USING THE SNOWBALL METHOD IN MARKETING RESEARCH ON HIDDEN POPULATIONS

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Abstract

Following the classical sampling theory, the researcher selects samples of people, businesses or others, in order to obtain the desired information. Drawing the samples is usually done by randomly selecting from a list representing the target population. In practice, this list is often not available. There are cases in which the population of interest is not fully known, not well defined and fully listed, and creating a sampling frame is difficult or impossible for the researcher.The solution to this situation comes from the snowball sampling method, the best way we can study hidden populations in marketing research. In this paper we are approaching the snowball method as a mean of accessing vulnerable and more impenetrable social groupings revealing the latest advances of this technique.

Key words*: market research, survey, hidden population, snowball method, non-probabilistic sampling*

1. Introduction

Subject to particularities of the statistical population and the objectives of the research, a series of non-random approaches, also named rational selection techniques have been developed in marketing survey practices[1]. One of the most important non probability sampling methods used in marketing we learn about in our marketing research course is the "snowball" sampling[2]. We are also briefed during the same course on the non-probability character of this approach which does not allow prior establishment of the possibility of including each particular subject in the sample as it is done in the probability surveys, fact which prevents definition of interferences.

Also known as the referral method or network sampling, the "snowball" sampling is normally used wherever there is little knowledge on the target population, whose boundaries or number are hard to define and the development of a sampling database is difficult if not impossible to achieve by the researcher[3]. The most frequent examples of using this method are met in the surveys intended to identify sensitive information or in researches carried out on *hidden populations.*

The term hidden populations, synonymous with "very rare human populations" or "difficult to approach populations" is being used to generally designate the populations for which there is no official information or which represent less than 2% of the population. In other words, these populations are difficult to identity, approach or recruit for research purposes, more often than not because of their social stigmata, legal status as well as subsequent lack of visibility of members of

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such population[4]. These categories of populations include relevant groups for public health purposes such as injectable drug consumers, relevant groups for public politics such as street youth and the homeless, as well as relevant groups in terms of art and culture, such as jazz musicians and other kinds of musicians or artists and the list remains open. Bryam (1999) used this method to create a sample consisting of British visitors of thematic Disney parks and Venter, Boshoff and Maas (2005) have also used this method to identify the owners or successors of small and average family companies in South Africa[5] to list only a few practical examples.

Inadequate public records raise difficulties in terms of sampling the developing countries which causes a significant part of the general population to qualify as "hidden" for sampling purposes. This category also includes the highly specialized target groups such as networks being formed or transformed very quickly or temporarily.

The "snowball" method also stands as an extremely valuable marketing research instrument whenever we want to access highly informed and experienced individuals in a specific field, product, production process, etc, individuals who can provide in-depth information which is not available elsewhere or in another manner[6].

2. Brief history

The "snowball" method has been developed based on the multiplicity sampling prepared by Sirken at the end of the 1960s for the sampling of rare populations[7]. In Sirkin's method the respondent is requested to indicate not only if a specific condition affects one's household but also if it affects a certain group of households such as those of children and brothers. The information concerning a phenomenon or event thus becomes available not only from the respondent's household but also from other households related to the respondent. Multiplicity is generated by the fact that the information referring to a certain event may be obtained from several sources and thus the capacity to detect rare events is significantly improved.

The approach based on multiplicity has been extended to the "snowball" sampling by Rothbart, Fine and Sudman (1982). They suggested adding to the survey a question related to the number of eligible respondents known to the respondent. The dimension of this network then offers the basis for multiplicity adjustment where the respondents are weighted with the opposite of the dimension of their network.

3. Definition and application methods

The *"snowball" method* implies the identification of an initial set of respondents who will be interviewed and who will be requested at the end of their interview to recommend potential subjects who share similar characteristics and who are relevant for the purpose of the subject survey. Request for referrals shall be initiated by the researcher by means of a phrase such as: " It was a great pleasure to meet you and I really appreciate the time you have so kindly offered. I was wondering if you happen to know other persons who share the same interest/experience as yours and who would be willing to meet me".

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[4] Gabor, M.R., Types of non-probabilistic sampling used in marketing research."Snowball" sampling, *Management-Marketing Review* (2007), no. 3/2007, ISSN 1842-0206, http://www managementmarketing ro/ pdf/articole/72.pdf

[5] Bryam, A., Bell, E., *Business research methods*, Second Edition, Oxford University Press (2007), ISBN 978-0-19-928498-6

[6] Gray, P.S., Williamson, J.B., Karp, D.A., Dalphin, J.R., *The Research Imagination: An Introduction to Quantitative and Qualitative Methods*, Cambridge University Press (2007), ISBN – 13:9780521705554

[7] Heckathorn, D.D., Extensions of respondent-driven sampling: analyzing continuous variables and controlling for differential recruitment using dual-component sampling weights, *Center for the Study of Economy and Society Working Paper Series* (2007), paper No. 37, April 2007, http://www.economyandsociety.org/publications/ wp37_Heckathorn_07.pdf

It is recommended to select the initial sample of respondents at random although easiness of access always dictates the initial sample in practice. The second set of respondents is interviewed and also requested to recommend names of other potential respondents for the subject survey. The process continues until the moment the researcher decides the sample is large enough to satisfy the purpose of the study or until the moment the respondents start repeating the names recommended which indicates that subsequent rounds of interviews would not bring additional relevant information[8]. There are certain specialists who consider that the satisfactory threshold is reached not by meeting a specific number enforced by statistical requirements but rather by access to a specific amount of relevant, quasi complete information on the investigated field.

Use of this method often raises the problem of defining the individuals who belong to the initial sample of respondents. The most important problems to be approached and solved to this effect are:

- Who holds sufficient authority to supply the opinions needed?

- How large is the hidden population?

- Can we define the limits of the hidden population?

- The manner in which we shall access the members of the hidden population;

- How can we obtain a high response rate?

- How can we measure and interpret the errors caused by non-replies?

- How can we effectively manage the interviews in a short period of time without negatively affecting their validity?

The relationship between the "snowball" sampling and the in-depth interview method is quite obvious and is established by the very definition of this sampling method[9]. Under these circumstances the quality of the process of obtaining referrals is of course related to the quality of the interaction between the respondent and interviewer – the respondent should not leave the interview with a feeling of dissatisfaction while the interviewer should gain the trust and sympathy of the respondent so as to increase his chances to her referrals from the respondent.

The main manners of using the "snowball" method are represented by:

➡   *the linear method* (see Figure 1) – which implies requesting from the first sample of initial respondents a single referral from the target population of the survey, a single referral being also requested during subsequent cycles of the survey;

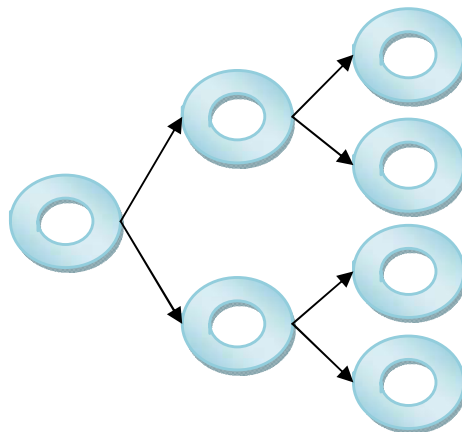**Figure 1.** *Graphic representation of the linear version of the "snowball" method*
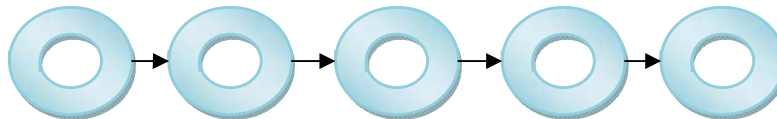
➡   *non discriminative exponential method* (see Figure 2) – which implies that the interviewer asks the initial respondents to indicate all the individuals they know and who belong to

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[8] Swisher, M.E., *Non-Probability Sampling*, course notes, Family, Youth & Community Sciences (2009), http://fycs-swisher.ifas.ufl.edu/OTS/Non-Probability%20Sampling.pdf

[9] Noy, C., Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research, *International Journal of Social Research Methodology* (2008), Vol.11, No.4, October 2008, pp. 327-344; Atkinson, R., Flint, J., Accessing Hidden And Hard-to-Reach Populations: Snowball Research Strategies, *Social Research Update* (2001), Issue 33, Department of Sociology, University of Surrey, ISSN: 1360-7898

the target population of the survey, the same system being applied to the subsequent cycles of the survey, the researcher interviewing all referrals obtained;

Figure 2. *Graphic representation of the non discriminative exponential version of the "snowball" method*

➥   *discriminative exponential method* (see Figure 3) – is similar in many respects to the non discriminative exponential method in the sense that the researcher asks the respondents to name all the persons they know within the target population of the survey. The difference from the former method resides in the fact that the researcher shall randomly select a certain number of individuals from the referrals offered by each respondent.

Figura 3. *Graphic representation of the discriminative exponential version of the "snowball" method*
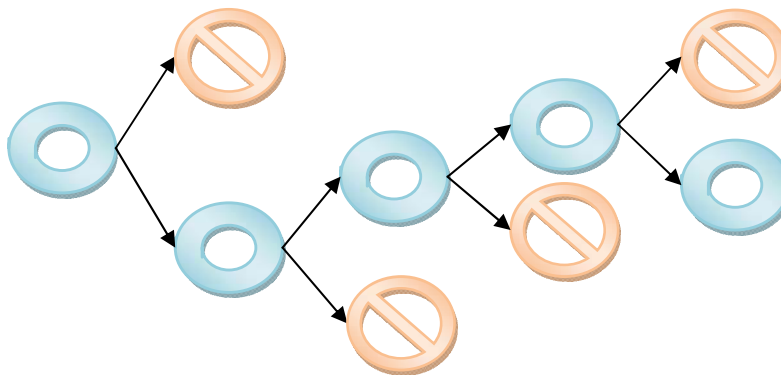
4. Advantages and disadvantages of using the "snowball" method

The advantages of the snowball method reside in the first place in the advantages of the non-probability sampling methods which are much faster and cost effective than the probability methods, allowing adjustment of the survey during progress thereof should the subject of the survey prove to

be "difficult"[10]. These surveys are recommended whenever it is not necessarily intended to generalize the data for the entire population, but rather to collect certain detailed informed on specific events or phenomena, whenever a list of the population being surveyed is not available or when the target population is hard to identify[11].

Use of the "snowball" method in marketing surveys brings along a series of advantages specific to this method:

■ the method of referrals allows the surveyor to reach populations which are otherwise difficult to be sampled using other sampling methods;

■ application of this sampling method does not require a complex planning and the staff used is considerably smaller in comparison to other sampling methods.

The major disadvantages of this method are basically related to the general disadvantages resulting from use of a non-probability sampling method[12]:

▢ the units being entered in the sample in an arbitrary manner, the probabilities of selecting the units in the sample can not be calculated. It is thus no longer possible to calculate variance and displacement of the estimator. Estimation of parameters by a trust interval is not allowed for this method.

▢ due to the selection manner of the survey units, there is no guarantee that all simple units of the population have a chance to enter the sample. As calculation of variance and displacement of estimator is not possible, the only way to evaluate the quality of data collected is to compare them to data available in an older report or in a different survey.

In addition to the limitation enforced by the non-probability character of the "snowball" method there is another series of limitations related to the specific characteristics of this method:

● the surveyor has limited control over the method. The individuals the surveyor may interview basically depend on the subject formerly interviewed;

● the surveyor is not familiar with the real distribution of the population and the sample;

● given the fact that the initial respondents tend to name the persons they know best and who share the same opinions, it is very likely that the subjects posses the same features and characteristics and thus the sample finally obtained by the surveyor represents only a small subgroup of the entire population or small target groups will pass unnoticed.

The most often errors occurring in the application of this method are caused by the following:

➡ interferences being obtained are only based on the initial sample of respondents as long as the subsequent respondents are not selected at random. However, as the initial sample is not selected at random in practice, interferences may not be obtained at the initial sample either;

➡ the samples extracted by means of this method tend to be un-representative due to the fact that the co-operant persons who agree to participate in the survey are over-represented;

➡ errors are also caused by the fact that part of the participants "hide" the referrals trying to protect friends or acquaintances, a problem which is difficult to solve particularly where there is a strong concern for confidentiality of data;

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[10] Gabor, M.R., Non-probabilistic Sampling Use in Qualitative Marketing Research. Haphazard Sampling. Volunteer Sampling, *The Annals of Oradea University* (2007), TOME XVI 2007 VOLUME II, pp. 954-958, ISSN 1582-5450, http://anale.steconomice.evonet ro/arhiva/2007/management-and-marketing/56.pdf;

[11] Tansey, O., Process Tracing and Elite Interviewing: A Case for Non-probability Sampling, *Annual meeting of the American Political Science Association* (2006), Marriott, Loews Philadelphia, and the Pennsylvania Convention Center, Philadelphia, PA, September 2006, http://www.asu.edu/clas/polisci/cqrm/APSA2006/Tansey_Process_Tracing.pdf

[12] Voicu, M.C., Aspects regarding the non-probabilistic survey method*, Romanian Statistical Review Supplement* (2009), No. 9/2009, pp.211-215, ISSN 1018-046x, category B+, CNCSIS, monitored ISI Thomson Philadelphia (SUA)

➡ referrals are obtained by means of the relationships between people, so that people belonging to a large social network shall be over-represented while individuals relatively isolated shall be under-represented.

Used in marketing surveys, the "snowball" sampling may be applied in the exploratory qualitative and also descriptive surveys without allowing however extrapolation of results for the target population although this method is incorrectly being used for this purpose.

5. Improvement in using "snowball" method

To improve the efficiency of the "snowball" method Frank and Snijders (1994) have created, starting from it, a method for the estimation of the hidden populations using a sample selected by the one-cycle referral method. To achieve this, they have selected a heterogeneous group of initial subjects, each of these drafting a list with all the known members of the target population. The dimension of the target population is then estimated based on the coverage rate of the members listed. In a similar manner, Klovdahl (1989) suggests the term random walk for the procedure which allows obtaining a sample of the hidden population by asking the respondents to suggest potential respondents who might possess the characteristics being studied and from which a unit is selected at random[13]. The results of this process highlight the structural characteristics of the connection network of the hidden population. In addition to this, Spreen and Zwaagstra (1994) suggest a combination between the "snowball" sampling method and the oriented sampling which uses ethnographic representation for location of the initial sample which becomes the basis for a network sampling.

Despite all these improvements and extensions of the "snowball" method, there are several problems yet to be solved to this day. The main problem in the methodological debate concerning sampling and analysis of the hidden populations is – how do we extract an (initial) sample at random?

The concentrated efforts of the specialists to improve the main disadvantage of the "snowball" method resulted in the respondent driven sampling (RDS) based on the referrals of the respondents by means of the combination between the referral method and a mathematic method which weights the sample in order to compensate its selection by a non-random method and where appropriate use of stimulants may lead to cutback of errors occurring in sampling by the referral method.

The respondent driven sampling (RDS)[14] based on the respondents' referrals basically consists in the respondents' recruiting other respondents among their acquaintances same as it is done in the "snowball" method and the surveyors' following who recruited whom, by means of the coupon[*] each respondent must offer to each acquaintance/friend/colleague[15] recruited, as well as the number of social contacts of the respondents. Then, using a mathematic model of the recruitment process, the sample is weighted to compensate for the non-random recruitment. This model is based on a synthesis and an extension of two areas of mathematics, the theory of Markov chain and the theory of the biased network, which have not been formerly used as standard instruments in the sampling theory. The statistics theory which resulted from the incorporation of these theories, named respondent driven sampling (RDS) allows the surveyors to supply both estimations on the population as well as indicators on the accuracy of these estimations.

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[13] Thompson, S.K., Targeted Random Walk Designs, *Survey Methodology* (2006), June 2006, Vol. 32, No. 1, pp. 11-24, Statistics Canada, Catalogue No. 12001XIE

[14] Heckathorn, D.D., Extensions of respondent-driven sampling: analyzing continuous variables and controlling for differential recruitment, *Center for the Study of Economy and Society Working Paper Series* (2007), paper No. 38, April 2007, http://www.economyandsociety.org/publications/wp38_Heckathorn_07.pdf

[*] the coupon includes contact information on how to reach the interviewer or the location where the interview takes place and the coupon code which allows reconstruction of the network

[15] Schonlau, M., Liebau, E., *Respondent Driven Sampling*, Research Notes of the German Data Forum (RatSWD) (2010), No. 45, September 2010

The problems of the "snowball" method occurring with each use of the method are being solved in the RDS method as follows:

Table 1. *Errors occurring following use of the "snowball" method and solutions offered by the RDS method*

Characteristics of the "snowball" method	Errors occurring following use of the "snowball" method	Solutions offered by the RDS method
Respondents may recommend a countless number of persons	1. Differential recruitment: those with a large size network may recruit a larger number of persons who are likely to possess similar characteristics; 2. Clustering: leads to decrease of the effective dimension of the sample.	Restriction of recruitment by restricting the number of recruitment coupons.
Characteristics of the social network are ignored	1. Grouping of individuals based on the network characteristics can not be measured; 2. Dimensions of the social network affect the selection probability.	1. Encoded coupons allow association of the respondent with the recruiter and the enlisted subjects; 2. Weighted comparison to take into account the measurable properties of the network
The respondents offer referrals, the interviewers must determine them to respond	Members accessible to outsiders participate only	The respondents are those who recruit the referrals, which also include the capacity to also exercise a social influence wherever the interviewer does not possess any; respondents remain in their offices.
Convenience sample – analysis restricted to definition of weights in the sample; generalization is not possible.	Selection probability is unknown	Collection of data referring to dimension of network of respondents to calculate the selection probability within the network; use of network properties to take into account clustering effects.

Source: adaptation of Johnston, L.G., Sabin, K., *Sampling hard-to-reach populations with respondent driven sampling*, Methodological Innovations Online (2010), 5(2), pp.38-48, ISSN 1748-0612online

As you can notice in the table above, RDS differs from the traditional "snowball" method in several respects. First of all, while sampling using the "snowball" method usually implies use of a participation incentive, RDS implies a dual stimulant system – reward granted for having been interviewed (primary reward) plus a reward for recruitment of other members of the hidden population (secondary reward). The recruiter exerts an additional pressure to this double reward, which may lead to a smaller number of non-replies as long as those not willing to participate in the survey on financial grounds may however accept participation as a favour to a friend. Secondly, the subjects are not requested to identify and name the other known members of the hidden population to the recruiter, but are requested to recruit these persons themselves. The RDS approach thus reduces the respondents' tendency to "hide" the referrals, offering the respondents the opportunity to allow

those being recruited to decide themselves if they are willing to participate in the survey. In the third place, the referrals are limited to a number of respondents who may be recruited by means of a pre-established number of coupons (normally 3 or 4), thus minimizing the influence of initial respondents on the structure of the final sample. Such limitation of the number of persons recruited stimulates achievement of long recruiting chains thus raising the degree in which the survey may approach the most hidden areas of the target population. And last but not the least, the relationships between the recruiters and the persons being recruited are documented allowing assessment and adjustment of recruitment errors during the final stage of data analysis, and the information on the dimensions of the personal network of each respondent is collected to allow weighted comparison by post-stratification to compensate over-sampling of respondents with large social networks.

The RDS method implies the existence of four essential elements in whose absence the method may not be named RDS approach. These elements are represented by[16]:

■ the documentation referring to who recruited whom being constructed by means of coupons;

■ recruitment must be rationalized by means of not more than 3-4 coupons normally allocated to a single respondent;

■ the information concerning dimension of network must be collected and recorded;

■ the recruiters and the persons being recruited should know each other (should have a previous relationship).

The efficiency of the RDS method is based on two remarks. In the first place, in the event the referral chains are long enough, namely the process of development of referral chains consists in sufficient recruitment cycles or waves, the structure of the final sample shall become independent from the initial sample in terms of characteristics and behaviour patterned studied. After a certain number of cycles the structure of the sample becomes stable and all the members of the target population have a selection probability different from zero. Hence, an essential element in the design of the RDS method implies application of the methods which lead to increase of the referral chains. While the final structure of the RDS sample is independent from the initial sample, the process for selection of the components of the initial sample may affect the rate in which a balance is reached as well as the speed of the sample selection process. In other words, the subjects of the initial sample possess certain characteristics which are more adequate than others in that they facilitate a higher "production" of referrals.

Following requirements should be observed during the selection process of the subjects of the first sample to improve efficiency of the RDS selection process:

□ respondents of the initial sample should have a great diversity in terms of factors whose impact is crucial in the development of social relationships within the population. These factors normally include basic demographic characteristics such as race, nationality, religion, caste, social standing and age.

□ as most of the social relationships are based on proximity, such as subjects living in the same street or working for the same company, initial subjects should be extracted from a variety of geographical areas occupied by the target population;

□ initial subjects should be individuals who maintain multiple social relationships and enjoy the appreciation of the target population. It would be much easier for such individuals to promote participation and speed up recruitment.

The second remark on which efficiency of the RDS method is based refers to the fact that the information collected during the sampling process may offer the means for calculation of the relative selection probabilities which in their turn offer the means for the calculation of both non-displaced

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[16] Magnani, R., Sabin, K., Saidel, T., Heckathorn, D., Review of sampling hard-to-reach and hidden populations for HIV surveillance, *AIDS* (2005), (suppl 2): S67-S72

estimators within the population and the variation of these estimators. In case of traditional sampling methods, such as simple random sampling or the stratified sampling, the sampling framework is built as a rule before selection of the first respondent. In a simple random sample, the selection probabilities are equal, while in a stratified sample, the special interest subgroups are over-represented and the selection probabilities are therefore unequal. The selection probabilities are established in both cases before selection of the first respondent the effects of the sampling scheme being quantified at a later stage.

In case of the RDS method however, the sampling framework is developed after completion of sampling based on two types of information collected during the sampling process. First of all, each pair of recruiter-recruited person is documented, thus offering the basis required for control of errors entered by the tendency of individuals to build social relationships in a non random manner. The information concerning who recruited whom is used to quantify the sampling errors caused by the non random structure of the network offering the basis for performing the estimations. Secondly, the respondents are asked how many other members of the target population they know. On a network based sample, the selection probability of an individual depends on the number of persons within the target population the subject individual is connected with and which gives him his so called class. The recruitment process may proceed for instance as follows: a typical respondent in the RDS method, namely Mr Popescu recommends Mrs Ionescu; without knowing the names of the two respondents, the researcher will ask Mrs Ionescu to supply information on the nature of her relationship with the person who had handed her the coupon; by means of the coupon code we shall then associate her to Mr Popescu and the information supplied on the nature relationship between the two; when Mr Popescu returns to receive his reward the recruiter will also ask him as well information on the nature of his personal relationships with the individuals recommended and this information shall be associated to the network; the recruiter shall also ask Mr Popescu to indicate the number of persons he knows in the target population; if his reply is 30 the recruiter can conclude that Mrs Ionescu had a selection probability of 1 to 30.

Despite all these improvements the RDS method still presents several disadvantages:

□ despite its apparent potential for fast recruitment, the RDS sampling may result in practice in a very slow recruitment for various reasons including:

- ◆ the small dimensions of the network;
- ◆ lack of relationships between the members of the target population;
- ◆ lack of enthusiasm for participation;
- ◆ inadequate incentives;
- ◆ a high degree of stigmata.

The real disadvantage consists in fact in the unpredictable response rate.

□ there is no software developed for the analysis of data collected by means of RDS. The only software developed so far is RDSAT intended for the definition of basic statistical estimators only.

The respondent driven sampling has been recently extended to the internet, extension which offers the possibility to sample large electronically connected populations in a fast way and with the minimum resources[17].

6. Conclusions

As popularity of qualitative surveys has significantly increased in the last years, both worldwide and in our country, it is only natural to focus on the non probability methods used in the

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[17] Wejnert, C., Heckathorn, D.D., Web-based network sampling: efficiency and efficacy of respondent-driven sampling for online research, *Sociological Methods and Research* (2007), May 18, 2007, http://www respondentdri vensampling.org/reports/web_rds1.pdf

marketing surveys, the theoretical and practical issues being very seldom approached in the textbooks. Such is the case of the "snowball" sampling, a method often used along the years both in exploratory and descriptive surveys, due to its capacity to discover precious information on the so called "hidden" populations.

In the paper we have presented above we have approached the "snowball" method basically in connection with the multiple advantages and also the improvements it may offer in marketing surveys. The latest and most popular improvement is named the respondent driven sampling based on the recommendations of the respondents which can be used to mitigate the non probability character of the method in order to correlate statistical interferences.

Despite the series of improvements brought to the "snowball" method, as presented above, there still are several issues which continue to raise the interest of researchers and which include:

- Identification of respondents and initiation of referral chains;
- Checking of eligibility of potential respondents;
- Employment of respondents as informal survey assistants;
- Control of types of referral chains and of the number of cases associated to each chain;
- Stimulation and monitoring of the referral chains and of quality of data collected.

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