JSDC

Journal of Studies in Dynamics and Change (JSDC);
Vol-8, Issue-4, ISSN: 2348-7038
www.jsdconline.com

Capturing Social Cost in Construction Sector: A Review of Literature through Meta-Analysis

Siba Sankar Mohanty[1]

Annie Rath[2]

ABSTRACT

All economic activities are associated with a dual range of costs i.e. the private costs and the social costs. While the private costs are always accounted for directly in the bidding process and transaction of materials and labour, the social costs often remain latent in the cost estimation process due to their impacts on third parties rather than the parties involved. Construction activities by virtue of their multifacetedness and large longitudinal and spatial scales generate a high level of social costs. However, given the numerosity of stakeholders, it has been observed that the social costs have conventionally been left unaccounted for in practice. The identification and assessment of such costs are relatively newer in the fields of civil engineering and construction cost management, nevertheless, the concept of social costs has been an integral part of the study of economics for a very long time expanding over a century. The present paper is an attempt towards exploring the concept of social costs as is defined and recognized in various fields of study in the realm of the construction sector. It adopts a meta-analysis approach to capture the extent, elements, directions, dimensions and methods of study with regard to social costs associated with the construction process as have been undertaken in previous studies. The analysis shows that due to wide diversities in the methods adopted for computation of social costs in the available literature, it is difficult to standardise the quantification of the cost. Moreover, the study also highlights the apathy shown in the contemporary literature towards developing an understanding on the alternative materials used in the construction sector.

Keywords: Valuation of environmental effects, Pollution, Social Cost Estimation

JEL Classification Codes: Q 51, Q 53, Q 52

Author Details:

1. Siba Sankar Mohanty is on the faculty in the Department of A & A Economics, Utkal University, Bhubaneswar, Email: ssmoh_1976@yahoo.co.uk
2. Annie Rath (Corresponding Author) is a Research Scholar in the Department of A & A Economcis, Utkal University, Bhubaneswar, Email: ratsdexpressor@gmail.com

Suggested Citation:
Mohanty, S. & Rath, A. (2021). Capturing Social Cost in Construction Sector: A Review of Literature through Meta-Analysis, *Journal of Studies in Dynamics and Change (JSDC), 8*(4). 17-30
DOI: www. https://doi.org/10.5281/zenodo.7796690
Published on: 01 October 2021

I. INTRODUCTION

The concept of social cost has always been a key element in understanding the failure of market systems in finding an appropriate equilibrium price. In the neo-classical paradigm, the social cost is defined as the sum of the private costs of exchange plus the costs borne by the economic agents operating at both spatial and longitudinal spaces for which they are not compensated or charged because market prices do not capture all the costs involved in the economic activities (Helbling, 2021; FRBSF, 2021). The heterodox viewpoint as an alternative to the above neoclassical thought largely centres around the views of William Kapp as the portion of the total costs of production which is shifted to the society with a motive to increase profits (Berger, 2017). No matter how we define it, a positive social cost over and above the market price always poses a burden to society and at times it is extremely difficult to compute the same. Therefore, the solutions proposed in both the Pigouvian paradigm as well as by Ronald Coase remain incomplete and questionable as the core basis of such solutions relies on the precise estimation of the social cost itself (Pigou, 1920; Coase, 1960). The existence of positive net social cost can be considered as a direct reduction of social welfare and is a critical policy question when it is associated with the production and consumption of products under social welfare and poverty reduction programmes.

II. MOTIVATION

In recent years, owing to the commitments of national governments to reduce multidimensional poverty and provide homes to the homeless, huge projects are being run globally in the construction sector. In India, mega infrastructure projects concerning the creation of road networks and the provision of houses have drawn a lot of policy attention on both the possible economic benefits these projects would bring to society on a longitudinal scale and also the possible social costs involved in these projects. Had it been an easy task to capture the social cost of construction activities, the damages caused to society due to such activities could have been compensated for through a resource transfer intervention. The paper seeks to explore the ideas presented in the existing literature on capturing social costs in the construction sector.

III. THE ANALYTICAL LANDSCAPE

Types of Social Costs

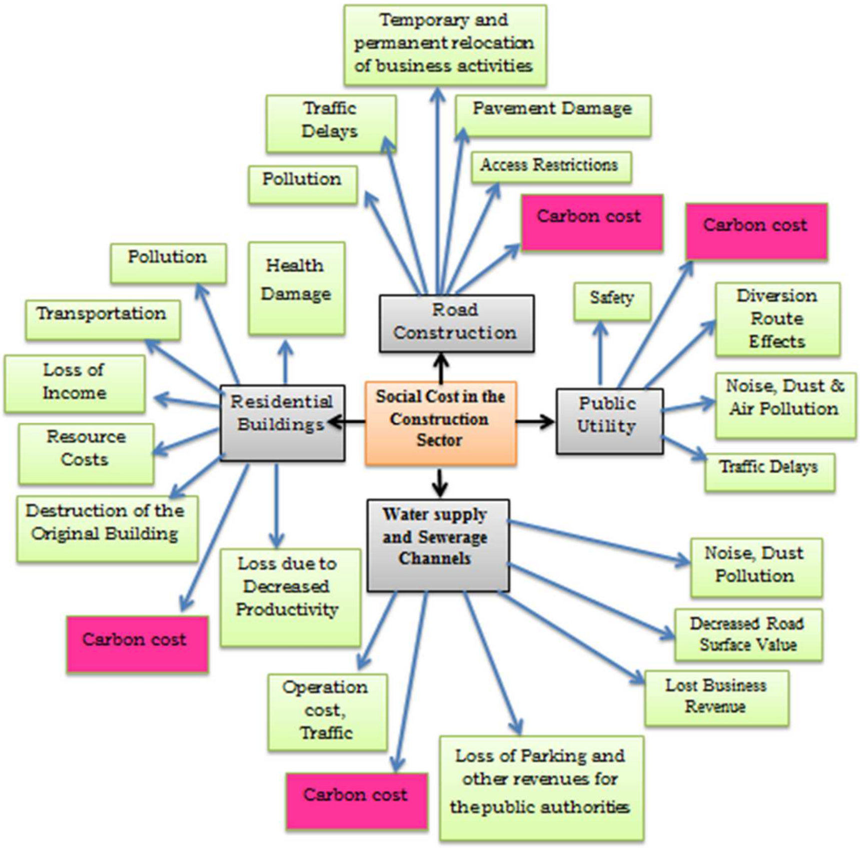
One important thing worth noting is, construction being a multifaceted activity, the cost of construction does not remain confined to the monetary costs alone, but there is also an overwhelming social cost associated with it. According to the Institute of Cost Accountants of India, market cost or simply cost "is a measurement, in monetary terms, of the amount of resources used for the purpose of production of goods or rendering services" (Institute of Cost Accountants, 2015). In traditional parlance, it is usually referred to as private cost. This is the internal cost or the direct monetized cost. External cost or externalities on the other hand "refer to the economic concept of uncompensated environmental effects of production and consumption that affect consumer utility and enterprise cost outside the market mechanism. As a consequence of negative externalities, private costs of production tend to be lower than their 'social' cost (Department of Economic and Social Information and Policy Analysis, 1997). Thus, these represent the social cost. While the direct costs of a construction project include costs related to owning the property, conception and development which include the cost of inputs, taxes, insurance, etc., the indirect costs include those arising from external factors, administrative expenses, etc. Social costs come under the purview of indirect costs which are borne by the public, not associated with the project as such and these costs are most often not included in the construction tender. The lack of legal binding to be responsible for the externalities of construction has kept the accounting of social costs an uncommon phenomenon in the evaluation of construction costs traditionally. Though it is a relatively new concept in the realm of civil engineering and construction management, it has formed a part of study and research in economics for over a century and a half now in relation to public policy. Danku et al (2020) report that Karl William Kapp, a heterodox economic theorist, explained social costs as the tangible and intangible losses to third parties or the general public resulting from private economic activities and that social costs are a largely non-market phenomenon (Danku, Adjei-Kumi, Baiden, & Agyekum, 2020).

Celik (2014) defines social costs of construction as,

> *"The people themselves and the environment they live in; their homes and neighbourhoods if located around the building construction zones are exposed to adverse impacts of the construction activities. In return, people react via altering their daily routine to resolve or alleviate the exposed disruptions to their common life patterns. Cost of this reaction is defined as the social costs associated with construction projects" (Celik, 2014).*

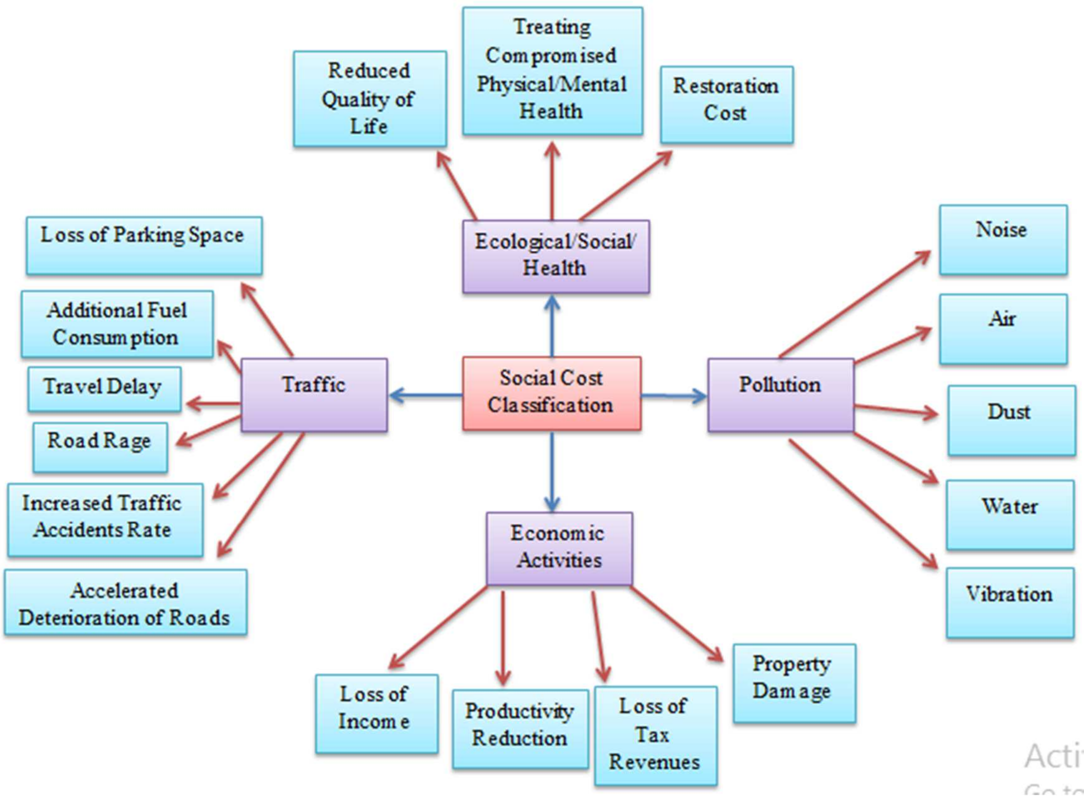
Read and Vickridge (2004) have identified eleven social costs related to infrastructure-based construction projects, namely, air pollution; vibration; dust, dirt and mess; traffic; diversion route effect; noise; plant and materials; safety; over pumping; and visual intrusion (Read & Vickridge, 2004). Gilchrist and Allouche (2005) have classified the indicators of social costs related to construction projects under four broad heads as (i) Traffic, consisting of the indicators: loss of parking space, additional fuel consumption, travel delay, increased traffic accidents rate, road rage and accelerated deterioration of roads; (ii) Economic Activities, consisting of the indicators: loss of income, productivity reduction, loss of tax revenues and property damage; (iii) Pollution, consisting of the indicators: noise, dust, vibration, air and water; (iv) Ecological/Social/Health, consisting of the indicators: treating compromised physical or mental health, reduced quality of life and restoration cost (Gilchrist & Allouche, 2005). The social costs from urban infrastructure-related construction projects may also be classified under (i) Natural Environment, which includes pollution improvement costs and ecology recovery costs; (ii) Public Property, which includes existing infrastructure repair costs; (iii) Local Economy, that includes income loss costs, productivity decline costs, tax decrease costs and energy consumption costs; and (iv) Human Society, that includes living quality decline costs, human health hazards costs, human rights infringed costs, traffic accidents increase costs and transportation time prolonged costs (Xeuqing, Bingsheng, Allouche & Xiaoyan, 2008). They provide a model for capturing social costs in the bid evaluation process by allocating different weights to different cost categories based on the opinions of experts in those respective fields. Yuan, Cui and Jiang (2013) have defined four categories of social costs related to residential building construction namely, impact on the community, impact on the economy, impact on the environment and impact on public property, consisting of elements like damage to health, civil rights, property and damage arising from construction in adjacent areas; loss of livelihood, productivity, resources, revenue and those arising from faulty decisions; pollution and transportation expenses (Yuan, Cui, & Jiang, 2013). Enshassi, Kochendoerfer and Rizq (2014) gathered 50 environmental impacts of construction from several studies, and categorised them under three broad heads namely, ecosystems, natural resources and public impacts, conducted a study in the Gaza strip with 50 professionals from the construction industry as their respondents. As per the opinions of the respondents on a five-point Likert scale, generation of dust, removal of vegetative cover, air and noise pollution have emerged as the most realized environmental impacts of construction work (Enshassi, Kochendoerfer, & Rizq, 2014). Celik, Kamali and Arayici (2017) by way of a thorough review of relevant literature conclude that basically classification of social costs based on the type of construction work seems the most common though there is barely any noticeable variation in the types of social costs identified across types of construction projects (Celik, Kamali, & Arayici, 2017). Figure-1 provides a brief framework for comprehending social costs in the construction sector. Another classification of social costs in the form of impacts on economic, ecological, social and biological life as a result of construction activities has been presented in Figure-2.

Figure-1: Mapping of Social Cost in the Construction Sector



Note: Carbon cost is the embedded carbon emissions of material production which is different from the onsite pollution.
Source: Chart drawn on the basis of (Çelik , Kamali , & Arayici, 2017)

Figure-2: Economic, Quality of Public Good, Quality of Human life and Environmental Classification of Social Cost



Source: Chart drawn as per the classification made by (Gilchrist & Allouche, 2005) as reported in (Çelik , Kamali , & Arayici, 2017)

Integrating Social Cost into Market Outcomes

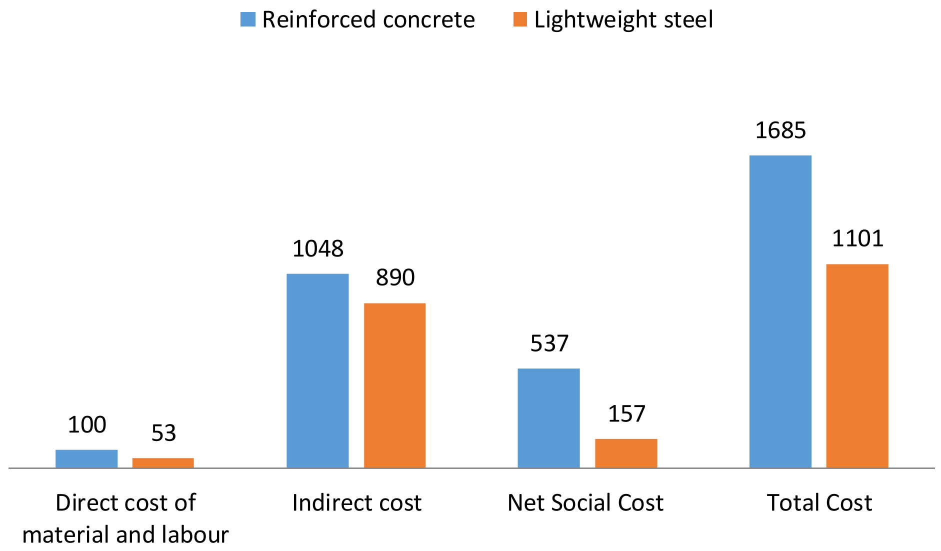
In recent times there has been increased awareness among governments and the public regarding social costs and the need to minimize them. The minimization of social costs can be achieved if they are made a part of the cost estimates and bid evaluation processes during the conception of a construction project. For the construction industry to move along a more sustainable path, there is a need to shift from the old paradigm of time, cost and quality into a newer one that takes into account aspects such as life cycle assessment in the context of time; material cost, minimal consumption of resources, social cost, etc. in context of cost; and, human satisfaction, minimal adverse impact on the environment, etc. in context of quality. Over the years several techniques have been developed for the valuation of social costs in the realms of Economics and Statistics, which can be broadly grouped under either of the two categories: direct valuation methods and indirect valuation methods. However, the selection of a particular method depends on the type and quantity of data and the nature of the indicator to be evaluated. Direct valuation methods are market-based methods which can be used for measurable values. These include techniques such as loss of productivity, which measures the reduction in income resulting from direct impacts of construction work on the production of goods and services; human capital, which accounts for the loss of earnings due to accidents on construction sites or traffic, etc.; replacement cost, which involves the additional cost to be borne to replace or restore a damaged or lost asset; and lane closure cost, which lies in the interface of direct and indirect evaluation techniques, with some components like administrative costs and cost of inspection during construction work (primarily of highways) being direct costs and others like cost borne due to traffic delays being indirect costs. Indirect valuation methods are used in cases where there is the absence of a market and the market for a linked good or service is used to indirectly determine an approximate cost. Under the indirect valuation techniques, are methods like hedonic pricing, which measure the cost of environmental and other neighbourhood factors by attributing the price difference between houses/properties in different localities to these characteristics; user delay costs, which refer to the total delay in time as a result of reduced speed along construction sites; and contingent valuation technique, which creates a hypothetical market during the survey to capture the respondents' willingness to pay to maintain or improve environmental amenities or their willingness to accept a certain amount or type of compensation so as to bear environmental damage. And two prevalent approaches to the incorporation of social costs in bid evaluation are the cost/benefit effectiveness method and the multi-rating evaluation system (Gilchrist & Allouche, 2005).

Measuring Social Cost through the Estimation of Cross-sector Impacts

Yu and Lo (2005) in their study have proposed a construction social costs model for measuring the externalities of an expressway construction in Taiwan based on three broad categories of impacts namely, traffic impacts, environmental impacts and business impacts. Using variables like travel time before and during construction work, extra distance travelled in detours, travelling cost of vehicles, the average number of passengers per vehicle, number of affected business units, average income loss per day per unit, total duration of construction work, etc. they have calculated cost components like daily vehicle delay cost, daily detouring cost, daily traveller's time value, daily noise pollution cost, daily air pollution cost, daily business loss, etc. which have been incorporated into an integrated model in matrix form to reach at the approximate total social cost. Their study has made use of both primary and secondary data. The limitations of the model as have been stated by them are: factors like economic impacts at national and global levels, psychological aspects, and some environmental impacts with regard to solid waste, etc. have been excluded from the model to avoid complications in the calculation as well as due to time-independent characteristic of some of these factors. They have focused on a time-dependent model so that the scheduling of such projects could be decided in a way as to minimize the most visible social impacts (Yu & Lo, 2005).

Celik (2014) in his doctoral thesis on '*Developing a Building Construction Associated Social Cost Estimation System for Turkish Construction Industry*' provides a method for estimation of social costs during the entire phase of building construction so as to compensate third parties accordingly. The study is based in Turkey and North Cyprus on 266 residents residing within 150 metre radius of the construction site. The considerations to be taken into account while estimating social costs are, location of the construction site, regulations regarding building construction, methods used for construction, and lifestyle of the nearby residents. He represents the social cost per local resident SCLR as the sum of the social cost for the neighbourhood (SCN), the social cost for household (SCHH) and the social cost for house/car (SCH), where each of these components is a sum of a set of sub-components. Like, the social cost for neighbourhoods is the sum of the costs of traffic problems, the cost of deficiency in recreational facilities and the cost of alterations in the ambient standard. Social cost for households is the sum of the cost of delay in meeting daily necessities, the cost of health/personal care and the cost of limitations in the use of outdoors. Social cost for a house/car is the sum of the cost of cleanliness of outdoor areas, the cost of cleanliness of indoor areas and the cost of cleanliness of the car. His interview with nine contractors revealed that for practical applicability it would be more appropriate for social costs to be computed separately from the bidding value, rather than as a share of the costs to be borne by the owner (Celik, 2014). Celik, Arayici and Budayan (2019) make use of the method proposed by (Celik, 2014) to assess the social cost incurred by the neighbourhood in the case of housing projects in North Cyprus and Turkey.

Figure-3: Market Cost and Social Cost of Constructing Modern Concrete Houses



Source: Drawn by authors on the basis of method adopted in Celik 2014

Many authors have also made attempts to measure the total cost of construction by categorising the cost into direct cost, indirect cost and social cost. While direct cost includes the material and labour cost of a housing project; indirect cost includes costs involved in land conversion for construction purpose, legal permissions and clearances, surveyor and engineer fees, fees to the contractor etc. Both direct and indirect costs of a construction project are borne by the owner of the construction project. However, social costs are those costs borne by the society in the form of pollution, traffic, health hazards to the nearby population, and so on. While it is difficult to measure the social cost very comprehensively, still a significant chunk of it can be computed through various methods identified in the contemporary literature (Tah, Thrope, & McCaffer, 1994; Read & Vickridge, 2004). Figure -3 shows an indicative extent to which social costs account for in a typical modern construction project. Based on the study by Celik 2014, and indexing the direct cost of material and labour at 100, we found that the social cost in the conventional steel reinforced concrete would be 537 (i.e., more than five times higher than the input cost in the construction sector). It is worthwhile to note that with the slightest modification in the materials used, the direct cost of construction activities can be moderated to an extent of 53 per cent and the social cost can be reduced to 30 per cent of the conventional social cost. In the forthcoming section, we have made an attempt to present the issue of capturing social cost through a meta-analysis of the existing literature.

IV. META –ANALYSIS OF RELEVANT LITERATURE

The meta-analysis of the relevant literature provided interesting insights into the current efforts of comprehending the incorporation of social cost in the mainstream cost calculations. Table-1 shows the diversity related to the definitional issues in the comprehension of social costs in the contemporary literature.

Table-1: Definitional Diversity in the Review of Literature

Author & year	Concise definition of the social cost	Area of research
(Field, 1997)	Social costs are the overall impact of an economic activity on the welfare of society. Social costs are the sum of private costs arising from the activity and any externalities.	Environmental economics
(McKim R. A., 1997)	The cost of construction to society which is not included in the construction bid.	Underground infrastructure systems
(McKim & Kathula, 1999)	The overall impact of a construction activity on the welfare of society.	Infrastructure management systems
(Allouche, Ariaratnam, ASCE, AbouRizk, & ASCE, 2000)	Generated costs due to execution of a construction project incurred by the parties involved in the contractual agreement.	Evaluation of construction technologies
(Rahman, Vanier, & Newton, 2005)	The construction, maintenance, repair, rehabilitation, any renewal of municipal infrastructure, cause considerable disruption and inconvenience that cannot be easily quantified, to a municipality and to the general public.	Municipal infrastructure management
(Gilchrist & Allouche, 2005)	Monetary equivalent of consumed resources, loss of income and loss of enjoyment experienced by parties not engaged in the contractual agreement, solely due to a construction process. Social costs take many forms including loss of revenue, productivity and time, consumption of non-renewable resources and accelerated deterioration of secondary roads.	Trenchless Technology Research

(Yu & Lo, 2005)	The construction social costs are external costs of a construction project that are undertaken by the public rather than by the project participants.	Road works
(Tanwani, 2012)	Construction causative adverse impacts that neighbouring communities are inevitably being exposed to due to implementation of construction projects.	Traditional construction methods
(Apeldoorn, 2013)	Costs associated with the construction works that are paid for by the community at large, and not realized as a cost that is included in the tendered contract price.	Water pipeline projects
(Celik, 2014)	Cost of alteration in the daily routine of third parties who react to alleviate the consequences of construction-borne disruptions on their common life patterns.	Building construction projects
(Enshassi, Kochendoerfer, & Ehsan , 2014)	Environmental Pollution	Environmental Impact Assessment
(Çelik , Kamali , & Arayici, 2017)	Costs caused by constructions that are to be paid by the third parties.	Environmental Impact Assessment
(Danku, Adjei-Kumi, Baiden, & Agyekum, 2020)	Economic activities that generate adverse environmental impacts in the form of pollution, traffic interruptions and interference in daily economic and social life patterns of adjacent residents are referred to as social costs.	Building Construction and Planning Research
(ICAI, 2015)	The cost by way of compensation by the polluting entity either under future legislation or under social pressure. It cannot be quantified by traditional models of cost measurement. They are best kept out of general purpose cost statements.	Cost accounting guidelines

Source: Compiled by authors

Table-2 shows the methodological perspectives and diversities related to the measurement of social cost in the spectrum of literature covered. Given the diversity of formulas used in different literature, it is too early to comment on the level of accuracy and preciseness to which these methods are able to compute social cost. However, it is clear that the researchers are factoring in a host of macro variables ranging from national income to consumption levels. This shows the complexities involved in issues related to the computation of social cost.

Table-2: List of formulas used in Different Sources for Computing Social Cost

References	Formula for Calculating Social Cost
Chris Hope，David Newbery	$$\frac{CC}{SCC} = \frac{cov\,(D_r, Y_{r0}) \div Y_{w0} + D}{cov\,(D_r, n_r)}$$ Where, SCC – Equity-weighted or social cost of carbon CC – Unweighted cost of carbon Dr – present value of climate change damage in region r expressed each year as a fraction of region r's GDP of that year, and discounted at a suitable discount rate (δ +(ν-1)g) Y_{r0} – region r's GDP now Y_{W0} – current world GDP

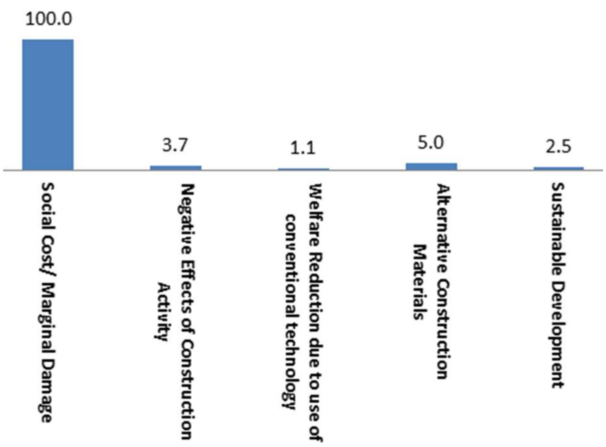
	n_r – region r's the share of world population D – average of the Dr's
Stephen Newbold, Charles Griffiths, Chris Moore, Ann Wolverton, and Elizabeth Kopits	$$SCC = \frac{dC_t}{dX_t} = \frac{\partial E[W_0]/\partial X_t}{\partial E[W_0]/\partial C_t}$$ SCC – Social cost of carbon W_0 – Social welfare in the current period C_t – Aggregate consumption X_t – CO_2 emissions in period t($\geq$ 0) The SCC is the amount of consumption that a decision-maker who aims to maximize E[W_0] would be willing to sacrifice to reduce CO_2 emissions by one unit (by convention, one metric ton) in period t (i.e., the marginal rate of substitution in the expected social welfare function between CO_2 emissions and aggregate consumption). In lay terms, this is the discounted present value of the future stream of damages caused by an additional ton of carbon emissions in period t.
William Nordhaus	$$SCC = \frac{\partial W}{\partial E(t)} \Big/ \frac{\partial W}{\partial C(t)}$$ SCC – Social cost of carbon at time t W – Social welfare E(t) – Emissions at time t C(t) – aggregate consumption in period t The numerator is the marginal impact of emissions at time t on welfare, while the denominator is the marginal welfare value of a unit of aggregate consumption in period t.
David Anthoff Richard S.J. Tola and Gary W. Yohef	$$SCC_r = \sum \frac{I_{tr}\left(\sum E_s + \delta_s\right) - I_{tr}\left(\sum E_s\right)}{\prod 1 + \rho + \eta g_{sr}} \Big/ \sum \delta_t$$ SCCr – The regional social cost of carbon (in US dollar per tonne of carbon) r – Region t and s – Time (in years) I – Monetised impacts (in US dollar per year) E – Emissions (in metric tonnes of carbon) δ - Additional emissions (in metric tonnes of carbon) ρ - The pure rate of time preference (in fraction per year) η - The elasticity of marginal utility with respect to consumption g - The growth rate of per capita consumption (in fraction per year)
Anthoff, David; Rose, Steven; Tol, Richard S. J.; Waldhoff, Stephanie	$$SCC_r = \sum \frac{D_{trs}(E_{1950} + \delta_{1950},\ldots,E_t + \delta_t) - D_{trs}(E_{1950},\ldots,E_t)}{\prod 1 + \rho + \eta g_{sr}}$$ SCCr,i – The regional social cost of greenhouse gas i (in 1995 US dollars per tonne of i) r – Region i – Greenhouse gas t and s – Time (in years) D – Monetised impacts (in 1995 US dollars per year) E – Emissions of greenhouse gas i (in metric tonnes of i per year) δ - Incremental emissions (in metric tonnes of i per year) ω - Increment emissions (in metric tonnes of i per year) ρ - The pure rate of time preference (in fraction per year)

	η - The elasticity of marginal utility with respect to consumption g - The growth rate of per capita consumption (in fraction per year)
Anthoff, David; Tol, Richard S. J.	$SCC_r = \frac{1}{\frac{\partial U}{\partial C}} \frac{1}{\sum \delta} \sum_r \sum_t \frac{dC \frac{\partial U}{\partial C}}{\prod 1+\rho}$ SCCr – The regional social cost of carbon (in 1995 US dollars per tonne of carbon) r – Region t and i – Time (in years) U – Utility D – Climate damages E – Carbon emissions (in metric tonnes of carbon) δ - Incremental emissions (in metric tonnes of carbon) ω - The marginal amount of extra emissions ρ - The pure rate of time preference (in fraction per year)
Inge van den Bijgaart, Reyer Gerlagh, Luuk Korsten, Matti Liski	$SCC = \Delta\theta(c)Y(t)W(\sigma,\gamma)$ Y(t) – Gross world product (GWP) at time t in nomial terms (e.g. dollars or euros) $^{\theta}$(c) – The economically relevant measure for climate sensitivity c i.e. the temperature increase associated with a doubling of the pre-industrial atmospheric carbon stock W – Damage-time aggregator, measure in number of effective years. It depends on the discount rate applied to future losses (described through σ) and the climate system parameters (described through γ). When there is no discounting σ = 0, W (0, γ) measures the mean lifetime of income lost due to a CO_2 impulse

Source: Compiled by authors on the basis of idea from Wang, P; Deng, X.; Zhou, H. & Yu, S. (2018)

We also analysed the frequency of selected keywords and phrases used in the literature we covered. In all the papers cited in the references, in comparison to the phrases “social cost” or “marginal damage”, the occurrence of words and phrases that denoted negative effects of conventional construction activities were only around 3.7 per cent. Similarly, the mention of “alternative construction materials” was around 5 per cent and the mention of “sustainable development” was around 2.5 per cent. The phrase indicating “welfare reduction due to use of conventional technology was around 1.1 per cent only. This indicates that while the contemporary literature had concerns on non-inclusion of social cost

Fig-4: Frequency of Mention of Keywords (in %)



Source: Computed by authors

and issues related to their measurement, it largely considered the same from a very neo-classical perspective of measuring externalities so that a reallocation process could be initiated. However, it ignored the larger issue of the carrying capacity of our ecological endowments and did not discuss much about the alternative techniques as well as loss of welfare.

V CONCLUSION

The present study made an attempt to understand how the issue of social cost in the construction sector has been addressed in the contemporary literature. Our meta-analysis of the relevant literature also showed the varied range and complexities in the variables used for computing social cost; thus making it difficult for a standardisation. It is observed that the consideration or actual implementation of social cost accounting in construction projects, especially residential building construction, is still quite low though it is increasingly being recognized and acknowledged as a crucial aspect associated with construction activity. The reasons have been attributed primarily to the difficulty in allocating social costs, lack of standard methods of estimation, absence of historical data, lack of noticeable agitation on part of people not a party to the contract but facing the externalities, no due appreciation of social costs, etc. However, previous studies highlight that the respondents' validation of the methods suggested by local residents and businesses around construction sites to reduce the social costs of construction was encouraging. Reducing the duration of work, scheduling the work during off-peak hours, coordinating with other works nearby, using alternative techniques and methods, and strict implementation of the environmental impact assessment (EIA) process during the initiation of projects, have been commonly suggested towards reduction of the social costs of construction. While it is important to understand the ways of reducing social costs, it is also pertinent to evolve ideas on developing alternative systems for the development of the construction sector. Our analysis of keywords shows that the contemporary literature is rather less vocal on this important aspect of development of the construction sector.

VI REFERENCES

Allouche, E. N., Ariaratnam, S. T., ASCE, A., AbouRizk, S. M., & ASCE, M. (2000). Multi-Dimensional Utility Model for Selection of a Trenchless Construction Method. *Construction Congress VI.* http://dx.doi.org/10.1061/40475(278)59.

Anthoff, D., & Tol, R. S. (2013). The Uncertainty About the Social Cost of Carbon: A Decomposition Analysis using FUND. *Climate Change, 117*, 515-530.

Anthoff, D., Tol, R. S., & Yohe, G. W. (2009, January). Discounting for Climate Change. *Working Papers ESRI 276* , 1-35.

Apeldoorn, S. (2013). Comparing the Costs – Trenchless Versus Traditional Methods. *MIESA, 34*(4), 55-57.

Berger, S. (2017). *The Social Costs of Neoliberalism: Essays on the Economics of K. William Kapp.* Nottingham, England: Spokesman.

Bijgaart, I. v., Gerlagh, R., Korsten, L., & Liski, M. (2016). A Simple Formula for the Social Cost of Carbon. *Journal of Environmental Economics and Management, 77*, 75-94.

Celik, T. (2014, December). Developing a Building Construction Associated Social Cost Estimation System for Turkish Construction Industry. Salford, Greater Manchester, England: College of Science and Technology, School of the Built Environment,University of Salford.

Celik, T., Kamali, S., & Arayici, Y. (2017). Social Cost in Construction Projects. *Environmental Impact Assessment Review, 64*, 77-86.

Celik, T., Arayici, Y., & Budayan, C. (2019). Assessing the Social Cost of Housing Projects on the Built Environment: Analysis and Monetization of the Adverse Impacts Incurred on the Neighbouring Communities. *Environmental Impact Assessment Review, 77*, 1-10.

Coase, R. (1960). The Problem of Social Cost. *Journal of Law and Economics, 3*(1), 1-44.

Danku, J. C., Adjei-Kumi, T., Baiden, B. K., & Agyekum, K. (2020). An Exploratory Study into Social Cost Considerations in Ghanaian Construction Industry. *Journal of Building Construction and Planning Research, 8*, 14-29.

Department for Economic and Social Information and Policy Analysis. (1997). *Glossary of Environment Statistics: Studies in Methods.* New York: Statistics Division, United Nations.

Enshassi, A., Kochendoerfer, B., & Ehsan , R. (2014). An Evaluation of Environmental Impacts of Construction Projects. *Revista Ingeniería de Construcción RIC, 29*(3), 234-254.

Field, B. (1997). *Environmental Economics: An Introduction (Ed-2nd).* Irwin/McGraw-Hill.

FRBSF. (2021). *What is the difference between private and social costs, and how do they relate to pollution and production?* Retrieved June 20, 2021, from Federal Reserve Bank of San Francisco: https://www.frbsf.org/education/publications/doctor-econ/2002/november/private-social-costs-pollution-production/

Gilchrist, A., & Allouche, E. N. (2005). Quantification of Social Costs Associated with Construction Projects. *Tunnelling and Underground Space Technology, 20*(1), 89-104.

Helbling, T. (2021). *Externalities: Priced do not Capture all Costs (Back to Basics Series).* Retrieved June 25, 2021, from Finance and Development: International Monetary Fund: https://www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/Externalities

Hope, C., & Newbery, D. (2006). Calculating the Social Cost of Carbon. *Working Papers EPRG 0720.*

ICAI. (2015). *Cost Accounting Standards Issued by Cost Accounting Standards Board (CASB).* New Delhi: The Institute of Cost Accountants of India .

McKim, R. A. (1997). Bidding Strategies for Conventional and Trenchless Technologies Considering Social Costs. *Canadian Journal of Civil Engineering, 24*(5), 819-827.

McKim, R. A., & Kathula, V. S. (1999). Social Costs and Infrastructure Management. *INFRA, 99*, 10.

Newbold, C. S., Griffiths, C., Moore, C., Wolverton, A., & Kopits, E. (2013). A Rapid Assessment Model for Understanding the Social Cost of Carbon. *Climate Change Economics, 4*(1), 1-40.

Nordhaus, W. (2014, March-June). Estimates of the Social Cost of Carbon: Concepts and Results from the DICE-2013R Model and Alternative Approaches. *Journal of the Association of Environmental and Resource Economists, 1*(1/2), 273-312.

Pigou, A. C. (1920). *The Economics of Welfare.* London: Macmilan.

Rahman, S., Vanier, D. J., & Newton, I. A. (2005). *MIIP Report: Social Cost Considerations for Municipal Infrastructure Management.* National Research Council of Canada.

Read, G. F., & Vickridge, I. (2004). Social or Indirect Costs of Public Utility Works. In G. Read, *Sewers: Replacement and New Construction: Replacement and New Construction.* Oxford: Elsevier.

Tah, J. H., Thrope, A., & McCaffer, R. (1994). A Survey of Indirect Cost Estimating in Practice. *Construction Management and Economics, 12*(1), 31-36.

Tanwani, R. (2012). *Social Costs of Traditional Construction Methods | Gunda Corporation.* Retrieved May 20, 2021, from https://gundacorp.com/2012/04/19/social-costs-of-traditional-construction-methods/

Waldhoff, S., Anthoff, D., Rose, S., & Tol, R. S. (2014, October). The Marginal Damage Costs of Different Greenhouse Gases: An Application of FUND. *Economics: The Open-Access, Open-Assessment E-Journal, 8*, 1-33.

Wang, P; Deng, X.; Zhou, H. & Yu, S. (2018), Estimates of the social cost of carbon: a review based on meta-analysis, *Journal of Cleaner Production*, DOI: 10.1016/j.jclepro.2018.11.058

Xeuqing, W., Sheng, L. B., Allouche, E. N., & Xiaoyan, L. (2008). A Practical Bid Evaluation Method Considering Social Costs in Urban Infrastructure Projects. *4th IEEE International Conference on Management of Innovation and Technology*, (pp. 617-622).

Yu, W.-D., & Lo, S.-S. (2005). Time-Dependent Construction Social Costs Model. *Construction Management and Economics, 23*(3), 327-337.

Yuan, Q.-M., Cui, D.-J., & Jiang, W. (2013). Study on Evaluation Methods of the Social Cost of Green Building Projects. In: Jun, W., Yanbin, L., Jinfeng, W., Fouad, R.H. (Eds.), *Advances in Industrial Engineering, Information and Water Resources.* WIT Press, Southampton.