2 CITATION: ORIGIN MEANING AND SCOPE

2.1 ORIGIN OF CITATION

The origin of footnote or citation practice cannot be determined. The footnotes mentioned at the bottom of the page have now attained a position of considerable been well established in scientific writing even when the early periodicals started about three centuries ago, Derek de Solla Price (78) states that "This most obvious manifestation of this scholarly bricklaying is the citation of references. One can not assume that all authors have been accurate, consistent and conscientious in nothing their source. Some have done too little, others too much. But it is generally evident from a long run of any scientific periodical that around 1850 these appear the familiar modern pattern of explicit reference to previous work on which rests the distinct, well-knit addition that is the ideal burden of each paper. Before that time, though footnoting is as old as scholarship itself compare the very term scholia for the accretion of learning."

Although, the practice of citation has a long history. Yet the use of the citations for other than their primary purpose seems to be of recent origin.

2.1 MEANING OF CITATION

Lin and Nelson (56) have pointed out that some confusion may arise from the indiscriminate use of the terms 'Citation' and 'Reference'. If 'citation' is read literally, it refers to each occasion upon which a reference is cited in the text. Thus, a single work may be cited many times in a publication, although it will appear only once in the bibliography (i.e. as a reference). Most citation studies have not made clear this distinction and it is possible that some error has been introduced into citation studies by the different usages of 'citation'.

According to Krause (52) "by reference we mean a footnote in an article which gives bibliographic information about an earlier article. By a citation we mean a footnote referring to a given article and necessarily contained in an article written at a later date. It is useful to think of 'reference' as a backward looking concept and of 'citation' as a forward looking concept. A footnote is of course both a reference and a citation.

Roland Fjerppe (45) takes the word citation in a generic sense, encompassing forms of written records or communications (books, journals, papers, reports etc.)
Units are chosen according to level of aggregation (e.g. articles or journals) appropriate for study. The term 'document' will be used for brevity although in the case of an article it refers only to a part of the physical document. The physical document themselves are too comprehensive and difficult to handle in large quantities. The primary workings material for citation analysis is therefore the document representation, uniquely identifying the physical document. These document representations are usually called (bibliographic) 'references' or 'citation'.

In other words, 'Reference' means 'the acknowledgement one document gives (in the form of document representation) to another'. Citation is 'the acknowledgement one document received from another'.

2.3 TAXONOMY OF CITATIONS

During the last four decades, the citation indexing has become popular as a device for retrieval and searching scientific publications on the topic or field of research. Citation indexes are providing information scientists with useful materials for studying literature pattern, information generation and propagation etc. All such activities are based on the hypothesis, taken as a major premise, that between a citing item and the members of the cited set of items, there is a cognitive relationship linkage of some form. In other words, it may be said that, the citing item makes use of some piece of information contained in each of the cited items for some purpose relevant to the context and content of it.

The reason citation indexes provide multidisciplinary searching capabilities is once again related to the fact that most indexes are not as qualified as the author himself to decide which previously published material is related to his current work. A citation takes advantage of the built in linkages between documents provided by authors citations by listing together all items with common citations. Ponsaki and Narin (75) have developed further refinement of citation counts which take into account, the length of papers, the prestige of the citing journal, and the different referencing characteristics of different segments of the literature.

As a consequence of this it has been suggested that citations can be considered as index of cognitive linkage between documents, just by the nature of use by the authors instead of actually attesting the content and subject extension of them. Therefore, Fano (30) and Kessler (51) independently suggested that if two different
documents refer to a common item, they should have a sort of closeness in their approach, study, context or cognition. Those which have no common cited ancestors are more likely to be unrelated or conceptually a far (48).

Linda Smith further reviews a few more articles regarding development of citation analysis. One of the important aspects of scientific communication is the way in which scientists interact with their colleagues in the production and dissemination of research results. The following three techniques have been devised to identify documents likely to be closely related:-

A) Direct citation
B) Bibliographic coupling
C) Co-citations.

2.3.1 DIRECT CITATION

This concept has been used by variety of researchers to establish relationship among documents of different types. The main credit for developing this technique goes to Garfield and Solla de Price. The latter provided a conceptual framework for understanding the concept of network in overall context of scientific disciplines. He has in fact proposed a model.

According to him - (i) each paper carries on an average a dozen citations back to the previous literature. His analysis shows that their exist, two separate modes of citation. The first accounting for almost half of all the references back may be called archival almost completely independent of the age of older paper being cited, and without structure. The second type of citation may be called, research front. New papers use the considered as cognitive relation according to Martyn (62). Even multiple common citations may not guarantee the base of brotherhood in terms of content. At best one can say that more than the common citations, more is the probability of their being cousins. The idea of bibliographic coupling can be theoretically elaborated by means of general mathematical framework for understanding it better. Practically speaking, we always prefer to formulate in terms of generation of citations instead of considering one step citation. Further, instead of considering the common citations or citation of two papers we think in terms of citation populations taken together. In this way we can prepare correlation matrices and quantitative measures of the bibliographic coupling strength and make direct applicability of clustering of
items. Thus in bibliographic coupling we see that later documents become linked up because they cite the same earlier documents of the articles in the context.

In bibliographic coupling each reference to earlier literature identifies an unique conceptual relationship between the cited and citing paper. There exist a sort of link between the reference citations and source citations. Martyn called it as an ancestor and descendant respectively.

2.3.2 BIBLIOGRAPHIC COUPLING

In the early 60's M.M.Kessler (50) of the Massachusetts Institute of Technology introduced the term bibliographic coupling, Kessler demonstrated coupling in a computerised study of the references in thirty six volume of the physical Review. This research emphasises the advantage of coupling units used as a retrieval tool 'Independent of Words and Language' and requiring no expertise of prior knowledge for comprehension. It further emphasised that if the number of common citations for two different papers be multiple rather than single, there strength of coupling is said to be more, implying that their cognitive contents are much close to each other. Kessler who experimented and developed the theory of bibliographic coupling, if a series of papers had further tried to establish the usefulness of the idea. The notion of the bibliographic coupling and these works have attracted the attention of experts in bibliometrics and information analysis as interesting but have been taken seriously. The main criticism against the hypothesis is that, a common parental citation may be independently by H.G. Small (96) and Marshakova in 1973 and later on developed by Small along with Griffith and others. Small presented co-citation as a form of document coupling which shows the frequency with which two documents are cited together. Small with others in fact identified cluster in various subject fields by computer programme developed by Indian standard Institution. The principle of co-citation is based on the fact that if two citations are cited together in the latter literature, they have relationship among them. The more the frequency of occurrence together the strength is the relationship between two. To be strongly co-cited a large number of authors must cite the two earlier works. So one can say that it is measurement of the degree of the relationship between papers as observed by practicing scientists or specialists. Further, because of its dependence on the practicing scientists, these co-citations, patterns may fluctuate as the interests and
intellectual pattern of the field change with time. Henry Small mentioned that a cocitation which links cited documents is very much analogous to association. If frequently cited documents can be taken to represent the key concepts of a discipline, the pattern of cocitation can be used to illustrate in detail the relationship existing between these concepts. Significant differences exist in the patterns of co-citation and patterns of coupling. Two documents are co-cited when they are jointly cited in one or more subsequently published documents. Thus in co-citation earlier documents become linked because they are later cited together.

The usefulness of co-citation studies is overcome by the development of secondary indexes of highly co-cited papers and the establishment of a "Cluster" or core of earlier literature in a field, contributing to a profile of the literature.

Time as a parameter plays a very important role in citation. Citation pattern can change over a period of time because of dependence upon the citing authors. Except on rare occasions a citing item precedes the citing item in a date of publication. Bibliographic coupling is an association intrinsic to the document (static), while citation is a linkage extrinsic to the document, and one that is valid only so long as they continue to be co-cited (dynamic). Kretschmer followed by Cawkell (53) have remarked that some works of generalisation of bibliographic coupling have come to our notice but we have not been able to identify any paper anticipating our ideas of direct generalisation. Credit goes to Kessler and Small who had developed the two excellent bibliometric tools for analysing literature structure, and based on the same supposition as the Gross idea. The tools, for studying relationships, have far reaching implications. No distinctly different technique has been produced since cocitation by Small in 1973, clustering and graphing being procedures using bibliometric coupling and cocitation. The many other articles since 1973 seem to be evaluations, applications or analyses of investigative process in attempts to describe more fully or support or duplicate previous research. An intensive research or clustering has been done in the Institute of Scientific Information including considerations of bibliographic coupling. However, Small (96) and Garfield (33) have pointed out that they have not been able to know the exact theoretical models being used by others or by ISI from published reports.
2.3.3 CO-CITATIONS

This concept for the first time was suggested other half of their references to connect back to the relatively small number of highly interconnected recent papers. In a particular field, each research paper is connected to all its neighbours by many lines of citations. A convenient image of pattern is to be found in knitting. Each stitch is strongly attached to the previous row and its neighbours.

2.3.4 SELF CITATION

Self citation means when researcher cites his own research documents for his research papers. Two assumptions can be made, when the researcher cites his own work too often.

1) The papers selected for citations are really important, when he is an authority in the specific subject.

2) The merit of a scientist is usually measured by the number of papers be published.

But now-a-days, how many times the paper has been cited is also a criteria for measurement of the standing of scientists. Solla de Price (78) correctly stated that citation stands for scholarship and therefore, the researchers cite their own citations to show their scholarships. The researcher working under his guide for dissertation/thesis cite the citation of his guide because of influence or to pay tribute to his guide. Jackson and Jackson have made citation studies of the Garden Research conference, U.S.A. in 1972. They have observed that the highest citation figure (260, 289) counted from the science citation Index were from self citations.

2.4 AGRICULTURE SCIENCE DEFINATION AND SCOPE

The terms agriculture is derived from Latin words 'ager' or 'aggrí' meaning soil and 'culture' meaning cultivation. Agriculture is a very broad term encompassing all aspects of crop production, livestock farming, fisheries, forestry etc.

2.4.1 HISTORY OF AGRICULTURE

The earliest man, Homo Erectus emerged around one and half million years ago and by about a million years ago he spread throughout old world tropics and later to temperate zones. About 500 thousand years ago, he learnt to control and use fire. The earliest man is distinguished from fellow animals by his intelligence and skill in making tools.
Homo sapiens, the direct ancestor of modern man lived 250 thousand years ago. Homo sapiens, the modern man, appeared in Africa about 35 thousand years ago. He is distinguished from all other extinct species of genus Homo, by large brain, small teeth and chin and capacity for making and using tools. He hunted a variety of animals and cooked their meat on fire. The weapons for hunting were boulders and spears of wood tipped with blades of flint. He also used stone-tipped arrows. Later he domesticated the dog which greatly helped him in hunting. Apart from the meat of animals, he gathered a variety of seeds, leaves and fruits from the jungle.

It is estimated that most efficient hunting and gathering can hardly support one person per square kilometer while pastoral life can support three and agriculture about a hundred. He had no control over food supply and was unable to clothe and shelter adequately. During the period 8700 BC to 7700 BC, he domesticated animals and turned a herdsman. He first domesticated sheep and later goat. Between the period 7500 BC to 6500 BC, man gradually shifted from hunting and gathering to agriculture. Stone axes were used for cutting trees and fire for burning forests. Grains of cereals were dibbled with the aid of pointed sticks. Later on, stone-hoes with wooden handles were invented. The cereals grown during this period were wheat and barley and later rice, maize and millets. Subsequently he domesticated cattle, pigs, horse and ass.

2.4.2 IMPORTANT EVENTS IN THE HISTORY OF AGRICULTURE

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>EVENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earlier than *</td>
<td>Hunting gathering</td>
</tr>
<tr>
<td>10,000 B.C.</td>
<td>Domestication of sheep</td>
</tr>
<tr>
<td>7700 B.C.</td>
<td>Domestication of goat</td>
</tr>
<tr>
<td>7500 B.C.</td>
<td>Cultivation of crops (wheat and barley)</td>
</tr>
<tr>
<td>6000 B.C.</td>
<td>Domestication of cattle and Digs</td>
</tr>
<tr>
<td>4400 B.C.</td>
<td>Cultivation of maize</td>
</tr>
<tr>
<td>3500 B.C.</td>
<td>Cultivation of potato</td>
</tr>
<tr>
<td>3400 B.C.</td>
<td>Wheel was invented</td>
</tr>
<tr>
<td>3000 B.C.</td>
<td>Bronze was used to make tools</td>
</tr>
<tr>
<td>PERIOD</td>
<td>EVENTS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2900 B.C.</td>
<td>Plough was invented, irrigated farming started</td>
</tr>
<tr>
<td>2700 B.C.</td>
<td>Silk-moth domesticated in China</td>
</tr>
<tr>
<td>2300 B.C.</td>
<td>Cultivation of chickpea, pea, sarson and cotton</td>
</tr>
<tr>
<td>2200 B.C.</td>
<td>Cultivation of Rice</td>
</tr>
<tr>
<td>1800 B.C.</td>
<td>Cultivation of finger millet</td>
</tr>
<tr>
<td>1725 B.C.</td>
<td>Cultivation of sorghum</td>
</tr>
<tr>
<td>1700 B.C.</td>
<td>Taming of horses</td>
</tr>
<tr>
<td>1500 B.C.</td>
<td>Cultivation of sugarcane, Irrigation from wells</td>
</tr>
<tr>
<td>1400 B.C.</td>
<td>Use of iron</td>
</tr>
<tr>
<td>15 century AD</td>
<td>Sweet orange, sour orange, wild brinjal, pomegranate</td>
</tr>
<tr>
<td>16 Century AD</td>
<td>Introduction of several crops into India by Portuguese. They are potato, sweet potato, arrow root, cassave, tomato, chilies, pumpkin, papaya, pineapple, guavas, groundnut, cashew nut, tobacco, American cotton, rubber.</td>
</tr>
</tbody>
</table>

Agriculture has no single and simple origin. It was started in different parts of the world during different periods. Present day agriculture in India as elsewhere has evolved itself through the ages. As India was a pastoral country before agriculture was started, development of crops and animals took place concurrently leading to various types of farming systems that are now seen in different parts of the country.

India's most important contribution to world agriculture is rice, the staple food crop of most of south, south east and east - Asia. Sugarcane, number of legumes and tropical fruit like mango are also natives of India. Indus valley and Harappan civilization flourished from the close of the third millennium B.C., until around 1750 B.C. Excavations in this area have revealed huge granaries. Barley, wheat, sesame, peas, date/palm, cotton and lentils were the main crops during this period. Wooden plough and wheeled cart were in use. Farmers used slingballs for scaring birds. Harappans knew ginning, spinning and weaving of cotton into cloth.

South India was a second initially independent agriculture region-crops were being raised here during the first half of the second millennium B.C. Two types of pulses and finger millet were cultivated. The third intermediate area was north and west of
Deccan plateau where the earliest cultivation of rice was recorded. Later, wheat, cotton, flax, lentils, pulses and millets spread to this region.

In later Vedic texts (1000 - 500 B.C.), there are references to cultivation of a wide range of cereals, vegetables, fruits and use of iron implem ents. Ploughing the soil several times, broadcasting seed, following and certain sequence of cropping is mentioned. Cow dung was used as manure. Irrigation of crops was common. Operations of reaping, threshing and winnowing are also described in Vedic texts. Monumental irrigation works were executed as early as first century AD.

Indian agriculture is predominantly of the subsistence type. Commercial crops like potato, sweet potato, tomato, chillies, groundnut, cashew nut, tobacco and American cotton were introduced into the country by Portuguese during 16th century AD. Subsequently subsistence economy was to an extent replaced with exchange economy. This is also known as commercialisation of agriculture.

2.4.3 AGRICULTURE SCIENCE

In pre-scientific agriculture, six persons could produce enough food for themselves and for four others. In years of bad harvest, they could produce only enough for themselves. With the development of agriculture science and application of advanced technology, five persons are able to produce enough food for 95 others.

Early knowledge of agriculture was a collection of experiences transmitted from farmer to farmer verbally. Experiments pertaining to plant nutrition in a systematic way were initiated by van Helmont (1577-1644 AD). He concluded that the main 'Principle of vegetation' is water. Jethro Tull (1674-1741 AD) conducted several experiments and published a book, 'Hoeing Husbandry'. His experiments were mostly on cultural practices and they led to the development of seed drill and horse-drawn cultivator. Arthur Young (1741-1820 AD) conducted pot culture experiments to increase the yield of crops by applying several materials like poultry dung, niter, gunpowder etc. He published his work in 46 volumes as 'Annals of Agriculture'.

Soil science began with the formulation of the theory of humus in 1809. Field experiments were started in Rothamsted experiment station, England in 1934 and soon after in other places in Europe. Research in plant nutrition and physiology was started in 18th century and continued to grow in scope. Sir Humphrey Davy
published his book 'Elements of Agriculture Chemistry' in 1813. About 1837, Sir John Bennet laws began to experiment on the effects of manures on crops. A truly scientific approach to farming was started in 1840 by Justice van Hiebig. His classical work on agricultural chemistry and physiology launched systematic development of agriculture. In 1842, Laws patented a process of treating phosphate rock to produce superphosphate and thus initiated the synthetic fertilizer Industry.

Systematic selection of cereal varieties according to predicted yield was commenced in the 18th century. The discovery of the laws of heredity and the ways to cause mutations by Gregor Johann Mendel in 1866 led to modern plant breeding. In 1876, Charles Darwin published the results of experiments on cross-and-self fertilization in plants. Since 1920 the application of genetics to develop new strains of plants and animals brought major changes in agriculture.

Agriculture engineering was mainly concerned with improving farm machinery and implements originally improvised by farmers. Mechanization took hold in western Europe and the newly settled countries only after 1850. Robert Ransome patented a cost iron share in 1785 and a self sharpening share in 1803. An efficient seeddrill was devised in 1830's. The first successful tractor was built in US in 1892. Farm implements and machinery were manufactured industrially on a large scale by 1930's. The application of electricity to agriculture was in 1920's due to economic pressure and decrease in labour availability.

Even in Neolithic times (about 7000 BC), farmers practiced a crude form of biological pest control involving more or less the unconscious selection of seed from resistant plants. In the 13th century locust attacks on crops and their control by hand picking of insects and spraying has been recorded. The first successful large scale conquest of a pest by chemical means was the control of grapevine powdery mildew in Europe in 1840's D.D.T. was first synthesized in 1874 by Dr.Paul Muller. Major advances in the study of plant diseases were recorded in 19th century. Later in the 20th century all plant diseases became object of systematic research.

Application of agriculture economics and scientific management of farms Commenced in German speaking countries early in the 19th century. In the 20th century, it was supplemented by the theory of optimum utilisation of production lines. After world war II, mathematical planning system and statistical computations of farms
enterprise data improved understanding of farm managerial problems. The key date in the history of agriculture research and education is 1862 when the U.S. Congress set up departments of agriculture and provided for colleges of agriculture in each state.

Scientific agriculture began in India when sugarcane, cotton and tobacco were grown for export purposes. In 1870, a joint department of agriculture, revenue and commerce was established. Later, on the recommendation of the Famine Commission of 1889, a separate department of agriculture was started with the object of increasing food production for local people and industrial raw materials for export. Work along scientific lines was started for the improvement of agriculture with the creation of agriculture department. In 1903, Imperial Agriculture Research Institute started at Pusa in Bihar and this gave a fillip to agricultural Research in India. Later in 1912, Sugarcane Breeding station was established in Coimbatore as a branch of Imperial Agriculture Research Institute, Pusa. Subsequently several agriculture research stations and agricultural colleges were started in 1929. Imperial council of Agriculture Research was established in Delhi to Co-ordinate the work of agricultural research in this country. After the earthquake of 1936, Imperial Agriculture Research Institute was shifted from Pusa to Delhi. Agricultural universities were started in India from 1964 onwards in different states.