Electronic Voting Machines: A Case of Study

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1 Abstract

Elections in India are conducted almost exclusively using elec- tronic voting machines developed over the past two decades by a pair of government-owned companies. These devices, known in India as EVMs, have been praised for their simple design, ease of use, and reliability. We will try to understand the social and political requirements of an EVM design: correctness, tamper proof guarantees, coercion free etc and try to work out a formal specification of an EVM design based on the requirements. Also, we will try to work out a functional design and verify the correctness against specification using a formal technique like Model checking or Automated theorem proving.

2 Introduction

India is the world's largest democracy. In recent national elections, more votes were cast than the combined population of the United States and Canada, and the vast majority of voters used paperless direct-recording electronic (DRE) voting machines. Though paperless DREs have been largely discredited in the academic security literature, Indian election authorities continue to insist that the electronic voting machines used in India, widely referred to as EVMs, are fully secure. For example, the Election Commission of India, the country's highest election authority, asserted in an August 2009 press statement: "Today, the Commission once again completely reaffirms its faith in the infallibility of the EVMs. These are fully tamper-proof, as ever". As recently as April 26, 2010, Chief Election Commissioner Navin B. Chawla was quoted in the media as saying the machines were "perfect" with no need for "technological improvement". To justify these claims, officials frequently cite the design of the EVMs, which is vastly simpler than that of most other DREs used globally, and a number of procedural safeguards. However, the details of the machines' design have been a closely guarded secret, and, until now, they have never been subjected to a rigorous independent security review. [**?**]

In this paper, we want to provide the reader with information about the Indian electronic voting system and work out a formal specification for the EVMs. This includes reasons to change from the earlier paper ballot system

and design challenges for EVM in the Indian context. We are writing with in the frame of a theoretical model called Social Construction of Technology (SCOT), developed by Wiebe Bijker and Trevor Pinch (1987). Along the lines of this model we argue that after the EVM has been adopted in India, different 'relevant social groups' interpreted the EVM in diverse ways. From the social constructivist perspective we argue there has been not just one but at least three different EVMs. With time the 'interpretative flexibility' diminished and 'relevant social groups' more or less agreed on one interpretation of the EVM.

3 Challanges for EVM in India

- **Cost**: With well over a million EVMs in use, the cost of the system is a major concern. The current EVMs are built from inexpensive commodity parts and cost approximately $200 for each set of units, far less than many DREs used in the U.S., which cost several thousand dollars.

- **Power**: Many polling places are located in areas that lack electricity service or have only intermittent service. Thus, the EVMs operate entirely from battery power, rather than merely using a battery as a backup.

- **Natural Hazards**: ndia's varied climate has great extremes of temperature, as well as other environmental hazards such as dust and pollution. EVMs must be operated under these adverse conditions and must be stored for long periods in facilities that lack climate control. An Election Commission report cites further dangers from "attack by vermin, rats, fungus or due to mechanical danger, [that might cause] malfunction".

- **Illitracy**: Though many Indian voters are well educated, many others are illiterate. The country's literacy rate in 2007 was 66%, and only about 55% among women, so handling illiterate voters must be the rule rather than the exception. Thus, ballots feature graphical party symbols as well as candidate names, and the machines are designed to be used without written instructions.

- **Unfamiliarity with Technology**: Some voters in India have very little experience with technology and may be intimidated by electronic voting. For example, "Fifty-year-old Hasulal Topno [... an] impoverished Oraon tribal, who gathers firewood from the forest outlying the Palamau Tiger Reserve, a Maoist hotbed 35 km from Daltonganj town" told a reporter, "I am scared of the voting machine," prior to its introduction in his village. Nirmal Ho, "a tribal and a marginal farmhand in the Chatarpur block of Palamau district," said he was "more scared of the EVMs than the Maoists" on account of his unfamiliarity with technology. To avoid further intimidating voters like these, India's EVMs require the voter to press only a single button.

- **Booth Capture**: A serious threat against paper voting before the introduction of EVMs was booth capture, a less-than-subtle type of electoral fraud found primarily in India, wherein party loyalists would take over a polling station by force and stuff the ballot box. Better policing makes

such attacks less of a threat today, but the EVMs have also been designed to discourage them by limiting the rate of vote casting to five per minute.

Any voting system proposed for use in India must be able to function under these constraints.

4 Theoretical framework (SCOT)

- "What is needed is an understanding of technology from inside, both as a body of knowledge and as a social system. Instead, technology is often treated as a 'black box' whose contents and behaviour may be assumed to be common knowledge"(Layton , 1977, p. 198 in Pinch & BIjker, 1987, pp. 21-22).

The theoretical model we are using is called the Social Construction of Technology (SCOT) developed by Wiebe Bijker and Trevor Pinch from 1983 and 1987. Basically this is a theoretical framework for explaining technological development as a social proc ess. One of the objectives is to argue against the idea that the development of a technology is always logical and rational, following a pre-determined path. From social constructivist perspective one cannot explain why a technology 'works' in society in merely technical terms. It is not the machines but rather the people who decide over uses, meanings, and designs. More specifically relevant social groups (RSG) decide everything that has to do with a technology's development according to their needs, values etc. RSGs can be institutions and organizations, organized and unorganized groups of individuals; "key requirement is that all members of a certain social groups share the same set of meanings, attached to a specific artifact" (Pinch &Bijker, 1987, p.30).

Now because there are several RSGs with difference in opinion it often occurs that in the development of a technology there is 'interpretative flexibility'. For example it is not unusual that users of a technology find alternative ways of using a tech nology, different from the intended use by the manufacturer. Or it simply means that different RSGs do not agree over a technology's use in society. RSGs can have different views, standards, aims, problem definitions, problem-solving strategies, standards,risk perceptions and so forth. The authors use the term 'technological frame' to bring together all these aspects in one concept. What usually happens is that over time interpretative flexibility diminishes. Whereas in the earlier stages of a technology's development there is a variety of interpretation attached to it, in later phases one dominant interpretation evolves. This is referred to as 'closure'. "Closure in technology involves the stabilization of an artifact and the 'disappearance' of problems.To close a technological 'controversy', one need not solve the problems in the common sense of the word" (Pinch & Bijker, 1987, p. 44). Most important in this context is whether the RSGs see the problems of a technology being solved.

5 EVM through the eyes of relevant social groups

The most important and dominant RSGs in this analysis are the Election Commission of India (ECI), civil society initiative VeTA, a security research team, and economic researchers on EVMs. Political parties, Indian citizens, and EVM

manufacturers appear less prominent in the way this paper describe the development of EVMs. This paper refer to political parties in rather general terms when some of them raised doubts about the integrity of EVMs. A gruop of people interviewed a number of Indian citizens however not enough in order to make any general statements. And the EVM manufacturers interestingly stayed out of the debate around EVMs themselves and there is only very little information publicly available about their stance over EVMs. The more dominant RSGs shall be introduced in more detail now. The ECI has the superintendence, direction and control over the entire process of conducting elections in India. It is a permanent and independent constitutional body (Rana,2006, p. 4). This means the ECI has the power to decide anything that has to do with the EVM, like its operation, security features, changes in the system. Whenever people have questions or concerns about anything related to EVMs they turn to the ECI. In December 2005 the ECI set a technical expert committee under the leadership of Prof. P.V. Indiresan, with Prof. D.T. Shahani and Prof. A.K. Agarwala of the Indian Institute of Technology (IIT). They were made responsible for examining EVM and making recommendations of possible changes in he system to the ECI (Agarwala, 2006, p. 1).

"VeTA is an independent national level Citizens' Forum for promoting Verifiability, Transparency and Accountability in Indian Elections. The Forum is a civil society initiative involving some of the best known computer experts, political scientists, public activists, administrators, academicians, legal professionals etc." (VeTA, 2010). President of VeTA is GVL Narashima Rao. He has written a book titled Democracy at Risk! Can we trust our electronic voting machines? (2010), which provides detailed information about concerns raised about EVMs, instances of malfunctioning, suspicions of EVM tampering, suggestions for improvement and more. Hari Prasad is the Technical Coordinator of VeTA and is managing director of NetIndia Private Limited, an IP Surveillance & Streaming Systems & Solutions company. He is a key technical person in the controversy about EVM security in India. V.V. Rao is the National Coordinator. He is an election watch specialist and is the main petitioners in the public interest litigation filed in the Supreme Court on EVMs (VeTA, 2010).

Hari Prasad as already mentioned is one of the key technical persons, who identified vulnerabilities in the Indian electronic voting system. In collaboration with a team of researchers and computer science experts he conducted the first government independent security analysis of Indian EVMs. His team includes Dr. J. Alex Halderman, professor of computer science at University of Michigan and Rop Gonggrijp, a technology activist who played a major role in banning electronic voting in the Netherlands. Rajnish Tiwari is a researcher at the Institute for Innovation and Technology Management at Hamburg University of Technology. In a recent publication (Tiwari & Herstatt, 2014) he used the EVM as a case study for exemplifying "frugal innovation" in India. This concept will be explained in more depth. They were not directly involved in the controversy about EVMs, but their analysis provides an interesting perspective, contrasting the views from India.

6 Issues with ballot system and Corruption

- "EVMs have changed the way elections are conducted in India. Earlier it used to be a lengthy and tiring exercise including complex procedures. Now the process has been simplified" (Viswanath, 2014, interview).

India is the biggest democracy in the world and the management of electi ons is a huge task. Year 2014's elections were done in nine phases from 7 April to 12 May. The ECI estimated 814.5 million voters and set up approximately 930,000 Polling Stations all over the country, for people to cast their vote (ECI, 2014c).Casting and counting votes used to be done manually in India. Before the implementation of an electronic voting system, India was using a paper ballot system. In manual elections of the previous kind "a nationwide ballot could consume around 8,000 tonnes of paper and 400,000 phials of indelible ink and require some 2.5 million strongboxes to store them under heavy security until votes were counted" (Kumar & Walia, 2011). Indelible ink is still used today, to mark a persons finger after voting. The counting of votes could take several days or weeks and the number of invalid votes was relatively high. For example in 1999 there were 7,098,879 votes declared invalid, whereas in 2004 the number was 101,625. Overall the expenses for printing ballot papers, storage, transportation and hiring personnel for counting votes were becoming higher with every election and counting of votes took a lot of time and effort. Those were main incentives for the ECI to think about changing the system.

Not only was the paper ballot system perceived as expensive and inefficient, it also had major security problems. One of the major problems is called booth capture. Often it happene d that criminal groups, delegated by political parties, captured a polling station and literally stuffed the ballot box with large numbers of votes for the favoured candidate. Moreover the stealing of votes used to be a common practice. One of our interviewees, who comes from Bhadgaon Besar, a small village in the Himalayan mountains, said: "I remember very well that in the villages those ballot papers were misused by wrong peoples" (Bhatt, 2014, interview). He explained that it is a common practice in India that another person casts one's vote. And not only in small villages but also when he moved to a bigger town called Mussoorie he rememberd, "once somebody else was voting for me and my vote was misused" (Bhatt, 2014, interview). As we will explain later, the problem of booth capture was addressed in the design of EVM and is technically much more difficult than in the paper ballot system. Hence in technical terms, cheating the system in this way became more difficult, however with the electronic system the re are new potential threats for election fraud. A general issue, which is still occurring nowadays, is that Indian politicians buy their votes. This is especially the case for poor people and slum inhabitants, since they will most likely care more about what to eat than about national politics. " Quite a few Indian politicians may be accused of literally buying their votes from the electorate," Rajnish Tiwari explained to us (Tiwari, 2014, interview). Hari Prasad put it this way: "The thing is that the politicians in India are buying votes. They buy each vote at 500 to 1000 bucks; sometimes go to 5000 bucks. And money and liquor play a major role in Indian elections. Though there are lots of organizations which are trying to bring awareness among the public, but still the corruption goes" (Prasad, 2014, interview). Overall the ECI and Indian citizens agree that the election system,

as it used to be, posed too many problems and had to be replaced by another system.

7 Implementation

Because of "recurring expenditure on printing, storage, transportation and security of ballot papers," the ECI discussed electronic voting for the first time in 1977 (Sa ini, 2013, p. 68). In collaboration with ECI the PSU Electronics Corporation of India Ltd. (ECIL) developed a prototype by 1979 (Tiwari, 2013, p. 89).In 1983 they were used for the first time in the Delhi Metropolitan Council Election. Then in the 1998 Assembly elections in Madhya Pradesh, Rajasthan and Delhi EVMs were used in 16 out of 543 c onstituencies. The ECI considered their use a success and hence decided to make use of EVMs on larger scale. "Being a peaceful State with a high literacy rate, Goa became EC's choice for experimenting with EVMs on this scale as a 'historic step'" (Rana, 2006, p. 13), and he ECI saw this as a crucial step in modernizing electoral management. On national scale EVMs were employed in the 2004 General Elections for the first time, and have been used since then in all General Elections and State Assemblies (Rana, 2006, p. 4)."In view of huge quantity requirements, another PSU, BEL (Bharat Electronics Limited), Bangalore was involved in mass manufacturing" (Saini, 2013, p. 68).The ECI has been proud of introducing this machine and described EVMs as "perfect","infallible", "tamperproof", with "no need for technological improvement" (Halderman, 2011, lecture; ECI 2009a). But not everybody was so enthusiastic about the implementation. Several sources revealed initial "scepticism of the political parties as well as the intelligentsia" (Saini, 2013, p 68). An Indian citizen was interviewed and he remembered that "people have been talking about it and there was a huge discussion of course also among intellectuals. Many people were saying it might be that people will manipulate with it and that was one concern. I remember that young people were for that and traditional people were sceptical" (Bhatt, 2014, interview). This paper propose that the ECI uses the technological frame 'the perfect EVM', which collides with the scepticism of a number of political parties and academics. Before we go deeper into discussions about EVMs we want to explain in more depth how the machine is operated, what challenges were to be incorporated into the design and what are main technical features

8 Design Challanges

When the ECI delegated ECIL and BEL to design an electronic voting machine, a number of challenges particular to the Indian context, had to be considered. This includes the cost of those machines, power supply, natural hazards, illiteracy, technological illiteracy and booth capture.

Due to the huge amount of machines employed all over the country and due to a limited budget, the ECI wanted to keep costs as low as possible. Through the eyes of the economic research team this goal has been achieved successfully: compared to other nations such as the USA, Indian voting machines are much more inexpensive (Tiwari & Herstatt, 2014, p. 70). Each machine comes at a price of Rs. 8670 plus taxes from the manufacturer (ECIL, 2012-13), which

translates to 104.7 6 Euros (at current exchange rate of 1 Euro = 82.8 INR, 2014).

The geography of India poses challenges, since many polling stations across the country are in remote areas without electricity supply. In past elections the polling officials have made amazing efforts to make voting possible in even the most remote villages in the Himalayan Mountains or the deserts of Rajasthan. Their means of transportation include boats, elephants, camels and ferries and sometimes the polling teams are trekking through many kilometres of jungle (Rana, 2006, p. 1; Chandrashekhar, 2014).“There are areas where you have to walk for 6 days to reach the polling station” (Shukla, 2010, panel discussion). Due to those obstacles Indian EVMs are entirely operating on battery power and are stand alone machines, not connected to any network(Prasad et al., 2010, p. 3). Compared to the old paper ballot boxes, EVMs are lighter, which also makes transportation easier. So generally EVMs are a relief for the ECI.

Extreme temperatures-from the freezing Himalayan mountain to boiling heat in the jungle and deserts – and other environmental hazards like dust and pollution, pose further challenges for EVM design and operation. Sometimes it rains so hard that the roads to the polling centres are not motor able and the only way is travelling on elephant back (Rana, 2006, p. 162).

EVMs must withstand those extreme conditions and have the capacity to absorb external shocks. Often EVMs are stored for extended periods in facilities that lack climate co ntrol. The Expert Committee of the ECI wrote in one of their reports about dangers from “attack by vermin, rats, fungus” that might cause malfunction (Agarwala et al., 2006, p. 6). In the eyes of the government these kinds of challenges are successfully ad dressed in the EVM design: The government of India has stated they are robust enough “to withstand rough handling and variable climatic conditions” (GOI, 2009, p. 181). The total adult literacy rate in India in 2008-2012 was about 62.8 per cent (UNICEF, 2014). Hence the machines need to be easy to use and not require written instructions.

Political parties and candidates use graphical symbols in their campaigns, which are then found on the ballot unit (BU). “The Presiding Officer will have a cardboard replica of the ballot unit with him”(GOI, 2009, p. 182), to demonstrate to the illiterate voters how to vote. An Indian citizen explained to me in an interview: “Illiterate people find it easier to press a button than putting stamp on a paper” (Verma, 2014, interview). Hence in technical terms electronic voting does not pose any problems for the illiterate.On the other hand there are still people in India who are unfamiliar with technology and there have been reports of people from tribes who felt intimidated by the machines (Rao, 2010, p. 44). Moreover blind voters have also been taking into consideration and the machines are made braille compatible. The problem of booth capture as such cannot be prevented with the EVMs. “However, the machine can not register more than 5 votes in a minute or 300 votes in an hour whereas a ballot box could be stuffed with any number of ballot papers “ (GOI, 2009 , p. 184).

Considering all the aspects addressing particular challenges in India, we can make some general statements. From a technical engineering perspective EVMs seem to be well adapted to the particular circumstances: The machines are described as light and robust and do not need electricity. They can be carried easier than earlier ballot boxes, they withstand extreme climate conditions and they work in remote villages without power supply. From an economic perspective EVMs are a good solution, because they are cheaper than the earlier paper

based system and do use considerably less paper. Counting is much faster and efficient and there is no need to hire extra personnel, which saves money as well. From a social perspective , EVMs take into consideration specific needs so that everyone is theoretically able to vote. And from an environmental perspective it has been argued that because of the high savings on paper EVMs have less of an impact than the paper ballot system. All of these points were incentives for the ECI to be optimistic about the machines and use the frame 'the perfect EVM'.

9 References

References

[1] Rune Steinsmo Ødegård, Master of Science in Physics and Mathematics, Norwegian University of Science and Technology, Department of Mathematical Sciences.

[2] India's Electronic Voting Machines (EVMs): Social construction of a "frugal" innovation by *Maximilian Herstatt, **Cornelius Herstatt, *Maastricht University , ** Hamburg University of Technology.

[3] Agarwala, A.K., Shahani, D.T., & Indiresan, P.V. (2006). Report of the expert committee for evaluation of the upgraded electronic voting machine (EVM). New Delhi: Election Commission of India. Retrieved May 05, 2014 from http://de.scribd.com/doc/6794194/Expert-Committee-Report-on-EVM.

[4] Biswas, S. (2014). India's BJP scored a historic win. BBC. Retrieved June 05, 2014 from http://www.bbc.com/news/world-asia-india-27435647.

[5] Brahman, C.R. (Producer). (2002). Training on Use of Electronic Voting Machine. Retrieved June 1,2014 from http://northgoa.gov.in/EVM-ECIL1.pdf.

[6] Chandrashekhar, V. (2014). India's election: Five questions on the world's largest democracy. The Christian Science Monitor. Retrieved May 29, 2014 from http://www.csmonitor.com/World/Asia-South-Central/2014/0407/India-s-election-Five-questions-on-the-world-s-largest-democracy-video

[7] ECI. (2009).Electronic Voting Machines-regarding. (PN/ECI/41/2009). New Delhi: Retrieved June 03, 2014 from http://eci.nic.in/eci_main1/current/pn080809.pdf.

[8] ECI. (2010a). A Background Note on Investigation against Mr. Hari Prasad and Others in the Case of the Missing EVM in Maharashtra. Retrieved June 04, 2014 from http://eci.nic.in/eci_main/recent/NOTE_HARIPRASAD.pdf.

[9] ECI. (2010b). Letter No.51/8/16/9/2010-EMS. Retrieved May 17, 2014 from http://www.indianevm.com/evm-resources.php.

[10] ECI. (2014). eneral Election to Lok Sabha Trends & Results 2014. Retrieved June 04, 2014 from http://www.webcitation.org/6PfWDNtfY.

[11] ECI. (2014b). Voter Turnout H ighlights of Lok Sabha Election 2014. Retrieved June 19, 2014 from http://eci.nic.in/eci_main1/SVEEP/VoterTurnoutHighlightsLokSabha2014.pdf .

[12] ECI. (2014c). General Elections-2014: Schedule of Elections. New Delhi: Election Commission of India.

[13] ECIL.(2012-13). 46th Annual Report 2012-13.Hyderabad: Electronics Corporation of India Limited.

[14] GOI. (2009).General Elections 2009: Reference Handbook. New Delhi: Press Information Bureau. Retrieved March 23, 2014 from http://www.pibaizawl.nic.in/pr/archive/e2009/rhandbook_english.pdf .

[15] Halderman, A. (2011). Security Problems in India's Electronic Voting System (CRCS Lunch Working paper No. 86 Herstatt/Herstatt-28-Seminar) [Lecture]. Boston: CRCS. Retrieved March 15, 2014 from https://www.youtube.com/watch?v=mCg3KUtkypo .

[16] Hauser, W. & Singer,W.(2001). The Democratic Rite: Celebration and Participation in the Indian Elections. In: Jayal, N. G. (Ed.). (2001). Democracy in India(pp. 289--310). New Delhi: Oxford University Press.

[17] IANS(2009). Voting machines 'manipulated' in Orissa polls, claims Azad.Thaindian News. Retrieved May 01, 2014 from http://www.thaindian.com/newsportal/politics/voting-machines-manipulated-in-orissa-polls-claims-azad_100206516.html.

[18] Jayalalitha, J., Biswas, D., Prasad, B.S.B., et al.(2010).All-party meeting to discuss Electronic Voting Machines (EVMs)-Potential for manipulations-Reg.Retrieved May 29, 2014 from http://www.indianevm.com/evm-resources.php.

[19] Jha, S.K. (2009). Advani has doubts about EVM, wants ballot papers back. The Indian Express. Retrieved March 28, 2014 from http://archive.indianexpress.com/news/advani-has-doubts-about-evm-wants-ballot-papers-back/485248/ .

[20] Kalita, P. (2014). An EVM that 'votes' only for BJP stuns poll staff in Assam. The Times of India.Retrieved May 25, 2014 from http://timesofindia.indiatimes.com/news/An-EVM-that-votes-only-for-BJP-stuns-poll-staff-in-Assam/articleshow/33153152.cms?

[21] Kohli, A. (Ed.). (2001). The Success of India's Democracy. Cambridge: Cambridge University Press. Kumar, D. (2014). BJP+29Parties=National Democratic Alliance.NDTV. Retrieved June 12, 2014 from http://www.ndtv.com/elections/article/election-2014/bjp-29-parties-national-democratic-alliance-527698 .

[22] Kumar, H. (2014). The Device that Runs the World's Biggest Election. The New York Times. Retrieved June 01, 2014 from http://india.blogs.nytimes.com/2014/05/06/the-device-that-runs-the-worlds-biggest-election/?_php=true&_type=blogs&_r=0 .

[23] Kumar, S., & Walia, E. (2011). Analysis of Electronic Voting System in Various Countries. International Journal on Computer Science and Engineering, 3(5).

[24] Pinch, T.J. & Bijker, W.E. (1987). The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. In: Bijker, W.E., Hughes, T.P., Pinch, T.J. (Eds.) The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology (pp. 17-50). Cambridge: The MIT Press.

[25] Prasad, H., Halderman, A., Gonggrijp, R., Wolchock, S., Wustrow, E., et al. (2010). Security Analysis of India's Electronic Voting Machines. Retrieved March 12, 2014 from http://indiaevm.org/evm_tr2010-jul29.pdf.

[26] Rana, M.S. (2006).India Votes: Lok Sabha & Vidhan Sabha Elections 2001-2005. New Delhi: Sarup & Sons. Rao, GVL N. (2010). Democracy at Risk! Can we trust our Electronic Voting Machines? New Delhi: VeTA. Retrieved March 28, 2014 from http://www.indianevm.com/book_democracy_at_risk_2010.pdf.

[27] Saini, M. (2013). Electronic Voting Machine: New Attack Vector. VIVEK: Issues and Options, (2). Retrieved May 04, 2014 from http://de.scribd.com/doc/124478041/Vivek-Issues-n-Options-February-2013.

[28] Tiwari, R., & Herstatt, C. (2012a). India - A Lead Market for Frugal Innovations? Extending the Lead Market Theory to Emerging Economies. Working Paper No. 67. Hamburg: Hamburg University of Technology.

[29] Tiwari, R. & Herstatt, C. (2012b). Frugal Innovation: A Global Network's Perspective. In: Die Unternehmung, 66(3), 245-274.

[30] Tiwari, R., & Herstatt, C. (2014). Aiming Big with Small Cars. Emergence of a Lead Market in India. Cham: Springer.

[31] UNICEF. (2014). UNICEF India Statistics Retrieved May 12, 2014 from http://www.unicef.org/infobycountry/india_statistics.html.

[32] USENIX (Producer). (2010). Panel on Indian Electronic Voting Machines (EVMs). 2010 Electronic Voting Technology Workshop/ Workshop on Trustworthy Elections. [Panel Discussion] Retrieved May 24, 2014 from https://www.usenix.org/legacy/event/evtwote10/tech/ .

[33] VeTA (2010). About VeTA. Retrieved May 22, 2014 from http://www.indianevm.com/about-us.php.