**Journal of Scientometric Res. 2021; 10(2):265-278**
http://www.jscires.org

*Research Article*

# The Many Facets of Frugality: Insights from a Quasi-comprehensive Literature Survey

**Shekhar Jain[1,*], Saradindu Bhaduri[2]**

*[1]Center for Studies in Science Policy, Jawaharlal Nehru University, New Delhi, INDIA and Delhi Assembly Research Center, New Delhi, INDIA.*
*[2]Center for Studies in Science Policy, and JNU-CFIA-Trans-disciplinary Research Cluster on Frugality Studies (TRCFS), Jawaharlal Nehru University, New Delhi, INDIA and International Institute of Social Studies, (of Erasmus University of Rotterdam), The Hague, THE NETHERLANDS.*

**ABSTRACT**
Frugal innovation has become a popular research agenda in the field of Innovation studies. Frugality, however, has been part of the intellectual tradition for centuries and scholarly giants such as Cicero, Adam Smith, Benjamin Franklin, David Hume have deliberated upon its meanings, nuances and applications. The present study using quantitative text mining approaches supplemented by qualitative methods aims at a detailed exposition of these deliberations to Gauge the complexity of the term, and its implications for the modern-day production and innovation processes. We used the Google' N-gram tool for qualitative text analysis. Subsequently, using the time series graph of N-gram we spot the relevant periods of the key narratives, and related documents, for a deeper scrutiny. This literature survey helps us recalibrate the concept of frugality, within innovation and technology discourse, to provide a philosophical underpinning, going beyond a strict criteria-oriented approach to define the concept of frugality. The study facilitates reimagining the process of innovation. Drifting away from the present (excessive) emphases on growth, mechanization and protocolization, a recalibrated concept of frugality nudges us to formulate a more human centered process of technological innovation.

**Keywords:** Frugality, Frugal innovation, Adam Smith, Google N-gram, Text mining, Human centered development.

**Correspondence**
**Shekhar Jain**
Center for Studies in Science Policy, School of Social Sciences, Jawaharlal Nehru University, New Delhi, INDIA.
Email id: jainshekhar.research@gmail.com

Received: 12-04-2021
Revised: 04-07-2021
Accepted: 18-08-2021
**DOI:** 10.5530/jscires.10.2.41

## INTRODUCTION

In recent years, the scholarship on innovation has seen a rising interest in the concept of frugality. The origin of this interest may be traced to the popular article 'First break all the rules: The charms of frugal innovation', published by 'The Economist' in 2010 at a time when Europe was reeling under the worst economic recession of the decade. A deeper scrutiny, however, suggests that "frugality", has, perhaps, never been out of fashion in the academic discourse, and sporadic publications using, and elaborating around, the term 'frugality' is visible, at least, from the 17th century. For some scholars, frugality appears in the public discourse whenever there is an economic downturn.[1] At times, it has found traction with the policy think tanks and international organisations as well. The UNESCO picked up frugality as a central theme of their January 1998 edition of 'UNESCO Courier', a magazine then published monthly in 27 languages and in Braille, under the title 'Frugality: A way to a better life'. More recently, European Commission has begun to make a pitch for 'frugal' innovations in its policy agenda[1]. In India, National Innovation Foundation has taken various initiatives to streamline policy initiatives for such innovations too[2].

With its increasing popularity, scholars have attempted to organize the literature on frugality from diverse perspectives. The work of Witkowski[1] and Lastovicka *et al*.[2] analyse frugality with respect to consumer behaviour, especially in the US. In an edited volume titled 'Roman Frugality', Gildenhard and Viglietti[3] explore the evolving meaning of frugality from Archaic Rome until the time of Adam Smith and David Hume.

Within the frugal innovation fraternity too, several reviews have attempted to offer deeper meanings of the term. Pisoni, Michelini, and Martignoni[4] identify that frugal innovation discourse has gone through three generation of deliberation from being product-oriented to market/process-oriented to criteria-oriented. Weyrauch and Herstatt[5] build their review on similar lines, wherein frugal innovation is characterized on the basis of substantial cost reduction, concentration on core functionalities, and optimised performance level. Such attempts act as stepping stones to a broader, and a deeper understanding of the concept of frugality, and, therefore, frugal innovation. Tiwari, Fischer, and Kalogerakis,[6] and Bhatti[7] indeed elaborate on frugality, taking into consideration a broader set of past scholarship and a longer time period. These

reviews are important for building a succinct, yet historically rooted, understanding of the concept of frugality. These reviews, however, often lack a structured approach to identify the major works in the field, or to evaluate the nuances of the term, besides missing out on the contextual and deeper exploration of some of the key historical documents and events having an influence on the concept. Consequently, the continuity, and breaks, in the concept, and the mutual interdependence among scholars, disciplines and space, perhaps, remain inadequately mapped.

To respond to some of these gaps, we undertake a fresh quasi-comprehensive literature survey of the discourse on frugality. We use both quantitative and qualitative method to gauge the extent and pattern of influence of the major publications on frugality to understand the evolution of the term. In addition, such a method helps identify the more universal characteristics of the term, beyond the sites of the advanced industrial economies, where these debates mostly took place. This would help contextualize policy knowledge around frugality and frugal innovation in the developing countries too. Furthermore, this survey enables us to reimagine and recalibrate the concept of frugality with several connotations not considered before, which adds to the established understanding of frugality as being affordable, efficient and effective use of resources[6,8] or being low cost or low frill product/technology.[9]

The paper is organized as follows. We discuss the methodology in detail in the next section. Thereafter, the key period specific characteristics of the term are discussed in sections 3, 4, 5 and 6. Section 7 makes the concluding observations.

## METHODOLOGY

Owing to the unique quasi-comprehensive nature of this survey wherein instead of considering the complete landscape of the discourse we restricted ourselves to the key documents published on frugality, at various junctures. To do this, we supplemented the existing, qualitative text mining, used in Scientometric studies, with quantitative approaches. In text mining approach, texts from a corpus of publications are mined using algorithms and then analyzed to draw conclusions. Several such methods are used in Scientometric studies in recent times (See Kostoff;[10] Ravikumar, Agrahari, and Singh;[11] Silalahi *et al*.).[12] One of these approaches is the use of Google N-gram (books.google.com/ngrams), hereon referred as N-gram, which have founded the field of Culturomics[13] and gaining attention of Scientometric scholars (see Omar *et al*.[14] Chan *et al*.[15] Kim *et al*.[16] Phani *et al*.).[17] N-gram is very similar to the burst detection algorithm[18] which can detect "sharp increases of interest in a specialty"[19] using the burst, identified within a time series data based on key words.

N-gram is an open source Google tool, which makes it easier to reproduce studies. It comes as a package based on the corpus of Google books (books.google.com) of over 40 Million titles[3]. In N-gram database one can search for phrases/words in Google books database and know how those phrases/words have occurred in a corpus of books over the selected period, in a graphical format[4]. One of the distinct advantage of N-gram is that Google has been digitizing archival documents in Google Books from all across the world making them searchable with limited or full preview[5]. So by using N-gram one can find documents which were previously not studied.

To gauge the context, using text mining or quantitative methods, in techniques such as 'burst detection algorithms' scholars relies on the burst within the usage of secondary terms or adjectives. Though, these bursts may explain the popularity of the concept at a given point in time, this method doesn't fully explain the impetus and reason behind the bursts. Often, it is seen that the popularity of a theoretical concept owes its popularity to some events in history or to some specific publication(s). For this reason it is important to understand the events and publications which took place before and after the burst to completely understand the rise and fall of a concept.

To achieve this, N-gram is first used to spot the publications and the points in time which may have an impact on the rise/decay of the concept. We searched N-gram database with keywords, i.e. frugal and frugality, and considered usage of the words as a proxy for the popularity of the concept. Then we used N-gram time series graph to identify the time period wherein we observed a sudden shift in the popularity and searched other databases to identify the relevant documents from the concerned time period which could plausibly explain the shift. Subsequently, we carried out the qualitative analysis of the identified documents, to understand how frugality as a concept evolved and used in different timeframes and the reasons for the peaks and troughs of its application and acceptance. At this stage, we used other databases and secondary searches to gauge the influence and impact of these publications/events. At many places we used dimensions.ai database[6] to quantitatively gauge the influence while at other places we used the secondary data and diverse scholarly publications.

One of the key strategies to track important documents was to break the content search on different databases such as Google Books, Google Scholar, Google web search in different timeframes particularly centered around the rise/fall shown in N-gram graph for the term 'frugal', 'frugality'. The overall period remained continuous covering the entire known history of the term 'frugal'. One of the reasons for breaking down the periods was to trace important documents and subjectively understand the changing dynamics of the frugality discourse over a specific time span. The other reason was to avoid the content which comes on top due to relevancy system

of search engine[7] and unearth the references which haven't been analyzed before. After we subjectively analyzed these documents, we further analyzed the forward and backward citations of the identified documents to ensure we do not miss out on any important document relevant for the understanding of the concept of frugality. It is important to note that Google Books, Google Scholar and general Google web, are unstructured databases so document count retrieved becomes immaterial as often there is duplication of search results and at times quite unrelated results may appear. In addition, we performed searches through wild card entries on Google N-gram to see what kind of phrases were being used in combination with the term frugal to develop a better contextual understanding and influence. Finally, as the last step of our strategy we thoroughly looked for the missing links, particularly when we saw overlap in the ideas of two scholars. Figure 1 provides a flowchart diagram of the adopted methodology.

## Frugality Across Time, Space and Disciplines : The Roman Origin and its English Interpretation

Etymologically, the word frugal traces its roots back to the 16th century and is derived from the Latin *frux*, meaning "fruit" or "value". Merriam Webster (Online Edition) dictionary elaborate it further and says

*Those who are frugal are unwilling to (lavishly) enjoy the fruits of their labors, so it may surprise you to learn that frugal ultimately derives from the Latin frux, meaning "fruit" or "value," and is even a distant cousin of the Latin word for "enjoy" (frui). The connection between fruit/value and restraint was first made in Latin; the Middle French word that English speakers eventually adopted as frugal came from the Latin adjective frugalis, a frux descendant meaning "virtuous" or "frugal." Although English speakers adopted frugal by the late 16th century, they were already lavishly supplied with earlier coinages to denote the idea, including sparing and thrifty.*[21]

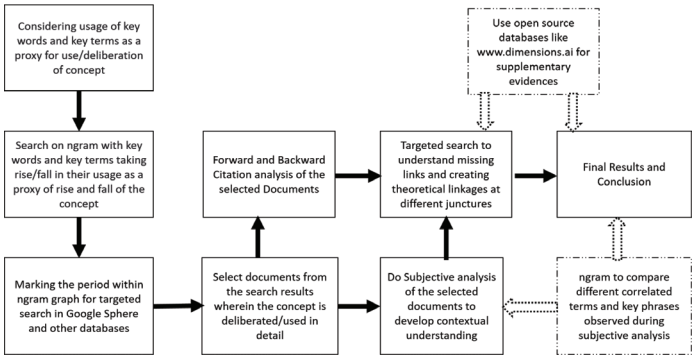


**Figure 1:** Flow Chart explaining the methodology of the paper. Steps enclosed on dotted boxes and arrows are steps to be done for supplementary understanding, may or may not be essential.

Following the Roman root of frugal and frugality, Gildenhard and Viglietti[3] explores the meaning and context of these terms, from Archaic Rome until the early 18th century, in their book 'Roman Frugality'. Even though Gildenhard and Viglietti[3] may be the first to do a detailed deliberation on the Roman origin of the word frugal, the idea of the Roman origin and meaning of the word frugal is well reflected in 19th century books. For example, Edward P Day[22] collects several quotes, few of them are reproduced in Table 1, on frugality and attributes them to the towering figures such as Plato, Cicero, and Agesilaus which indicates that Roman roots of the term frugal have been well known.

In addition to the Roman roots, the etymological analysis of frugality brings forward an important point that frugality doesn't necessarily mean thrift, which is perhaps the most widely used meaning imputed on it (see Gildenhard and Viglietti).[23] In fact, the early English literature indicates that frugality doesn't exactly translate as 'being thrifty' and they both have different meanings and connotations. For example, we can see literature as early as Assheton (p22)[24] saying, while describing 'dispositions and behaviour' of known people, "Some are *thrifty and frugal*, who will *not only keep, but improve* what you give them" (emphases added). The statement indicates that 'frugal', as a disposition and behaviour, aims at improving what one receives in addition to merely being thrifty. In later document, Hackwood (p112)[25] distinguishes between the two more clearly and writes, "*frugality* is *carefulness* in our way of living. *Thrift* is *saving something* for the future" (emphases added). We can even see a detailed deliberation around this interpretation of frugality in Johnson (p12),[26] who in his book 'Muddling Toward Frugality' uses the original meaning of frugality and doesn't equate frugal with thrift. Johnson writes, "*The origins of the word frugality in Latin are frugalior meaning useful or worthy, and frux, meaning fruitful or productive. These meaning give the word a nice feeling, but unfortunately, the word has changed over the years, and has come to mean thriftiness, the abstention from luxury and lavishness*."

**Table 1: Some of the Quotes from Day's Collection.**

| Quote | Author |
|---|---|
| To live frugally is to live temperately | Plato |
| The world has not yet learnded the riches of frugality | Cicero |
| By sowing frugality we reap liberty, a golden harvest | Agesilaus |
| Frugality is founded on the principal that all riches have limits | Bulwer |
| Be frugal, and let frugality be a part of your children's education | Thurlow weed |
| Frugality may be the cause of drinking water; and that is no small saving, to pay nothing for one's drink | Lord bacon |
| Gluttony and luxurious living are followed with shame, but temperance and frugality with commendation | Plato |

Source: Day (p 309)[22]

Many scholars27] seem to follow this line of argument, and equate 'thrift' with 'frugal' for their operationalisation and further theorization. In this paper we re-examine this apparently straightforward relationship equating thrift with frugality.

## Golden Period of Frugality Discourse: From Christianity Virtue to Economic Concept

In English literature, the use of frugality can be easily traced back The titles such as 'The moral history of frugality with its opposite vices, covetousness, niggardliness, prodigality and luxury' written by Sir George Mackenzie in 1690 is worth mentioning here. However in this era of English literature, the usage of the term was majorly restricted within a religious context and was seen mostly as a Christianity virtue.[28-30] In this period, many scholars such as Benjamin Franklin, David Hume, Adam Smith, Jeremy Bentham deliberated on the concept of frugality, (Table 2).

In the early 18th century and mid-19th century the meaning of frugal went beyond being a Christianity virtue and found its place extensively in economic and political economy literature provoked by the works of Bernard Mandeville[23] (*see Primer*[31] *for detailed account of Mandeville work*). Bernard Mandeville in his poem titled 'The Grumbling Hive' (1705)[8] presented a critic to the virtuous world and an idea that several actions which are considered to be virtuous were instead, self-interested at their core and therefore vicious.[32,33] Mandeville devoted a section in his book to demean frugality and argued

**Table 2: Selected List of 18th and 19th century publications which elaborately used the concept of frugality.**

| S. No | Pub. Year | Title | Author/Publisher |
|---|---|---|---|
| 1 | 1691 | The Moral History of Frugality, with its opposite vices, Covetousnes, Niggardliness, Prodigality, and Luxury | Sir George MACKENZIE |
| 2 | 1714 | The Fable of the Bees | Bernard Mandeville |
| 3 | 1748 | Advice to a Young Tradesman | Benjamin Franklin |
| 4 | 1758 | Way to Wealth | Benjamin Franklin |
| 5 | 1758 | Essays, Moral, Political, and Literary | David Hume |
| 6 | 1759 | The Theory of Moral Sentiments | Adam Smith |
| 9 | 1759 | Upon Political Frugality | Oliver Goldsmith |
| 7 | 1765 | The Frugal Housewife; Or, Complete Woman Cook | Susannah CARTER |
| 8 | 1776 | Wealth of Nation | Adam Smith |
| 10 | 1782 | The modern cook: and frugal housewife's compleat guide to every branch in displaying her table to the greatest advantage | E. Spencer |
| 11 | 1802 | The Frugal Housekeeper's Companion. Being a Complete System of Cookery, Etc | Elizabeth ALCOCK (of Liverpool.) |
| 12 | 1812 | The Duties of Religion and Morality<br>As Inculcated in the Holy Scriptures with Preliminary and Occasional Observations | Henry TUKE |
| 13 | 1813 | The Young Woman's Companion, Or, Frugal Housewife | Russell and Allen |
| 14 | 1819 | Two discourses | J. Deighton and Son |
| 15 | 1829 | The American Frugal Housewife: A Book of Kitchen, Economy and Directions | Lydia Maria Child |
| 16 | 1843 | The Works of Jeremy Bentham | Jeremy Bentham, John Bowring |
| 17 | 1855 | Discretion, Industry, Frugality, and Cheerfulness considered. | Henry TUKE |
| 18 | 1856 | The Principles of Political Economy applied to the Condition, Resources and Institutions of the American People | Francis Bowen |
| 19 | 1864 | Education for Frugal Men at the University of Oxford | Drummond Percy Chase, William Charles Salter |
| 20 | 1868 | Frugal education attainable under the existing collegiate system: with an account of the expenses of the system at St. Edmund hall | Edward Moore |
| 21 | 1870 | American Political Economy | Francis Bowen |
| 22 | 1883 | Notes of lessons on moral subjects | Frederick William Hackwood |
| 23 | 1884 | Day's Collacon<br>An Encyclopaedia of Prose Quotations, Consisting of Beautiful Thoughts, Choice Extracts, and Sayings, of the Most Eminent Writers of All Nations, from the Earliest Ages to the Present Time, Together with a Comprehensive Biographical Index of Authors, and an Alphabetical List of Subjects Quoted | Edward Parsons Day |

Source: Own Compilation based on Google Books

that frugality is a direct consequence of the resources and produce of the nation. He argues[34] (p 198), that

"*to make a nation generally frugal, the necessaries of life must be scarce and consequently dear; and that therefore let the best politician do what he can, the profuseness of frugality of a people in general, must be always depend upon, and will in spite of his teeth, be ever proportion'd to the fruitfulness and product of the country, the number of inhabitants, and taxes they are to bear*."

Mandeville's ideas were seen as very provocative by people believing in Christianity virtues. As a result, the 1724 edition of the book was presented as a public nuisance by the Grand Jury of Middlesex[35] which provoked widespread discussion, often critical, of Mandeville's ideas throughout the 18th century. In fact, it is widely debated how Mandeville's thoughts influenced the ideas of Adam Smith. There is a plethora of literature which have attempted to decipher the relation between Mandeville and Smith[9], in which even the likes of Schumpeter,[36] and Rosenberg[37] have contributed. The curiosity seems obvious as Smith presented a direct critic of Mandeville in 'Theory of Moral Sentiments' (TMS, henceforth) and called Mandeville's ideas as 'licentious system'. Along with Smith, another scholar who was influenced by the ideas of Mandeville was Benjamin Franklin.[38] Franklin refers to Mandeville as 'most facetious, entertaining companion' in his autobiography. In fact it is reported that Mandeville's ideas, arguably, have influenced the scholarship of Francis Hutcheson, David Hume, and Jean-Jacques Rousseau as well[32,33] Although, for the purpose of this paper we will only discuss frugality in the works of Smith and Franklin as Smith's role in influencing the concept of frugal innovation have been unearthed in recent scholarship[39] and in some scholarship Franklin too is seen as somebody who pioneered the concept of 'frugal' solutions.[40]

Smith uses the term frugality in an elaborate manner in 'The Wealth of Nation' (TWN, henceforth) and in bits and pieces in TMS. However, even though Smith doesn't use the term frugality in an elaborate manner in TMS, the TMS acts as a bedrock to understand Smith's philosophy as it gives insight into the philosophical underpinning of the Smith-ian scholarship.[41] Besides, in TMS Smith criticize Mandeville explicitly which is not the case in TWN. Although, Smith's idea around frugality in TWN remains quite orthogonal to the ideas of Mandeville where he argues that frugality along with industry is one of the reasons (and not a consequence) of the wealth of a nation.[42]

Overall, Adam Smith makes frugality as one the major tenets of his scholarship and along with emphasizing upon 'industry and frugality' as a way to wealth creation, Smith uses the term frugal in a variety of other contexts and situations in TWN, not just limited to their economic meanings, such as 'thriftiness'. Smith's use of frugality in TWN ranges from demonstrating the value of 'experience' in innovative solutions to frequently encountered problems of daily lives or as a behavioral trait.[39] In addition, Smith look into the frugality of the stakeholders of the society, or an economic system, at large such as the magistrate, government, peasants, individual, republic, creditor, borrowers, workman. Moreover, Smith doesn't limit the application of frugality only to behaviour; the phrases such as 'plan equally frugal' (Book IV, Chap VII p. 558), 'very frugal method' (Book I Chap XI p. 216) indicates its use for the emphasis on non-tangible things as well. Through such diverse applications, Smith broadens the aspects and meanings of the term. Table 3, at the end of this section, gives a tabulated view of how the use of frugality is distributed across the contexts and chapters of TWN.

In one of the instances in Book V Chapter I (p 1052)[10] of TWN.[43] Smith calls a magistrate frugal when he judiciously "*leave a profession to itself, and trust its encouragement to the individuals who reap the benefit of it*". Here Smith seems to relate frugality with being judicious to visualise that the profession should be left to flourish by not giving it any protection, but to let it be rewarded by the demand of its beneficiaries. He however, makes an interesting departure from the then prevailing practice of linking frugality with religion, but actually pointing out that such 'frugal' practices of allowing a clergy to earn his life through the offerings of his beneficiaries could be counterproductive, because, in his own words, "*in every religion except the true it is highly pernicious, and it has even a natural tendency to pervert the true, by infusing into it a strong mixture of superstition, folly, and delusion*" (*p* 1053). The 'frugality' of leaving such professions on their own might actually help check the spread of superstition and folly in the society. hitherto considered natural, is challenged in the most unequivocal manner.

In another instance in Book 1 Chapter XI (p 216), Smith says, "*Columella, who reports this judgment of Democritus, does not controvert it, but proposes a very frugal method of enclosing with a hedge of brambles and briars, which, he says, he had found by experience to be both a lasting and an impenetrable fence*". Here Smith, talks about a 'frugal method' to enclose kitchen garden which is based on his experiential knowledge derived from field, and not from the books. Here for Smith frugal takes the meaning of what is experientially validated to be good-enough in serving the purpose. Columella could take on the more theoretical knowledge (or lack of it) of Democritus in finding a workable solution through the knowledge he gained through experience. This discussion in our view brings an important addition to the discourse on frugality by pointing out that frugality (here in knowledge) could be seen as an evolving concept, gained through practical experience. We elaborate more on this aspect in a later section.

**Table 3: Showing distribution of term Frugal and frugality in TWN.**

| Book number and Title | Chapter | Number of times term Frugal and Frugality is used |
|---|---|---|
| **Introduction and Plan of the Work** | Introduction | 1 |
| **Book One:** Of The Causes Of Improvement In The Productive Powers Of Labour, And Of The Order According To Which Its Produce Is Naturally Distributed Among The Different Ranks Of The People | Chapter 1. Of the Division of Labour | 1 |
| | Chapter VIII. Of the Wages of Labour | 1 |
| | Chapter X. Of Wages and Profit in the different Employments of Labour and Stock | 2 |
| | Chapter XI. Of the Rent of Land | 2 |
| **Book Two:** Of the Nature, Accumulation, and Employment of Stock | Chapter II. Of Money Considered as a Particular Branch of the General Stock of the Society, or of the Expense of Maintaining the National Capital | 2 |
| | Chapter III. Of the Accumulation of Capital, or of Productive and Unproductive Labour | 14 |
| | Chapter IV. Of Stock Lent at Interest | 2 |
| **Book Three:** Of the Different Progress of Opulence in Different Nations | Chapter II. Of the Discouragement of Agriculture in the ancient State of Europe after the Fall of the Roman Empire | 1 |
| **Book Four:** Of Systems of Political Economy | Chapter I. Of the Principle of the Commercial, or Mercantile System | 1 |
| | Chapter V.Of Bounties | 1 |
| | Chapter VII. Of Colonies | 1 |
| **Book Five:** Of the Revenue of the Sovereign or Commonwealth | Chapter I. Of the Expenses of the Sovereign or Commonwealth | 1 |
| | Chapter II. Of the Sources of the General or Public Revenue of the Society | 4 |
| | Chapter III. Of Public Debts | 4 |
| **Total** | | **38** |

Source: Own Compilation.

In several places in TMS too, Smith associates frugality with prudence and rationality desirable in human-beings, as reflected in the following passages.[44]

*"In the steadiness of his industry and frugality, in his steadily sacrificing the ease and enjoyment of the present moment for the probable expectation of the still greater ease and enjoyment of a more distant but more lasting period of time, the prudent man is always both supported and rewarded by the entire approbation of the impartial spectator, and of the representative of the impartial spectator, the man within the breast."(Part VI Section I, para 11)*

*"It is from the unremitting steadiness of those gentler exertions of self-command, that the amiable virtue of chastity, that the respectable virtues of industry and frugality, derive all that sober luster which attends them."(Part VI Section III para 13)*

Smith associates frugality with the virtue of prudence, self-command, fortitude, and justice.[30,45] It is important to note that Smith while associating frugality with these virtues takes a recalibrated approach in comparison to the earlier interpretations of frugality. Smith dismisses frugality as linked to poverty and doesn't associate his idea of frugality with the stoic philosophy or religious practices as was popularly believed in his time.[30] For Smith, frugality is neither natural, nor driven by indoctrinations, or 'mutinous and turbulent passions'.[45] It is rather an outcome of learning, and judicious reflections of an impartial spectator, based on reason. Incidentally, Amartya Sen adapts these ideas of impartial spectator, self-command, justice, prudence to develop his widely acknowledged capability approach.[46] This connection further opens up a new, hitherto unexplored, avenue to extend the scholarship of frugal innovation keeping in mind the Smithian understanding of frugality and using the vast development and innovation discourse built on Sen's capability approach (See for example Jiménez and Zheng,[47] Oosterlaken[48]).

Benjamin Franklin, on the other hand, supports, like Smith, the relation between wealth and frugality. But unlike Smith, he doesn't criticize Mandeville explicitly. Franklin uses the term frugality in a rather limited sense and contexts compared to Smith. Franklin largely confines its usefulness as being industrious for 'way to wealth'. In one of his publications, 'Advice to a young tradesman' published in 1748, Franklin writes, "*way to wealth, if you desire it, is as plain as the way to market. It depends chiefly on two words, industry and frugality; that is, waste neither time nor money, but make the best use of both*".[49] Ideologically Franklin remains closer to Smith than Mandeville despite his 'praises' for the latter, which is perhaps expected given the very cordial personal relation they shared with each other.[20] It is interesting to note that like Smith's work, Benjamin Franklin's work too received wide acceptance all over Europe. It is reported that by the year 1850 one of Franklin's publication i.e. 'The Way to Wealth', had 1,100 editions in twenty-six languages.[50]

In addition to his scholarly position, Franklin is believed to have practised frugality in his life. In his autobiography, frugality is mentioned as the 5th virtue among 13 virtues required for attaining moral perfection and defined as "*Make no expense but to do good to others or yourself; i.e., waste nothing*",[51] chap. IX). Considering the growing discourse on frugal innovation, it would be very difficult to discard Franklin's

emphasis on frugality, as an innovator who innovated 'frugal solutions',[40] as mere coincidence. Rather it indicates that frugal and frugality can be a thought process and approach as argued by Radjou and Prabhu.[52]

Even though Mandeville was perhaps the first scholar to provoke a discussion around frugality, Smith's influence on the discourse on frugality much exceeded that of Mandeville. For example, dimensions.ai database shows 12,838 documents on searching with keyword ((Frugal OR Frugality) AND "Adam Smith") while with keywords ((Frugal OR Frugality) AND "Mandeville") returns only 4,124 documents. Further, the key words ((Frugal OR Frugality) AND "Mandeville" AND "Adam Smith") showed 2,707 documents which means out of 4,124 documents 2,707 had mentioned Adam Smith as well. In addition, Figure 2 and Figure 3 show N-gram graph made using the key words frugal, or frugality. This shows how the usage of the terms peaked during the active years of Adam Smith. The graph adds to the argument that why Smith is really important for the discourse on anything related to frugal or frugality. In the same graph we can also see that post the active years of Smith, the usage of the terms declined.

Further, the N-gram search enriches our arguments about the influence of Adam Smith on frugality discourse. From Figure 4 we can see that the usage of the phrase 'Industrial and frugal' or 'frugal and industrial' peaked during the active years of Adam Smith. These two were the central driver of wealth in TWN. We now analyse the reasons for the decline of the term after Smith.

## Frugality discourse after smith: the consumerism era until the great depression and the vietnam war

From the late 19th century until around the last quarter of the 20th Century, not very extensive usage or debate around the term frugality can be seen. The concept of frugality was sporadically, and rarely, used in this period. For example, we find some discussion around 'frugality bank', an idea given by Jeremy Bentham (b. 1748- d. 1832)- the founder of utilitarianism, while advocating for establishing small saving

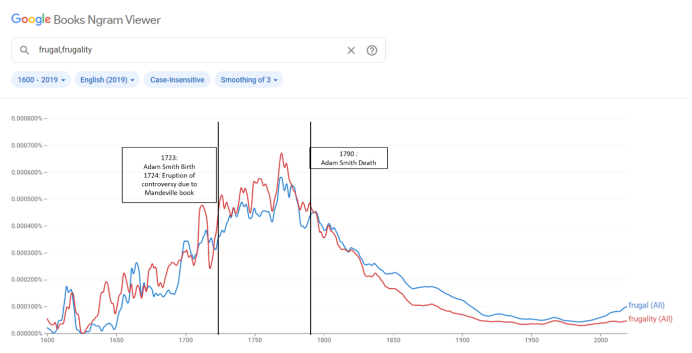


**Figure 2:** N-gram graph with Keywords frugal, frugality for period 1600 to 2019 (Original).

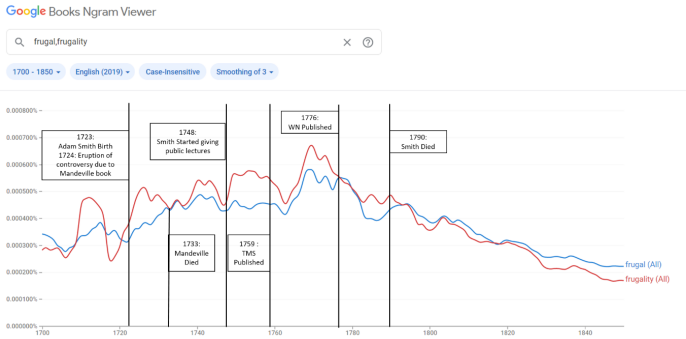


**Figure 3:** Ngram graph with Keywords frugal, frugality for period 1700 to 1850 (Original).

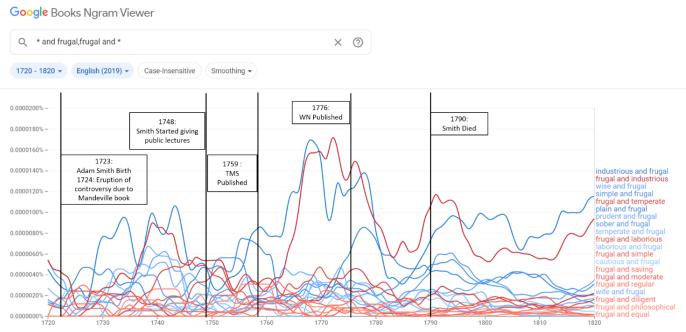


**Figure 4:** Ngram graph showing different phrases used with frugal between 1720 and 1820 (Original).

scheme bank meant for the 'poor',[53] by encouraging thrift on their part.[54] Besides, frugality in this era remained a part of moral education as we see in Hackwood.[25]

One of the reasons for the downfall of the concept of frugality in this era could be the rise of 'consumerism'[55] accelerated by the discovery of new energy sources such as oil, gas, and electricity.[56] Also, the improvements in the means of travel and communication made this new force more potent.[56] Some historians claim that "*Consumerism is a mobilising force at the heart of twentieth-century social and political history*".[57] The central feature of this new economic force was the revolution in the production of industrial and agricultural goods and the advent of the profit-driven corporation.[56] The situation of those times can aptly be summarized in the words of William Leach from the book 'Land of desires'

"*Growth was fast and furious, and often too dangerous or intense for many men accustomed to old-fashioned forms of quiet marketing and selling. By the late 1890s so many goods, in fact, were flowing out of factories and into stores that businessmen feared overproduction, glut, panic, and depression. A crisis in distribution struck the new economy, menacing the gains achieved in production. And out of the turmoil (the threat of which, however, would never disappear), businessmen would turn to new kinds of merchandising. Out of the turmoil would come a steady stream of enticements—display and*

*decoration, advertising, fashion, style, service, and so forth—to break up the logjam of goods and to awaken Americans, as Emily Fogg Mead wrote, to "the ability to want and choose."*[56]

The proponents of this new economic force had left no stone unturned to defend this new order and dedicated efforts were made by corporations to lure the working class to break down old habits of thrift and promote new consumerist desires.[58] The extent of these attempts is well reflected from a congregation given in a Philadelphia church in 1913 by Simon Patten (1852 –1922) who was an economist and the chair of the Wharton School of Business, who said, "*I tell my students to spend all that they have and borrow more and spend that. It is foolish for a person to scrimp and save*."[59] He further added, "*It is no evidence of loose morality when a stenographer, earning eight or ten dollars a week appears dressed in a clothing that takes nearly all of her earnings to buy. It is a sign of her growing moral development*".[59] Certainly when we look at these thoughts in contrast of Smith's argument "*every prodigal appears to be a public enemy, and every frugal man a public benefactor*" (Book II Chapter III, p 452, WN), it is not much difficult to imagine how much opposition the idea of frugality must have faced in the era.

However, as we mentioned earlier, the idea of frugality keeps coming back into fashion whenever the 'age of plenty' was challenged, such as during wars, and gave moralists new opportunities to speak for frugality.[1] Although, during this era the concept of frugality was never theorized and debated like it happened in the early 18th century. The concerns for frugality in this era were largely remained confined to a narrow understanding of thrift (see Witkowski)[1] and perhaps, philosophical underpinning of frugality were lost in a process of promoting thrift which is evident in the lack of any theoretical deliberation on the concept until the decade of 1970s. We can see from Figure 5 that with the increasing usage of thrift, the usage of frugal declined.

The rise of thrift in this era occured as a result of the planned actions to promote the so called 'thrift industry' in the form of the small scale saving institutions and the system of 'home finance' which emphasised on systematic savings and mutual cooperation between society members (p 12).[60] These systems began in 1831[60] and developed slowly over the next forty years, with their growth getting accelerated post 1880s (p 12).[60] Though the failure of some of these institutes in 1890s did create a dent in their popularity, but they quickly made a course correction by being institutionalized and democratic. Mason writes, "*In 1892, these leaders formed the United States League of Local Building and Loan Associations as a national trade association to promote the principles of thrift and home ownership as well as the political and economic interests of the thrift movement"* (p 39). These attempts established the thrift institutions as one of the major source of consumer finance until the Great Depression.

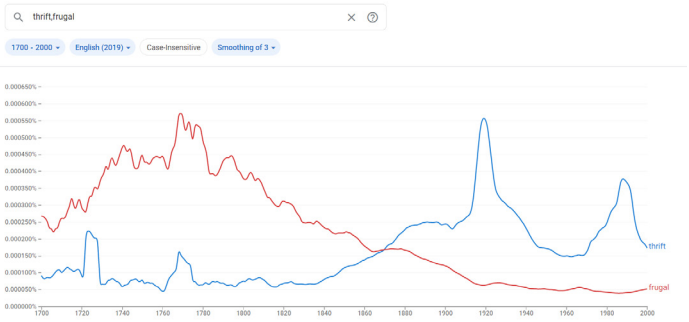


**Figure 5:** Comparison of thrift and frugal in Google N-Gram (Original).

This thrift movement was at its peak in the beginning of the 19th century (see Figure 5). In this period there were people like Simon William Straus who founded the American Society of Thrift in 1914.[11] Throughout the growth of the idea of consumerism, the idea of thrift was seen as a counter movement. The proponents of consumerism kept demonizing thrift as 'against the economy'. The nuances of frugality perhaps got lost in this conflict, and instead became confined to a narrow understanding of thrift (see Witkowski.[1]). One can see an abrupt peak in the usage of thrift[12] around the year 1918 in Figure 5. These were the years when Thrift movement was at its peak. This was also the time when the war efforts promulgated the necessity of being thrifty.[61] Perhaps as a result of these movements, and the circumstances the world saw, the first International Thrift Congress, which took place in Milan during 26-31 October 1924 was attended by delegates from 27 countries. The Congress also passed a resolution that October 31 will be celebrated as World Thrift Day.[62,63] Further, it is important to note that the proponents of the movement understood the distinction between Frugal and Thrift but dismissed the former as a 'haphazard', and inadequate substitution of the latter. For example, Simon William Straus in his book 'History of the Thrift Movement in America'[64] published in 1920, quotes from his own speech and writes (p 152),

"*You educators understand that the boys or girls who go out from your school room into actual life with only a haphazard idea of frugality with will without doubt never become frugal men or frugal women. They will, in all likelihood, live haphazard lives, saving and spending alike, unwisely. But if they had been taught lessons in thrift; if there had been as much attention paid to teaching them personal economics as was given them in arithmetic or any other one study, their equipment for practical life would have been much better.*"

For him thrift largely means saving money, without really worrying about how one spends the earning before savings, which is clear from his position that "*Thrift means, in general way, merely the elimination of waste*" (p141) and elaborates waste as, "*what might be considered wasteful or*

*extravagant habits on the part of one individual because they involve expenditure greater than he can afford, would, on the other hand, not be considered extravagance for one possessed of greater wealth*" (p141–142). Further, to counter the argument of that '*practices of thrift would create ruinous conditions in business*', Straus attempts to distinguish between constructive and destructive thrift (p 18) And he argues that constructive thrift is something which is taught in school in a scientific and organized manner (p 148). Anyhow, it appears that the Strauss' arguments doesn't have many takers but his arguments does shed light on the fall the concept of frugality and, perhaps, how frugality got subsumed under the notion of thrift. The detailed investigation of the evolution of thrift, however, is beyond the scope of this paper but one can take a note of the fact that the thrift industry didn't decline post depression or even after World War II; instead it only prospered. The downfall of the industry begins only in 1965 with the American war in Vietnam, and met with a full blown crisis by the end of 1970s.[65] One will have to do deeper scrutiny of the conditions of the American economy and society in this period to understand the causes of the same. However, what is of our interest is that this was the time when frugality regained its momentum.

## Frugality Discourse Post 1970: Re-Imagination and Application of the Con-Cept of Frugality

Post 1970 the world economy again saw a downturn in the aftermath of the Vietnam War. The oil prices were rising, and an economic crisis was looming large. Under these circumstances frugality came to be debated again and publications started reappearing. Alongside, a movement for appropriate technology was on the rise following Schumacher's legacy of the 'small is beautiful' -today considered to be one of the origins of the current thoughts on 'frugal innovation'.[48,66] A central point of the discourse was the ecological and environmental concerns, underlining the impending threats of resource depletion. In this era frugal and frugality received enough emphases to eventually find a place in the first ever National Science and Technology Policy, Organization, and Priorities Act of 1976 (P.L. 94-282) of the United States of America. This policy emphasized on the frugal use of resources as one for developing future technologies and emphasized on policies encouraging "*the use of science and technology to foster frugal use of materials, energy, and appropriated funds*". The relevance of frugality in technology and innovation discourse thus makes its first appearance.

This was also the time when 'Future studies' began to attract attention among academic scholars on technology and development.[67] The researchers from Stanford Research Institute (now SRI International), including Duane Elgin, Peter Schwartz, and Willis Harman got influenced by the concept of frugality and an imagined future of the USA around it. In the study titled 'Alternative futures for environment policy planning : 1975–2000' they presented 10 scenarios of the future considering the population having three values viz. achievement values, survival values and frugal values.[68] They assumed that the population characterised by Achievement Values to achievement values emphasize on material things such as status, fame, outward opulence etc.; People with survival value embrace the values of the achievement sector14, but would find it difficult to realize these values due to the material circumstances they are in. While people with frugal values emphasised upon *voluntary simplification* of the exterior aspects of life in order to attain greater richness of inner aspects. The assumption is later vindicated by DeYoung[69] who empirically found that a frugal lifestyle may be fulfilling and rewarding.

It was hypothesized that when the population with frugal value increases, there would be an increase in 'backyard inventors'. In the report, Elgin *et al*. (p 58)[68] treat the 'backyard inventors' "*as alternative organizations to produce technology appropriate to the new realities. Moreover, it was a technology that the average person could understand and tinker with*." This is noteworthy that the report nowhere undermines (modern) technologies instead demands for a frugal technology with more connection with the society. To describe these frugal technologies Elgin *et al*. (p 182)[68] write, "*these new conditions in no way suggest less need for technology, but rather need of a different kind of technology--more frugal of energy and material, are cooperative with natural ecosystems, more adapted to different cultures emphases, more humane. Capital will be needed for changeover to less polluting and resource extravagant technologies, new energy sources, etc. In general, investors will have to be satisfied with a lower return on capital*".

SRI international's ideas were centered around 'Voluntary simplicity' a term articulated by Richard Gregg (1885–1974) in his 1936 article '*The Value of Voluntary Simplicity*' published in Visva - Bharati Quarterly, Aug. 1936.[70] Perhaps, it isn't a mere coincidence that like the way Gandhi had influenced Schumacher,[71] Gandhi had influence on Gregg's ideas too. Indeed, Gregg spent a considerable amount of time in India with Gandhi and translated Gandhi's ideas for American citizens[15]. Interestingly, Gandhi had propagated a much similar idea, that of voluntary simplicity, when he explained the concept of Trusteeship. Gandhi elaborates in Harijan, (3-6-1939, p. 145,)

"*Supposing I have come by a fair amount of wealth – either by way of legacy, or by means of trade and industry – I must know that all that wealth does not belong to me; what belongs to me is the right to an honourable livelihood, no better than that enjoyed by millions of others. The rest of my wealth belongs to the community and must be used for the welfare of the community*."

The SRI researchers Elgin and Mitchell (p 6)[72] clarify that "*There appear to be no mechanical or philosophic reasons why frugality and simplicity cannot coexist with high technology and the profit motive*". Henderson[73] too postulated that voluntary simplicity could be "*the fastest growing consumer market of the coming decades: rising in value from about $35 billion today, to some $140 billion in 1987*," and to "*well over $300 billion in 2000 (all in 1975 US$)*". Here, frugality does not seem to be associated with thrift any more.

As we have mentioned above, Johnson[26] in his book 'Muddling Toward Frugality' chose not to equate frugal with thrift. While emphasizing upon the 'logic of frugality' for a weather analyses how frugality can be a way forward in a resource constrained future. Johnson[26] further postulates that in the events of scarcity, which to him seemed inevitable, there would be an emphasis on small scale and labour intensive production, localization and decentralization. Besides, Johnson also brings up the developing countries in this discussion. Johnson,[26] argues that while there are several challenges the developing world faces, they have three important advantages i.e. 1) Their reliance on the local renewable resources; 2) They are well adapted to the environment 3) They are small in scale and decentralized.[26] In a way Johnson[26] portrayed the developing world as inherently frugal and then went on to write, while criticizing the '*cultural imperialism*' of the developed world, "*It is a long way home; we face the task of discovering and building a way of life that functions in equilibrium with the environment. At some stage, we are likely to look to less developed countries for ideas*" (p 228).[26] Unfortunately, this did not become mainstream in the literature on frugality. One of the reasons could be that the backdrop of the energy crisis and falling economy in which these arguments were developed was soon over, and the world chose to move towards resource intensive technologies once again[16]. However, seeing the current progression of technology one may say that the idea of 'energy frugal' and 'material frugal' technologies weren't completely ignored, as we see the rise of renewable energy technologies and push for the environmental friendly technologies in the last few decades.

In 1987, Schonberger, adds an important dimension to frugality discourse through his article 'Frugal manufacturing' in Harvard Business Review. This article made a pioneering attempt to conceptualize frugality in the context of a manufacturing process, perhaps advancing the argument of the SRI International scholars. He imagines one such scenarios of frugal approach in manufacturing and calls it as 'minifactories'[17]. To be able to use the frugal approach in manufacturing, Schonberger suggest a list of things for the manufacturers. In his view, manufacturers should get most out of conventional equipment and existing facilities before implementing large-scale automation projects; should have control over manufacturing strategy; should be able to modify, customize, and simplify machines so that machines remain relevant for the changing product needs; should approach faster machines and high production capacity with caution, and should understand that the big machines, separated equipment, and long conveyor systems disconnect people and obscure opportunities for merging processes.[74]

Further, to demonstrate the advantage of frugal approach, Schonberger[74] cites the example of Japan's industrial ascendency. There he notes Japanese industry spent 60% of their capital in incremental improvements to old machines while U.S. industry spent only 25% on improvements to existing equipment—75% went to new machines. The other important argument Schonberger[74] makes is that frugal approach can lead to employee-led innovation and writes that,

*"Frugal approaches have shown that many of the best ideas arise out of the everyday observations of employees, not the abstract analyses of student engineers. Semiskilled operators have the hands-on experience to conceive of and install, say, simple machine-to-machine transfer chutes or rollers. They can rough out plans for warning devices and electrical switches that synchronize processes, even though engineers will generally be needed to refine the designs. Tapping the minds of operators in these ways is like turning on an improvement engine at each machine. Companies that plunge into full-scale automation will be denied these benefits."*

This argument of Schonberger[74] provides a kind of backing to Bhaduri and Talat[75] argument that frugality can be a way forward to avoid 'Collingridge's dilemma', or in Schonberger words, "*Frugality dictates putting in a small increment of capacity, tentatively planning a second increment, and then pausing to watch sales. If the product is a failure, cancel the second increment; if it's a success, put the next increment in. The idea is to add machine capacity in a way that permits backing off*", if needed. Besides, it is important to note that while Schonberger[74] emphasizes on the frugal approach in manufacturing, he doesn't propose a binary against automation, and duly acknowledges, "*Automation has the potential to lower costs and minimize variations in quality, but it makes sense only when it solves clear-cut problems and when it costs less than simpler solutions introduced incrementally.*"

In the last decade of the millennium Lastovicka *et al*.[2] and Nash[76] were two important additions to the discourse of frugality. Lastovicka *et al*.[2] Studied frugality in context of consumer behaviour and adds to the scholarly understanding of frugality through a seminal literature review. They analyzed the literature and segregated it on the basis of religious perspective, early American perspective, economic perspective, self-help perspective, psychological perspective and the perspectives from qualitative research. They place their understanding within the consumer behavior and concludes that "*frugality is not pure deprivation but reflects short-term*

*sacrifices in buying and using consumer goods to achieve idiosyncratic longer- term goals*". On the other hand, Nash[76] tried to show frugality as a way of life in his analysis. The importance of Nash[76] lies in his explanation of what is NOT frugality, something which perhaps has led to the misunderstanding of the concept. Table 4 provides other relevant exposition of Nash[76] which explains what IS NOT frugality. One of his views is worth mentioning while discussing frugality in relation to technology. He doesn't assume frugality as an "anti-technological phenomenon". It insists, instead, that ethically acceptable technologies must be "appropriate" to relevant values and "social and ecological conditions."

In addition to the reemphasis on frugality by Lastovicka *et al*.[2] and Nash,[76] last decade of the millennium added a new dimension in the frugality discourse when Goldstein and Gigerenzer used the phrase 'fast and frugal' in a paper presented in Eighteenth Annual Conference of the Cognitive Science Society in 1996.[77] One can see from Figure 6 that how this phrase led the imagination of scholars within the frugality discourse and largely shaped the scholarship around frugality until the advent of the discourse on frugal innovation. Originally, the fast and frugal approach was discussed within the realm of decision making.[39] However, Bhaduri[39] explores the possibility of using this strand of frugality scholarship for frugal innovation discourse and simplify the theory by giving an argument that frugality in decision making comprises three main characteristics, namely: 1.) a search process using simple hierarchical steps and intuitive reasoning (rather than clearly-defined rule-based decisions); 2) efforts to adapt to the environmental challenges through demonstrated capacity for learning and imitation; 3) emphasis on actual performance, practicability and effectiveness rather than logical/scientific validation. Recently, Bhaduri *et al*,[78], Patil and Bhaduri[79] have analyzed this narrative of frugality in articulating the need for incremental, and decentralized policy processes under resource scarcity and uncertainty.

**Table 4: Nash[76] view on what is NOT Frugality.**

| | |
|---|---|
| **Frugality is NOT** | Austerity |
| | A world-denying asceticism that makes some feel competitively righteous—but woefully deprived. |
| | A fixed formula for production and consumption. It is not legalism. It does not entail the righteous rigidity and casuistic rules that preoccupy some of the frugal. Instead, frugality is a relative concept, expressing a fittingness to appropriate ends |
| | a strictly individualistic phenomenon |
| | The means to prosperity. The moral purpose of frugality includes capital formation. Though it is not miserliness or hoarding, frugality surely includes saving and investing—reserving and increasing resources for future plans and needs, like educational expenses or retirement. But frugality also has a more comprehensive purpose, which includes just and generous sharing |
| | A strategy for keeping the poor in their place. Its objective is not to keep the poor in their place, but to enable the poor to rise to a new and adequate place |
| | a return to a rustic or pastoral ethos |
| | An anti-intellectual phenomenon. For example, both the concept and the practice of frugality are in themselves complex, requiring sophisticated reflection on responsible production and consumption |
| | Anti-technological phenomenon. It insists, instead, that ethically acceptable technologies must be "appropriate" to relevant values and social and ecological conditions. |

Source: Compilation based on Nash[76]

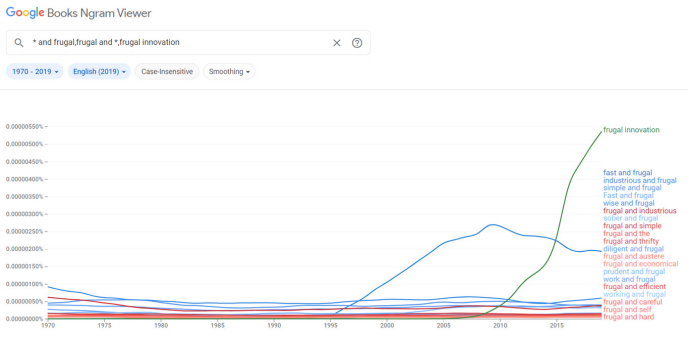


**Figure 6:** N-gram graph showing the rise of phrase 'fast and frugal' and 'frugal innovation' (Original).

## CONCLUSION

The chronological account of the various phases of the discourse on frugality shows unambiguously the rich potential of the term. In this Paper we identified the pattern, and then analyzed a few key documents in detail to understand how frugality as a concept evolved over the years and was influenced by the several key historical events. In addition, we gauged the extent of influence of past publications and historical events irrespective of their popularity on the rise/fall of the frugality discourse. One of the key finding was the identification of the connections between different events, scholars and thinkers which have shaped the larger meaning of frugality.

Also, even though a claim for the comprehensiveness of this survey is difficult to make, given the huge literature around this concept, we can certainly claim to have brought on surface several aspects of the frugality discourses, of the past decades and centuries, which have significant potential to recalibrate the ongoing discourse on frugal innovation. This recalibration opens avenues for creating a more 'human centered' development discourse wherein enabling individual freedom, choices, reason, learning and capability take the center stage. Such a discourse can rescue the current association of frugality with poverty and 'an act of compulsion under extreme resource scarcity'. Indeed, a significant amount of scholarship on

frugality in the past revolved around voluntary frugality, as opposed to the current emphasis on frugality as a compulsion, thrust upon the individual by a resource constraint environment.

To do this study, we improvised a methodology following the ongoing tradition of text mining techniques. These techniques enables scholars to explore documents which haven't been studied before and find linkages between 'apparently' isolated events and scholarships. We supplemented the quantitative text analysis with the qualitative analysis to deliberate upon the meanings, nuances and applications of the concept. We did quantitative text analysis using N-gram tool developed by Google using the corpus of Google books. This tool return results similar to that of 'burst detection algorithms' used in Scientometric studies. We then used the time series graph returned by N-gram to spot the relevant periods, events and documents for a deeper scrutiny and to gauge the extent of influence several scholars had over the concept.

While a sizeable portion of the initial deliberations around frugality made an attempt to relate frugality with either religious virtues, or stoichism, contributions of Benjamin Franklin and Adam Smith, and later by Schonberger can be seen as a powerful rebuttal to these tendencies. Perhaps Berry (p 372)[30] can be quoted here who points out that for Smith frugality "*is not a moral bulwark against the invasive corruptions of bodily appetites and social degradation but a practice or pattern of behaviour that serves to enhance social wellbeing, including the rightful enjoyment of material benefits by all*." Their contributions not only secularized the term, but also opened up new opportunities to add dynamism to the concepts by locating their reasons and drivers in the immediate contexts, the learning environment, as well as the decision-making processes of the actors.

The contemporary discourse on frugal innovation does find positive-ness of frugality in resource constraint environment. Here frugality is found to be applicable only to the solutions which are alternative to the established solutions having a lower cost index while the resources arguments is usually subsumed within the affordability aspect of it. Confining the positive-ness of frugality to the foreseen benefits strictly within a resource constraint setting is claustrophobic to the true potential of the term. The argument of looking for a cheaper alternative of the same kind comes with a loaded argument that the present 'unaffordable' solution is something everyone is aspiring for. This in turn restricts people from making choices as it is already assumed what technology people may want. This goes against the freedom of choices people may have, similar to what Amartya Sen have argued in his work 'Development as Freedom'. These shortcomings are tackled once we recalibrate frugality with Smithian understanding of the term. As for Smith none of the decisions are taken in isolation and every individual take decision in consideration of the society around him/her. Here the principle of 'impartial spectator', shaped by the ideas of reasonableness, justice and rationality, guides individual. To emphasise one may quote, Hühn (p 1) [41] who argues, "*Smith elegantly connects the individual and society. Smith's innovation process is thus an exercise in social construction and not a destructive process based on radical selfishness*".

Such a recalibrated idea of frugality, we argue, opens up a scope for a more humane technology which is possible to modify, customize, and simplify more easily. In other words, it results in a technology 'a person could understand and tinker with' or a technology appropriate for the new social realities or 'cooperative with natural ecosystems' and 'more adapted to different cultures emphases'.

These ideas do have implications for the current discourse on frugal innovations. A few scholars are working to juxtapose frugality against over-engineering.[18] Schonberger's views here could help identify the pathways to prevent such over-engineering. The importance of observational learning, learning by doing, and hands-on experiential knowledge of people involved with the production process, emphasized by Schonberger, might recast the relationship between labour and technology. It would, however, be naïve to restrict the meaning of over-engineering within the material aspects of an innovation. Innovation, after all, is primarily a cognitive process where judgements and decisions under uncertainty are crucial. Over-engineering such aspects of an innovation process might lead to over-protocolization of decision-making processes through use of algorithm. A frugality approach, in this respect, would involve replacing algorithms by heuristic based decisions guided by experience, learning and judgment of people involved with the innovation process.[39,79] The frugality rooted in these arguments, in our view, bring radically different viewpoints from the current understanding of it being merely a cost-effective alternative to a 'prodigal' technology. This way, frugality not just results in saving of resources but also give direction to the society wherein the people contribute towards a more human centred, cognitively enriching, goals of innovation and development.

## ACKNOWLEDGEMENT

We are thankful to the anonymous reviewers of the journal for their critical but constructive observations.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## REFERENCES

1. Witkowski TH. A brief history of frugality discourses in the united states. Consumption Markets and Culture. 2010;13(3):235-58. doi: 10.1080/10253861003786975.
2. Lastovicka JL, Bettencourt LA, Hughner RS, Kuntze RJ. Lifestyle of the tight

and frugal: theory and measurement. J Consum Res. 1999;26(1):85-98. doi: 10.1086/209552.
3. Gildenhard I, Viglietti C, editors. Roman frugality. 2020th ed. Roman Frugality. Cambridge University Press; 2020.
4. Pisoni A, Michelini L, Martignoni G. Frugal approach to innovation: state of the art and future perspectives. J Clean Prod. 2018;171:107-26. doi: 10.1016/j.jclepro.2017.09.248.
5. Weyrauch T, Herstatt C. What is frugal innovation? Three defining criteria. J Frugal Innov. 2017;2(1):1. doi: 10.1186/s40669-016-0005-y.
6. Tiwari R, Fischer L, Kalogerakis K. Frugal innovation: an assessment of scholarly discourse, trends and potential societal implications. In: Herstatt C, Tiwari R, editors. Lead Market, India: India Studies in Business and Economics; 2017; 13-35.
7. Bhatti Y. What is frugal, what is innovation? Towards a Theory of Frugal Innovation. Oxford; 2012.
8. Prabhu J. Frugal innovation: doing more with less for more. Philos Trans A Math Phys Eng Sci. 2017;375(2095). doi: 10.1098/rsta.2016.0372, PMID 28461436.
9. Rao BC. How disruptive is frugal? Technol Soc. 2013;35(1):65-73. doi: 10.1016/j.techsoc.2013.03.003.
10. Kostoff R. Text mining for science and technology – a review part I – characterization/scientometrics. Journal of Scientometric Research. 2012;1(1):11-21. doi: 10.5530/jscires.2012.1.5.
11. Ravikumar S, Agrahari A, Singh SN. Mapping the intellectual structure of scientometrics: A co-word analysis of the journal Scientometrics (2005-2010). Scientometrics. 2015;102(1):929-55. doi: 10.1007/s11192-014-1402-8.
12. Silalahi VMM, Hardiyati R, Nadhiroh IM, Handayani T, Rahmaida R, Amelia M. A framework for text mining in scientometric study: A case study in biomedicine publications. J Phys.: Conf Ser. 2018;1007(1):012030. doi: 10.1088/1742-6596/1007/1/012030.
13. Michel JB, Shen YK, Aiden AP, Veres A, Gray MK, Google Books Team, *et al*. Quantitative analysis of culture using millions of digitized books. Science. 2011 Jan 14;331(6014):176-82. doi: 10.1126/science.1199644, PMID 21163965.
14. Omar M, Mehmood A, Choi GS, Park HW. Global mapping of artificial intelligence in Google and Google Scholar. Scientometrics. 2017;113(3):1269-305. doi: 10.1007/s11192-017-2534-4.
15. Chan HF, Mixon FG, Torgler B. Fame in the sciences: a culturomics approach. Scientometrics. 2019;118(2):605-15. doi: 10.1007/s11192-018-2975-4.
16. Kim JY, Joo GJ, Kim HW, Kim GY, Do Y. A scientometric study of the limnological societies: inferences of research collaboration and core topics based on publication networks. Inland Waters. 2016;6(3):395-405. doi: 10.1080/IW-6.3.849.
17. Phani S, Lahiri S, Biswas A. Culturomics on a Bengali newspaper corpus. In: Proceedings International Conference on Asian Language Processing. IEEE Computer Society; 2012;237-40.
18. Kleinberg J. Bursty and hierarchical structure in streams. Data Min Knowl Discov. 2003;7(4):373-97. doi: 10.1023/A:1024940629314.
19. Chen C. CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. J Am Soc Inf Sci Technol. 2006;57(3):359-77. doi: 10.1002/asi.20317.
20. Eliot TD. The relations between Adam Smith and Benjamin Franklin before 1776. Polit Sci Q. 1924;39(1):67. doi: 10.2307/2142684.
21. Word of the Day: frugal [internet]. Merriam-Webster [cited Jun 14 2021]. Available from: https://www.merriam-webster.com/word-of-the-day/frugal-2021-05-08.
22. Day EP. Day's Collacon: An Encyclopaedia of Prose Quotations. International Printing and Publishing Office, 1884.
23. Gildenhard I, Viglietti C [introduction]. In: Gildenhard I, Viglietti C, editors. Roman frugality. Cambridge University Press; 2020.
24. Assheton W. A theological discourse of last wills and testaments. Brab. Aylmer; 1696.
25. Hackwood FW. Notes of lessons on moral subjects. Paternoster Row: T. Nelson & Sons; 1883.
26. Johnson W. Muddling toward frugality. Sierra Club Books; 1978.
27. Tiwari R, Kalogerakis K, Herstatt C. Frugal innovations in the mirror of scholarly discourse: Tracing theoretical basis and antecedents. In:R&D Management Conference, Cambridge, UK; 2016.
28. Mackenzie G. The Moral History of Frugality, with its opposite vices, Covetousnes, Niggardliness, Prodigality, and Luxury. 1961.
29. Berry CJ. From poverty to prosperity: The recalibration of frugality. In: Roman frugality. Cambridge University Press; 2020;372-99.
30. Primer I, editor. Mandeville studies. The Hague: Martinus NijhoJf; 1975;1-223.
31. Kaye FB. The influence of Bernard Mandeville. Stud Philol. 1922;19(1):83-108.
32. Vandenberg P, DeHart A. Bernard Mandeville, 1670-1733. Retrieved from https://iep.utm.edu/mandevil/.
33. Mandeville B. The fable of the bees: or, private vices, public benefits. Third J Tonson. 1724.
34. Landreth H. The economic thought of Bernard Mandeville. Hist Polit Econ. 1975;7(2):193-208. doi: 10.1215/00182702-7-2-193.
35. Schumpeter JA. History of economic analysis. Routledge; 1954.
36. Rosenberg N. Mandeville and laissez-faire. Journal of the History of Ideas. 1963;24(2):183-96. doi: 10.2307/2707844.
37. Faden ZW. A transatlantic interpretation of Bernard Mandeville. 2009. Retrieved from https://dra.american.edu/islandora/object/0809capstones%3A9/datastream/PDF/view
38. Bhaduri S. Frugal innovation by 'the small and the marginal': an alternative discourse on innovation and development. Erasmus University Rotterdam; 2016.
39. Bhatti YA, Ventresca M, How C. "Frugal Innovation" be conceptualized? Ssrn; 2013;1-26.
40. Hühn MP. Responsible innovation: A Smithian perspective. Philos Manag. 2018;17(1):41-57. doi: 10.1007/s40926-017-0057-y.
41. Hurtado Prieto JH. Bernard Mandeville's heir: Adam Smith or Jean Jacques Rousseau on the possibility of economic analysis. Eur J Hist Econ Thought. 2004;11(1):1-31. doi: 10.1080/0967256032000171489.
42. Smith A. Wealth of the nation. 1776.
43. Smith A. The theory of moral sentiments. HG Bohn; 1853.
44. Davis GF. Philosophical psychology and economic psychology in David Hume and Adam Smith. Hist Polit Econ. 2003;35(2):269-304. doi: 10.1215/00182702-35-2-269.
45. Eiffe FF. The Smithian account in Amartya Sen's economic theory. Nordbergstraße. 2008.
46. Jiménez A, Zheng Y. Tech hubs, innovation and development. Inf Technol Dev. 2018;24(1):95-118. doi: 10.1080/02681102.2017.1335282.
47. Oosterlaken I, Grimshaw DJ, Janssen P. Marrying the capability approach, appropriate technology and STS: the case of podcasting devices in Zimbabwe. Philosophy of Engineering and Technology. 2012:113-33. doi: 10.1007/978-94-007-3879-9_7.
48. Franklin B, Houston A. Advice to a young tradesman, written by an old one. In:Franklin: The Autobiography and Other Writings on Politics, Economics, and Virtue. Cambridge University Press; 2004.
49. Reinert SA. The way to wealth around the world: Benjamin Franklin and the globalization of American capitalism. Am Hist Rev. 2015;120(1):61-97. doi: 10.1093/ahr/120.1.61.
50. Franklin B. The Autobiography of Benjamin Franklin. New York: Putnam's Sons. 1916.
51. Radjou N, Prabhu J. Frugal Innovation: A New Business Paradigm. Retrieved from https://knowledge.insead.edu/innovation/frugal-innovation-a-new-business-paradigm-2375.
52. Lewins W. A history of banks for savings in Great Britain and Ireland. Son and S. Low, Son and Marston; 1866.
53. Horne HO. A history of savings banks. Calcutta: Oxford & IBH Publishing Co; 1947.
54. Trippett F. The fall and rise of U.S. Frugality Time Mag. 1980;115(9):84-6.
55. Leach WR. Land of desire merchants, power, and the rise of a new American culture. Vintage; 2011.
56. Hilton M. Introduction: luxury's shadow. In:Consumerism in twentieth-century Britain: The search for a historical movement. Cambridge University Press; 2003.
57. Beder S. Consumerism: An historical perspective. Pacific Ecologist. 2004;9(1):42-8.
58. The working girl: The southern. The Guardian;
59. Mason DL. From buildings and loans to Bail-Outs: A history of the American savings and loan industry, 1831-1995. Cambridge University Press; 2004.
60. Murphey C. Thrift through education. New York: AS Barnes; 1929.
61. NPH.gov.in. World Thrift Day. Retrieved from https://www.nhp.gov.in/world-thrift-day_pg
62. WSBI-esbg.org. World Savings Day: A more detailed history. Retrieved from https://www.wsbi-esbg.org/Events/WSD/Pages/History.aspx.
63. Straus SW. History of the thrift movement in America. J B Lippincott Comp. 1920;275.
64. Brumbaugh RD, Carron AS, Jaffee DM, Poole W. Thrift Industry Crisis: Causes and Solutions. Brookings Papers on Economic Activity. 1987; 2:349-88. 1987;1987(2). doi: 10.2307/2534486.
65. Leliveld A, Knorringa P. Frugal innovation and development research. Eur J Dev Res. 2018;30(1):1-16. doi: 10.1057/s41287-017-0121-4.
66. Marien M. The two visions of post-industrial society. Futures. 1977;9(5):415-31. doi: 10.1016/0016-3287(77)90022-2.
67. Elgin D. Alternative Futures for Environmental Policy Planning, 1975-2000. Environmental Protection Agency, Office of Pesticide Programs, Strategic Studies Unit; 1975.
68. De Young R. Encouraging environmentally appropriate behavior: the role of intrinsic motivation. J Environ Syst. 1985;15(4):281-92. doi: 10.2190/3FWV-4WM0-R6MC-2URB.
69. Gregg RB. The value of voluntary simplicity in the Indian. J Visva-Bharati Q. 1936.
70. Ishii K. An economics for development and peace: with a particular focus on

the thought of Ernst F. Schumacher. Forum Soc Econ. 2003;32(2):41-55. doi: 10.1007/BF02779078.
71. Elgin D, Mitchell A. Voluntary simplicity. Planning Review. 1977;5(6):13-5. doi: 10.1108/eb053820.
72. Henderson C. The frugality phenomenon. Bull At Sci. 1978;34(5):24-7. doi: 10.1080/00963402.1978.11458505.
73. Schonberger RJ. Frugal manufacturing. Harward Buisness Review. 1987;65(5):95-100.
74. Bhaduri S, Talat N. Bhaduri S, Talat N. RRI Beyond its Comfort Zone: Initiating a Dialogue with Frugal Innovation by 'the Vulnerable'. Science, Technology and Society. 2020;25(2):273-90. doi: 10.1177/0971721820902967.
75. Nash JA. Toward the revival and reform of the subversive virtue: Frugality. The Annual of the Society of Christian Ethics. 1995;15:137-60. doi: 10.5840/asce1995158.
76. Goldstein DG, Gigerenzer G. Satisficing inference and the perks of ignorance. In:Proceedings of the eighteenth annual conference of the Cognitive Science Society; 1996.
77. Patil K, Bhaduri S. 'Zero-error' versus 'good-enough': towards a 'frugality' narrative for defence procurement policy. Mind & Society. 2020;19(1):43-59. doi: 10.1007/s11299-020-00223-7.
78. Kheirandish R, Mousavi S. Herbert Simon, innovation, and heuristics. Mind & Society. 2018;17(1):97-109.
79. European Commission, Fraunhofer ISI, Nesta, Saunders T, Schnabl E, et al. Study on frugal innovation and reengineering of traditional techniques. Publications Office of the EU; 2017.
80. Tucker DM. The decline of thrift in America: our cultural shift from saving to spending. Greenwood Publishing Group; 1991.
81. Carswell R. The crisis in thrift institutions and housing finance. University of Pennsylvania Journal of International Law. 1982;4(3):275-89.

## ENDNOTES

1. See. European Commission report 'Study on frugal innovation and reengineering of traditional techniques'[80])
2. At the same time, however, the association of frugality with being cheap, inexpensive and/or an act of people living under extreme resource constraint has often been the reason for the term not getting enough traction among policymakers and social elites, leading to its under-utilization in policy processes, across countries.
3. "Libraries and publishers around the world helped us chase this goal, and together we've created a universal collection where people can discover more than 40 million books in over 400 languages." Source: https://blog.google/products/search/15-years-google-books/
4. "What does the Ngram Viewer do?" Source: https://books.google.com/ngrams/info
5. "The Library Project makes it possible for users to search on Google through millions of books written in many different languages, including books that are rare, out of print, or generally unavailable outside of the library system." Source: https://support.google.com/websearch/answer/9690276?hl=en
6. "Dimensions contains more than 100 million publications, ranging from articles published in scholarly journals, books and book chapters, to preprints and conference proceedings…". Accessed February 18, 2021. Source: https://www.dimensions.ai/products/free/.
7. "These ranking systems are made up of not one, but a whole series of algorithms. To give you the most useful information, Search algorithms look at many factors, including the words of your query, relevance and usability of pages, expertise of sources, and your location and settings." *How Search algorithms work* Accessed February 18, 2021. Source: " https://www.google.com/search/howsearchworks/algorithms/
8. Better known under the later title, The Fable of the Bees: or, Private Vices, Publick Benefits, 1714 and second edition in 1724 with two new essays.
9. There are 11,260 document in Dimensions.ai database with the keyword "Adam Smith" AND "Mandeville"
10. Page number for the quote may differ depending upon the publisher of the reprint
11. It is interesting to note that Simon W. Straus was also a mortgage banker and ran a company called S.W. Straus and Company see Tucker[81] for more details
12. The second peak around year 1981 is the time when Thrift industry had failed which had provoked a large scale policy discussions. See Brumbaugh Jr. and Carron[65]
13. See Chapter 12 The Politics of Debtor America in David M Tucker, '*The decline of thrift in America : our cultural shift from saving to spending*'[81] to see how the Vietnam war impacted the School Banking program. Schools were the major avenue to teach thrift since the rise of Thrift Movement. And Carswell[82]
14. "This sector of the population emphasizes material things status, fame, affluence, and outward achievement-on the personal level; and growth, bigness, competition on the system level. Other description of values congruent with this sector include: Mechanistic, materialistic, individualistic, secular, centralized, scientistic, emperical" (p 13)[68]
15. "Richard Bartlett Gregg (1885-1974) was an American philosopher, pacifist and peace activist who died in 1974. He was one of the first Americans to live and work with Gandhi and brought Gandhian philosophy to America in the early 20th century…." Accessed February 18, 2021. Source: http://www.richardgregg.org/bio
16. Another reason could be the acceptance of another futuristic Herman Kahn (1922 – 1983), co-author of the book 'The Year 2000' and, who had a view that capitalism and technology held nearly boundless potential for progress.
17. Minifactories: "In fact, Westinghouse-Asheville has no such scenes to photograph. The interior of the plant is arranged into clusters of machines and operators, or minifactories, each making a finished product and organized according to flow of work. This eliminates the department-to-department distances usually spanned by conveyors. Machines, their extraneous adjustment knobs and cranks immobilized, are arranged by product type. You do not see shears all lined up together, but a shear next to a turret punch press next to a press brake. And there are, of course, pegboards full of tools—nearby and instantly available for quick machine setup."[74]
18. See, for instance, https://www.leiden-delft-erasmus.nl/en/news/frugal-and-responsible-innovations-in-the-healthcare-and-water-sector . Accessed on 26 June 2021