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Sampling and Sample Size Determination in Survey Research: A Comparative Analysis

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Abstract **Review Article**

Sampling and sample size play significant roles in the reliability of a research study. Unsuitable, inadequate or disproportionate sample sizes may result to unreliable and inaccurate research outcomes. This study therefore emphasized on the importance of sampling and determination of sample size in survey research. The study also reviewed the criteria for a good sample size as well as factors that determine sample size decision. Methods of determining appropriate sample size were explained while Taro Yamane's, Krejcie and Morgan's and Cochran's formulae of calculating sample size for survey research were objectively discussed. The study thus recommended as a matter of importance that determination of an appropriate sample size should be given high priority by researchers carrying out a survey research and that for finite population, any of the three formulae examined i.e. Taro Yamane's, Krejcie and Morgan's and Cochran's formulae can be used to calculate sample size since it has been established that there is no material difference among sample sizes obtained through these formulae.

Keywords: Sample Size, Sample Size Determination, Sampling, Sampling Methods, Survey Research.

INTRODUCTION

In a survey research, the population is the main focus. Typically, the researcher finds that it is not feasible to investigate every item in the population, so he must use sampling procedures to choose a sample from the population. Gathering data that is representative of a population is the common objective of survey research. Within the bounds of random error, the researcher applies the representative data generated from the field to extrapolate findings from the sample back to the population. The most common mistakes in research projects were sampling error when calculating sample size and disregard for response and non-response bias (Chanuan, Kajohnsak & Nittaya, 2021).

The sample size that a researcher uses for study activity must be chosen so that the observations it makes accurately reflect observations made by the population as a whole. The population size must be reduced to an appropriate sample size in order to collect data from research fields. This is done by processing reference numbers that have been analysed from samples called Statistics back to the population. This is necessary because, in most cases, it is very difficult for scholars to access large populations. Chanuan et al., (2021) argue that a dependable sample should be obtained using probability sampling, adhering to the baseline criteria specified in the statistical analysis of the data. It should possess identical characteristics to those of the population.

On the other hand, research inquiries frequently use sampling approaches to more accurately estimate at a lower cost and in less time. For research questions to yield reliable results, sample size calculation and sampling method selection are critical steps. Even a well-conducted study may not identify significant effects or associations or may estimate those impacts or associations too loosely if the sample size is too small. Similarly, an excessively high sample size would make the study more complex and could perhaps produce inaccurate results. Furthermore, increasing the sample size would increase the study's cost. Consequently, a crucial component of each scientific study is the sample size (Chanuan, 2020). Marshall, Cardon, Poddar and Fontenot (2013) explained that both sample size and sampling techniques in qualitative research are as important as they are in quantitative research.

Determining the sample size is a challenging procedure that calls for the assistance of a researcher with extensive training in research and statistics, according to Blaikie (2018). Methods for determining sample size are primarily based on the study's primary measure and design. Sampling has been given less attention in qualitative research compared to the other methods and this leads to poor quality research results and low effectiveness. When the quality of research result is high, it will have a great impact on the stakeholders and increase its effectiveness (Adam, 2020).

Statement of the problem

In every qualitative research, sampling which essentially entails sample size, sampling methodologies, and sampling designs considerations is crucial. As such, sampling supposed to be a given more attention in all qualitative research works. Regrettably, this is often not the case as sampling has been given less attention in qualitative research compared to the other methods and this leads to poor quality research results and ineffectiveness. In addition, sample sizes in most cases are chosen in an indiscriminate way in many research works (Adam, 2020). This in turn has adverse effects on the reliability of data generated, the validity of the research work and, the extent to which the research outcome truly represents the population.

Sample size is a vital aspect of research study, therefore, to achieve the desired outcome in research work, appropriate sample size planning is required. However, many researchers failed to take this into consideration (Rao, 2012). According to Chow, Shao, Wang, and Lokhnygina (2017) sample size selection plays significant role in research work and its outcome. Marshall et al., (2013) contended that many current studies disregard the need of proper sampling methods and sample size. As a result, researchers were unable to make precise and dependable conclusions about the population. Scholars also affirmed that Taro Yamane’s (1967) formula for calculating sample size in research is suitable only for finite population despite its popularity over and above other formulae (Adam, 2020; Nanjundeswaraswamy & Divakar, 2021; Chanuan et al., 2021; Oyeniyi, 2022).

It is against this backdrop that this study seeks to review sampling and sample size determination and comparatively analyse Taro Yamane’s, Krejcie and Morgan’s and Cochran’s formulae for sample size determination.

Objective of the Study

The objective of this study is to empirically review sampling and sample size determination and comparatively analyse Taro Yamane’s, Krejcie and Morgan’s and Cochran’s formulae for sample size determination.

LITERATURE REVIEW

Survey Research

This type of research intends to provide solutions to issues that relate to who, what, where and how questions of the study. It involves the use of questionnaire to gather for the study. The use of survey research is beneficial to the researchers because it is cost effective, results from the sample can be generalised on the entire population and its results can be compared with other results (Oyeniyi, 2022). According to Singleton and Straits (2009), survey research can use quantitative research methods like questionnaires, qualitative research methods using open-ended questions or both. They further stressed that this kind of research is commonly used to describe and explore human behavior. In her own opinion, Ponto (2015) stated that survey research had developed into a rigorous approach to research with scientifically tested methods detailing who to conclude (representative sample), what and how to distribute (survey method) and when to initiate the survey and follow up with non- responders so as to ensure high quality research process and result. She also affirmed that the most common of gathering data in survey research are questionnaires and interview. She then concluded that survey research is a useful and legitimate method to research that has clear benefits in helping to describe and explore variables and constructs of interest.

Sampling

Sampling involves the deliberate selection of a subset of individuals from a larger population to gather information and make inferences about the overall characteristics of the population. Sampling has two main advantages: accelerated data gathering and decreased costs (Singh & Masuku, 2014). Nanjundeswaraswamy and Divakar (2021) provide a concise definition of sampling as the act of choosing a smaller portion from a bigger group or population. They argued that population refers to the complete set of individuals that a certain study aims to investigate, whereas sample represents a subset of the full population that is chosen to represent the whole. According to Asika (2009), a population refers to all possible elements, individuals, or observations related to a certain phenomenon that is of interest to the researcher. The act of selecting a subset of this population for study is known as sampling. He further asserted that a population can be classified as either finite, meaning its size or extent can be conceived and estimated, or infinite, indicating a comprehensive count of all elements comprising that population.

Sampling Methods

Nanjundeswaraswamy and Divakar (2021) categorised sampling methods into two primary groups: probability sampling methods and non-probability sampling methods.

Probability Sampling Methods

Probability sampling methods entail the utilisation of random selection to choose sample items, guaranteeing that each item has an equitable opportunity to be included in the sample (Adam, 2020). He argued that probability sampling necessitates the fulfilment of certain requirements.

1) A comprehensive inventory of issues to be examined should be accessible.

2) The size of the universe must be determined.

3) The required sample size should be explicitly stated.

4) Every element should have a uniform probability of being chosen.

Probability sampling methods encompass the following:

Random Sampling: Termed as basic random sampling. This methodology employs the concept of randomization, ensuring that each individual within a population has an equal probability of being chosen. This type of sampling yields a more accurate estimation of parameters in research compared to purposive sampling. Each individual in the sampling frame has a distinct and nonzero probability of being chosen for the sample (Singh & Masuku, 2014). Random sampling is the primary technique used in probability sampling (Asika, 2009).

Systematic Sampling: This is the process of selecting the nth topic or item from a population that is listed in a sequential manner. The value of nth is often calculated by dividing the population by the desired sample size. The population is represented by the variable N. According to Blaikie (2018), the initial item of the sample is chosen randomly, whereas the subsequent items are selected using systematic methods. The mathematical relationship is expressed as R = N/n, where N represents the total population, n represents the size of each unit, and R represents the interval used for sampling. For instance, if a population consists of 5000 items and we want to select 1000 items using a systematic sampling strategy, the sample interval would be calculated as follows: 5000 divided by 1000 equals 5. The process will now involve selecting every fifth item following the initial one.

Stratified Sampling: According to Etikan and Bala (2017) the method involves dividing the population into different sub-population known as strata. Following the process of stratification, each stratum is then sampled as a distinct sub-population, from which individual objects can be chosen randomly. He further stressed that some of the parameters for selecting stratification variable for the dividing the population include homogeneity and relatedness. This sampling technique is highly relevant if the population is heterogeneous. However; this approach has a major challenge of selecting the ideal stratification variables (Casteel &Bridier, 2021).

Cluster or Area Sampling: In this methodology, the entire population is partitioned into smaller units known as clusters. The cluster samples exhibit greater intra-group variation and inter-group similarities. Market research is the most appropriate application for it (Nanjundeswaraswamy & Divakar, 2021). According to Etikan and Bala (2017), cluster sampling involves dividing a state into districts, revenue divisions, and villages, and selecting clusters of people from these areas. On the other hand, Chow et al., (2017) argue that cluster sampling is most suitable when there are natural but relatively homogeneous groupings within a population. Furthermore, they claimed that cluster sampling is a more economically efficient method compared to other sample techniques.

Non-probability Sampling Methods

These approaches lack a guarantee of randomization, while there is a possibility of random outcomes occurring by accident. The elements of the population do not possess the privilege of being selected with an equal probability in the sampling process. Oyeniyi (2022) states that the determination of sample size for non-probability sampling lacks clarity and is not subject to rigid regulations. Non-probability sampling methods encompass various types, such as:

Quota Sampling: Quota sampling is a method that entails separating the population into separate and non-overlapping sub-groups, much to stratified sampling. Afterwards, the application of judgment is used to select units from each segment, considering a preset proportion. It is important to note that the sample is chosen in a non-random manner. Nevertheless, the chosen samples may exhibit bias due to the unequal probability of selection for all individuals (Singh & Masuku, 2014).

Convenience or Accidental Sampling Method: Nanjundeswaraswamy and Divakar (2021) state that samples in this method are selected based on the researcher's discretion. It is the best method for sample selection on a particular issue. The researcher tries to get sample of convenient elements by choosing convenient sampling units. In convenient sampling method, the respondents are selected because they happen to be there at that point in time. This method is the least expensive and least time consuming among all the sampling methods. Examples are journalists interviewing people on the street (Adam, 2020).

Judgmental/Purposive Sampling Method: This is the process of selecting sample responders who are most capable of providing the necessary information. The legitimacy of the outcome depends on the researcher's discernment in selecting the sample (Castel & Bridier, 2021). A researcher who is carrying out a study on the use of family planning pills needs to focus more on young female between the ages of sixteen (16) and thirty-five (35) years in order to get a reliable outcome. This method is best adopted when few people possess the data needed (Etikan, Musa & Alkassim, 2016).

Snowball sampling Method: The strategy entails selecting a single individual from the population who can assist the researcher in identifying additional individuals that may not be within the researcher's knowledge. When using this method, it may be difficult and at times almost impossible to access and identify numbers of the potential population

(Oyeniyi, 2022). Asika (2009) affirmed that the method is beneficial because of the use of population characteristics in randomly selecting the initial respondents which gives it a strong resemblance of a probability sampling technique.

Sample Size and its Importance on Research Outcomes

Sample size refers to a subset of a population that is necessary to obtain enough information for making conclusions (Sekaran & Bougie, 2010). Uttley (2019) defines sample size as the total number of individuals included in the sample. Memon, Salleh, Mirza, Cheah, Ting, Ahmad, and Tariq (2020) defined sample size as the total number of participants to be included in a research project. Sample size refers to the total number of observations included in a sample. The symbol "n" is widely used to represent it. Inference will be made about the population based on the sample statistics. Estimating the sample size is crucial as the standard error is contingent upon it (Nanjundeswaraswamy & Divakar, 2021). Sample size is a calculation of the minimum number of participants needed to identify a relationship between a specific effect size and variability (Chow et al., 2017). Oyeniyi (2022) states that the sample size can be influenced by several aspects, such as population variance, population size, population parameter, and cost.

The sample size is crucial due to its impact on the statistical power. Statistical power refers to the probability that a statistical test will correctly detect a significant difference if one genuinely exists. The test's sensitivity is contingent upon its statistical power, as demonstrated by Browner & Newman (1978); Nanjundeswaraswamy & Divakar (2021). Blaikie (2018) explained that the pivotal role of sample size is to make conclusions about the population of the study. He further emphasized that sample size used in research work is function of data collection cost and sufficient statistical power.

Sample Size Determination

Sample size determination is the process of selecting the appropriate number of objects to be included in a sample (Sharma, 2017). The choice of sample size is crucial as it ensures the inclusion of a sufficient number of participants that can produce credible research conclusions with a high level of statistical confidence. Oyeniyi (2022) elucidated that the determination of a precise sample size relies on factors such as the desired level of estimation accuracy, the acceptable margin of error, and the proportion of respondents with identical attributes, among other considerations. When conducting a survey using stratified sampling, if the population is diverse, it is necessary to have varying sample sizes for each population group. In a census, data is gathered by conducting a complete enumeration, resulting in a sample size that is equivalent to the population size. Greater sample numbers typically result in enhanced accuracy when estimating unknown parameters. This is further supported by the law of large numbers and the central limit theorem (Singh & Masuku, 2014; Blaikie, 2018).

Criteria for a good Sample Size

According to Casteel and Bridier (2021) three critical components that must be put into consideration when calculating sample size are: level of precision, level of confidence or risk and degree of variability.

Level of Statistical Precision / Sampling Error: Statistical correctness pertains to the level of resemblance between the computed value and the corresponding value in the target population. The statistical precision is typically assessed using the standard error, which may be determined in two ways: descriptively and inferentially. Descriptively, precision can be assessed by calculating the standard error, which is the difference between the sample estimate and the population parameter. Nanjundeswaraswamy and Divakar (2021) defined precision as the extent to which the value of the population may be calculated within a specific range, typically expressed as a margin of error of +5%.

Confidence / Risk Level: Confidence level refers to the level of certainty or probability that an assumption or numerical value is accurate. The central limit theorem states that when a sample is selected repeatedly from a population, the average of a certain property, such as the mean, acquired from that sample will be equal to the true attribute of the population.

Degree of Variability: The degree of variability refers to the dispersion of characteristics within a given population. In order to achieve a desired degree of precision, a bigger sample size is necessary for a population that is more diverse. Conversely, for a population that is more uniform, a smaller sample size is adequate to meet the desired precision level (Nanjundeswaraswamy & Divakar, 2021). In their study, Singh and Masuku (2014) stated that when dealing with a population that is more similar in characteristics, a lower sample size is sufficient to achieve a desired level of accuracy. Conversely, a population that is more diverse in characteristics requires a bigger sample size to get the same degree of accuracy. For example, a proportion of 50% suggests a higher degree of variability compared to proportions of 90% or 10%. This is because proportions of 90% and 10% suggest that the majority either have or don't have the attribute of interest, whereas a proportion of 50% represents the maximum variability within a group.

However, the best approach to fulfil these criteria is to conduct a pilot study that has at least thirty (30) respondents because it will greatly assist to refine the main survey (Oyeniyi, 2022).

Factors that Determine Sample Size Decisions

According to Memon et al., (2020) factors that need to be put into consideration when estimating an appropriate sample size include:

Nature of research and statistical analysis: The selection of sample size is heavily influenced by the research design. A sophisticated model with a multitude of variables necessitates a more extensive data collection compared to a straightforward model with only a few variables. Similarly, models that include moderators or several groups require a higher sample size. The selection of the unit of analysis also has an impact on the size of the sample. Research conducted at the organisational level, with top-level executives such as CEOs, CFOs, and HR managers as respondents, generally has a smaller sample size compared to research conducted at the individual level, which includes employees, clients, and similar persons. Furthermore, doing a pre-testing and/or pilot study necessitates a reduced sample size in comparison to a primary study.

The population size to be sampled: The magnitude of the population directly influences the determination of the sample size. In the case of a large population, the size of the sample and the method used for sampling will greatly influence the researcher's capacity to make generalisations about the entire population.

Research supervisor/examiner: The preference of a research student's supervisor or examiner is an often influential factor in the selection of sample size by the students. Many supervisors hold the belief that a significant sample size is crucial in order to improve the generalizability of findings and draw more precise conclusions. Consequently, they frequently encourage students to diligently devise and gather data from a substantial number of participants. Large sample sizes can cause statistical significance to become too sensitive, leading to a Type 1 mistake, as stated by Hair, Black, Babin, and Anderson (2018). The resilience of a sample is contingent upon the meticulous choice of respondents rather than its magnitude (Boreham, Davison, Jackson, Nevill, Wallace, & Williams, 2020).

Practical considerations: Decisions regarding sample size may be influenced by limitations like as budget, time, resources, and other constraints. Researchers frequently encounter difficulties in physically accessing a geographically scattered population as a result of cost constraints. Obtaining a sufficient and unbiased sample by either travelling across states to collect data or employing enumerators is a laborious and expensive process. Hence, when faced with constraints on obtaining a sizable sample, it is imperative for researchers to disclose both the ideal sample sizes as well as the actual sample sizes employed in the study. In their study, Mooi, Sarstedt, and Mooi-Reci (2018) suggested that researchers should take into account the estimation of the proportion of potential respondents, the proportion of respondents who are willing to participate, and the proportion of respondents who are likely to accurately complete the questionnaire. This can be advantageous in accurately determining the appropriate sample size for planning purposes.

Methods of Determining Sample Size

Researchers employ four primary approaches to determine the optimal sample size: the census method for small populations, replicating the sample size of similar studies, extracting sample size data from published tables, and utilising formulas to calculate the sample size (Singh & Masuku, 2014; Nanjundeswaraswamy & Divakar, 2021).

Census Method: The census approach involves using the entire population as the sample. This method is only appropriate when the population size is relatively small, as the accompanying costs can be high otherwise. This approach eradicates the possibility of sampling mistake and furnishes data on every individual within the community. It is a suitable approach for medical research due to its perfect accuracy.

Using a sample size of similar studies: This approach involves utilising the existing sample size from comparable studies within the same domain. Nevertheless, this poses a drawback as the inaccuracies in sample size determination from the preceding study may persist.

The use of Published Tables: The sample size for research in this method is established using public tables that offer the sample size for predefined parameters. However, it is important to consider certain considerations when utilising the published tables. This is because the use of published tables is based on the assumption that the characteristics of the population follow a normal distribution (Oyeniyi, 2022).

The use of Formulas: This involves the application of one of the various available formulas to calculate sample size. One of those available formulas is Krejcie and Morgan's formula which is the focus of this study. The researcher can integrate various degrees of accuracy, level of certainty, and range of variation to ascertain the suitable sample size. However, it is highly essential for researchers to review literature to determine the conditions and requirements for the use of these formulas (Oyeniyi, 2022). Chanuan et al., (2021) explained the different formulas a researcher can adopt reasonably to calculate the appropriate sample size for his research which include but not limited to:

a. Krejcie & Morgan Formula (Krejcie & Morgan,1970)
b. Cochran Formula (Cochran, 1963)
c. Jacob Cohen Formula
d. G*Power Program
e. Taro Yamane's Formula (Yamane, 1967)

Out of the formulae for calculating sample size stated above, the study objectively examined Taro Yamane's, Krejcie and Morgan's and Cochran's formulae.

Taro Yamane's (1967) formula for determining sample size

Taro Yamane's formula is an approximation of known sample size formulae such as Krejcie and Morgan as well as Cochran formulas for proportion at 95% confidence level and population proportion of 0.5. Yamane's formula in its present state is, therefore, best suited for categorical variables and only applicable when the confidence coefficient is 95% with a population proportion of 0.5 (Adam, 2020). The formula is most appropriate for survey research and finite population (Adam, 2020; Nanjundeswaraswamy & Divakar, 2021; Chanuan et al., 2021; Oyeniyi, 2022).

Taro Yamane formula is given as $n = \frac{N}{1+N(e)^2}$ where:

N = Population size

e = error limit or level of precision

n = sample size

Supposing there were 1,322 doctors targeted in Lagos state for a research work at 95% confidence level; using Taro Yamane approach; sample size would be:

$$n = \frac{N}{1+N(e)^2}$$

$$= \frac{1,322}{1 + 1,322 \times (0.05\times0.05)}$$

$$= \frac{1,322}{4.305}$$

n = 307

Therefore, sample size = 307. This represents 23% of the total population.

Krejcie and Morgan's (1970) formula for Sample Size Determination

The method; developed by Krejcie and Morgan in 1970, is an estimation of sample size based on established formulas such as Taro Yamane and Cochran formulae. It specifically applies to a 95% confidence level and a population proportion of 0.5. Krejcie and Morgan (1970) formula for determining sample size provides identical sample sizes in all cases where the researchers adjusts the t-value used based on population size which is required when the population size is less than 120 or less (Adam, 2020). Also, Krejcie & Morgan formula is appropriate for survey research and finite population (Memon et al, 2020).

The formula below was used by Krejcie and Morgan (1970) to determine sample size:

$$n = \frac{x^2 NP(1-P)}{d^2(N-1) + x^2 P(1-P)}$$

n = sample size,

x^2 = Chi-square table value for one-degree freedom at the desired level of confidence and reliability level 95% (x^2 = 3.841)

N =population size,

P =proportion of the population (assumed to be 0.50 since this would provide the maximum sample size), and

d = acceptable error of sample size expressed as a proportion (0.05).

Using Krejcie and Morgan's formula to determine the sample size from the above example; sample size would be:

$$n = \frac{x^2 NP(1-P)}{d^2(N-1) + x^2 P(1-P)}$$

N = 1,322, x^2 = 3.841, P = 0.50, d = 0.05

$$n = \frac{3.841 \times 1{,}322 \times 0.5\,(1 - 0.5)}{(0.05)^2\,(1322 - 1) + 3.841 \times 0.5\,(1 - 0.5)}$$

$$= \frac{1{,}269.45}{3.3025 + 0.9603}$$

$$= \frac{1{,}269.45}{4.2628} = 297.8$$

Sample size = 298. This represents 22.5% of the total population.

Cochran's (1963) formula for calculating sample size

Cochran developed formulae to determine sample sizes for both infinite and finite population.

i) Cochran's formula for calculating sample size when the population is infinite:

The formula developed by Cochran to determine sample size for infinite population is:

$$no = \frac{z^2\,p\,q}{e^2}$$

Where; no = sample size,

z^2 = the abscissa of the normal curve that cuts off an area α at the tails (1 - α equals the desired confidence level is 95%),

e = the desired level of precision,

p = the estimated proportion of an attribute that is present in the population, and

q = 1-p.

The value for z is found in statistical tables which contain the area under the normal curve.

The usage of the formula demands that the level of confidence and the related z values be determined (Chanuan, 2020, Oyeniyi, 2022).

Level of confidence	z values
90%	1.65
95%	1.96
99%	2.57

Assume there is a large population but that we do not know the variability in the proportion that will adopt the practice; therefore, assume p=.5 (maximum variability). Furthermore, supposing we desire a 95% confidence level and ±5% precision, the sample size will be as follows--

p = 0.5 and hence q =1-0.5 = 0.5; e = 0.05; z =1.96

$$\mathbf{no = \frac{z^2\, p\, q}{e^2}}$$

$$no = \frac{(1.96)^2\,(0.5)\,(0.5)}{(0.05)^2}$$

no = 384.16

Sample size = 384

ii) Cochran's formula for calculating sample size when population size is finite:

Cochran pointed out that if the population is finite, then the sample size can be reduced slightly. This is due to the fact that a very large population provides proportionally more information than that of a smaller population. He proposed a correction formula to calculate the final sample size in this case which is given below

n = no / [1 + {(no – 1) / N}]

Where n = sample size

N = population

The example above under the infinite population can be adjusted to embrace finite population. Using the population of 1,322 earlier used above; the sample size can be determined thus:

n = no / [1 + {(no – 1) / N}]

n = 384/ [1 + {(384 – 1)/ 1322}]

n = 384/1.2897

n = 298.

Sample size = 298. This represents 22.5% of the total population.

The table below shows the values of the sample sizes calculated from different populations using the three (3) formulae stated above.

Table 1: Comparative Sample sizes calculated for finite population by Taro Yamane's, Krejcie and Morgan's & Cochran's formulae

S/N	Population (N)	Taro Yamane			Krejcie & Morgan			Cochran		
		5%	7%	10%	5%	7%	10%	5%	7%	10%

1	450	212	136	82	208	137	79	207	137	79
2	582	229	150	85	231	146	83	332	147	83
3	693	254	158	87	248	153	84	247	153	85
4	799	266	163	89	259	158	86	260	158	86
5	806	267	163	89	259	158	86	260	158	86
6	845	272	164	89	265	159	86	264	159	86
7	858	273	165	90	265	161	86	266	160	87
8	892	276	166	90	269	161	86	287	161	87
9	909	278	167	90	270	162	87	270	161	87
10	922	279	167	90	270	162	87	271	162	87
11	985	285	169	91	276	163	87	277	164	88
12	1009	287	170	91	278	165	88	278	164	88
13	1058	290	171	91	282	166	88	282	166	88
14	1073	292	171	91	282	166	88	283	166	88
15	1115	294	173	92	286	168	88	288	167	89
16	1167	299	174	92	289	168	89	289	168	89
17	1184	299	174	92	291	169	89	290	168	89
18	1256	303	176	93	295	169	89	294	170	89
19	1298	305	176	93	295	170	90	297	170	90
20	1322	307	177	93	298	170	90	298	171	90
21	1584	319	181	94	310	175	91	309	175	91
22	1908	330	184	85	320	178	91	310	178	92

(Source: Authors' Computations, 2025**)**

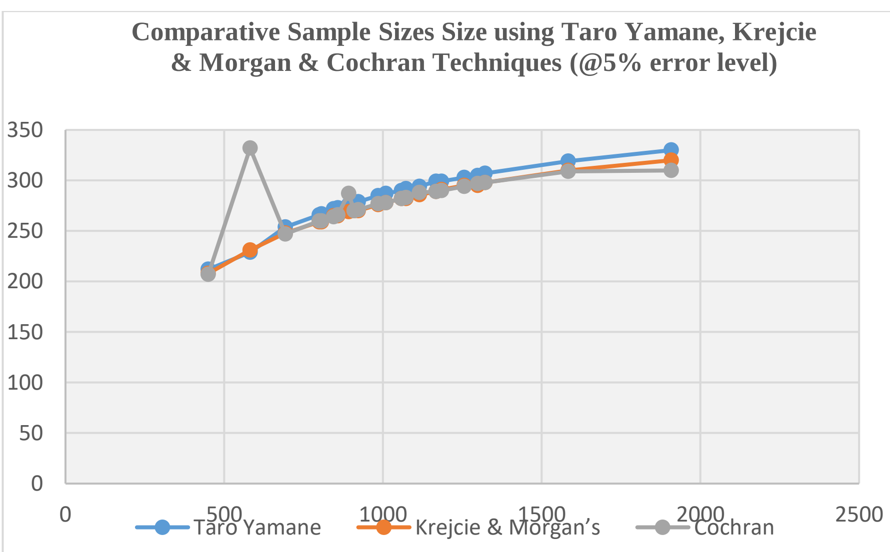

Fig. 1: Comparative Sample Sizes Size using Taro Yamane, Krejcie & Morgan & Cochran Techniques (@5% error level)

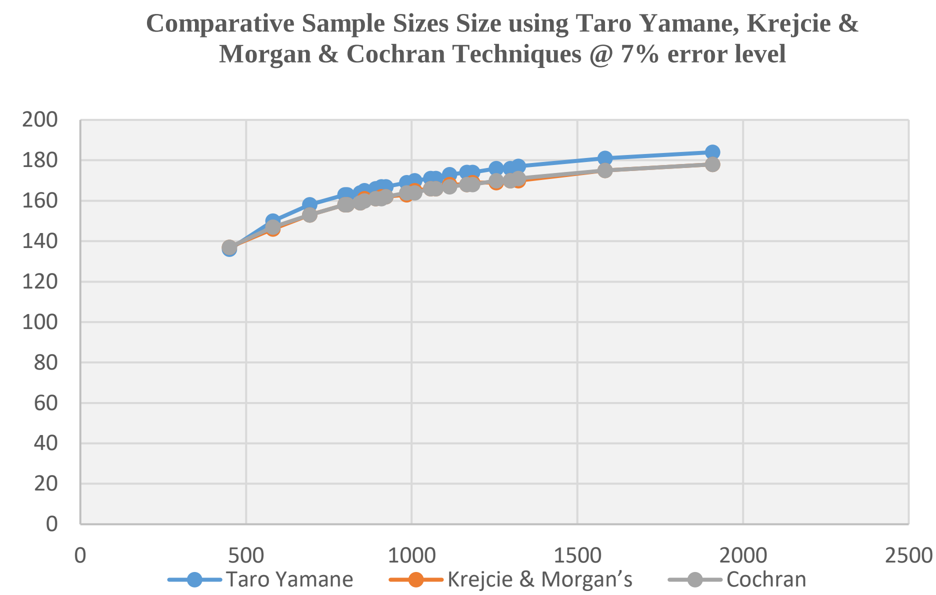

Fig. 2: Comparative Sample Sizes Size using Taro Yamane, Krejcie & Morgan & Cochran Techniques (@7% error level)

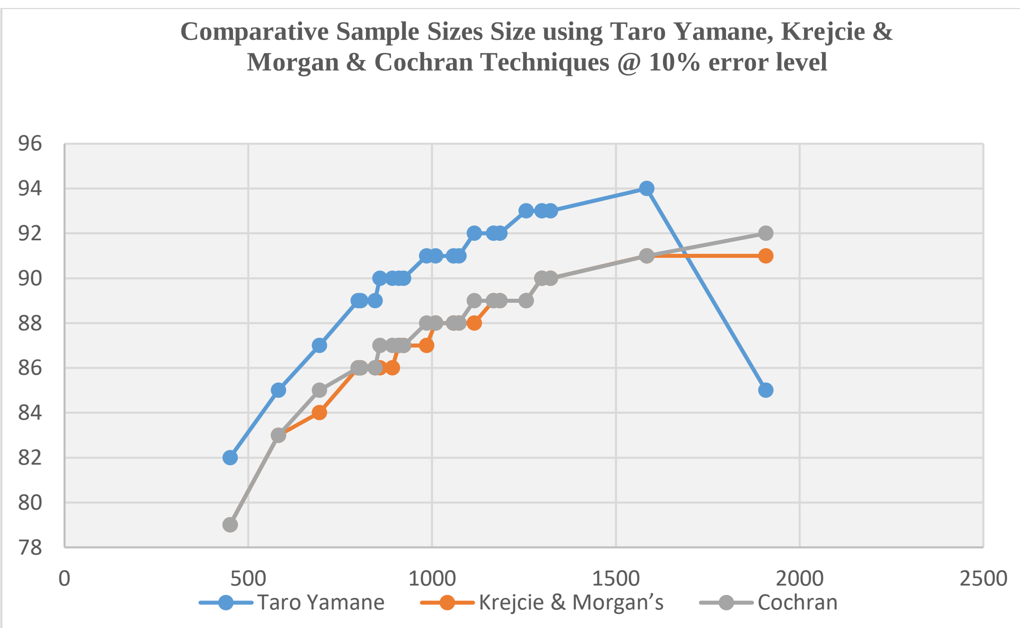

Fig. 3: Comparative Sample Sizes Size using Taro Yamane, Krejcie & Morgan & Cochran Techniques (@10% error level)

Conclusion

Based on the revelations from the table and the graphs above, the study concluded that for finite population Taro Yamane's formula in most cases produced the highest value of sample sizes though there was no significant difference between sample sizes obtained through Taro Yamane's formula and that of Krejcie and Morgan as well as Cochran's formulae. Unlike Taro Yamane's and Krejcie and Morgan's formulae, the study affirmed that Cochran's formula is also suitable for determining sample size for infinite population (Adam,2020; Oyeniyi, 2022). The study also described the concept of survey research, sampling and sample size determination.

Recommendations

In view of the discoveries during the study, it was recommended among others that:

i. For finite population, any of the three formulae examined i.e. Taro Yamane's, Krejcie and Morgan's and Cochran's formulae are suitable for the calculation of sample size since it has been established that there was no material difference among sample sizes obtained through these formulae.
ii. For infinite population, Cochran's formula should be used to calculate sample size since it gives dependable and reliable sample size.
iii. Topmost priority should be given to sampling techniques and sample size determination in survey research in order to arrive at reliable and dependable research outcomes.

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