equip the budding and mid-career extension professionals with state-of art research skills); improving the quality of academic research by diversifying research themes and methods, enhancing the quality of research publications in the peer-reviewed journals through rigorous review process and reorienting the extension research courses by incorporating new research methods and techniques.

AESA: Previous blogs on this theme

1. RESEARCH IN EXTENSION: NEW TOOLS TO REINVENT ITS FUTURE, Dr P Sethuraman Sivakumar. March, 2013. (available at http://aesagfras.net/Resources/file/Blog%204%20Enhancing%20the%20potential%20of%20quality%20videos%20for%20farmers.pdf)
2. RESEARCH IN EXTENSION: IT IS TIME TO INTROSPECT, Dr R. M. Prasad. March, 2013. (available at http://aesagfras.net/Resources/file/Blog%205Research%20in%20Extension%20It%20is%20time%20to%20introspect.pdf)
3. EXTENSION RESEARCH AND TECHNOLOGY DEVELOPMENT, Dr M J Chandra Gowda, Dr Sreenath Dixit, Dr R Roy Burman & Dr P N Ananth. February, 2014. (available at http://aesa-gfras.net/Resources/file/FINAL-M_J_Chandre%20Gowda-13-FEB.pdf)
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5. SCIENTIFIC PUBLISHING IN EXTENSION: ARE WE DOING ENOUGH AND ARE WE DOING WELL? (Dr S V N Rao, Dr K Natchimuthu and Dr S Ramkumar. October 2014. (available at http://aesa-gfras.net/Resources/file/Blog%2040.pdf)
6. NEGOTIATING REALITY: A PRAGMATIC APPROACH FOR CONDUCTING QUALITY EXTENSION RESEARCH Dr P Sethuraman Sivakumar December 2014. (available at http://www.aesa-gfras.net/Resources/file/RS-eds-12FEB-2015%20final%20ver%20Blog%2044%20(1).pdf)

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