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Inching Towards the Metre: Rethinking Metrology, Nationalism, and Development in India (1833-1956)*

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Abstract:

This article shows that enforcement of standardised weights and measures in India was tied to shifting normative notions of planned economic development. Rethinking the links between metrology (weights and measures) and the state allows historians to probe the technologies of state governance. Historical narratives have over-emphasised the ability of the state to rule economic and social spaces through measurement systems. How various contending groups lay claim to such technologies remains imperfectly understood. To some, measurements were a technology of economic coordination, to others they were a technology of governance; to others still it became a technology of planned development.

Sites of calculation were also shaped in culturally sensitive ways. Besides increased quantification within bureaucracies, reforms had to be framed within everyday economic relationships. The nationalist state invoked 'Indian tradition' to enforce measurement standards and achieve planned economic development. A technocratic rationale had to be bolstered with the cultural authority of 'Indian science'.

Metrology socially organises an inherently cognitive human activity. Governments use measurements to rule, businesses use them to compete, and people use them to mediate mundane social and economic activities. India's transition to the metric system occurred when this global technology was reconstituted to address these contending claims.

I Introduction

Jawaharlal Nehru, writing to his Chief Ministers in 1955, reminded them, ‘the metric system like the zero symbol, originated in India. This was a gift of India to the world, but in this, as in some other matters, we lagged behind and other countries went ahead.’¹ Such a claim is clearly disputable. The metric system was forged during the turbulence of the French Revolution in the 1790s. But Nehru’s statements illustrate how metrological reforms as part of India’s modernisation were ensconced in what the editors of *Science and Culture* in 1935 termed the ‘middle path’: building modern science over the cultural foundations of the country’s ancient and variegated civilisation.² The reform of India’s metrology in 1956 was especially significant given that the British colonial government had been unable to ‘settle upon an organized system for the country as a whole’ throughout their rule of the subcontinent.³

Rethinking the links between legal metrology (a system of weights and measures) and the state allows historians to probe the technologies of state formation and governance.⁴ Historical literature has established the notion that metrology is a

¹ Jawaharlal Nehru, *Letters to Chief Ministers - Vol. 4* (Delhi, 1988), letter dated 14 April 1955.

² ‘Editorial: Science and Culture’, *Science & Culture*, i (1935), 1, 4.

³ *Report of the Weights and Measures Committee 1913-14*, Government of India, Simla, 1914, 7.

⁴ Metrology is a relatively under-researched topic in the historical literature. Kula was the first to systematically decipher the economic and social logic of historical measurement units; Witold Kula, *Measures and men* (Princeton, 1986). Ken Alder, ‘A revolution to measure: The political economy of the metric system in the *ancien régime*’, in M Norton Wise (ed.), *The values of precision* (Princeton, 1995), extends this to show how the metric system overturned ancient European measurement practices. Scholarly literature on the metrology of non-European regions is sparse. History and philosophy of science literature deals more with the epistemological issues rather than social processes of metrological change: e.g. Simon Schaffer, ‘Metrology, metrication and Victorian values’, in *Victorian*

constitutive element of state formation.⁵ What remains imperfectly understood is how various contending groups lay claim to this technology, framed the discourse regarding the structure and constitution of legal metrology, situated it within economic and cultural contexts, and tied it to normative notions of state governance and the political economy. Historical narratives often tend to over-emphasise the ability of the state to control or rule economic, political and social spaces through technocratic systems, including metrological systems. Examples of such narratives are reflected in Headrick's 'technological imperialism', Prakash's 'sinews of power' or Latour's 'metrological chains' descriptions of space and state.⁶ There is considerable evidence that metrological reforms fit imperfectly within such narratives when the very notion of the state and its role is in flux.

Using the case of India, the paper will demonstrate that metrological reforms were the result of a long-drawn process embedded within shifting notions of the state, the economy and the social organization of measurements (an inherently cognitive human activity). It will show how integration of domestic markets and the removal of barriers to internal commerce remained insufficient factors for standardising weights

Science in Context Bernard Lightman (ed.), *Victorian Science in Context* (Chicago & London, 1997).

⁵ Bruce Curtis, 'From the Moral Thermometer to Money: Metrological Reform in Pre-Confederation Canada' *Social Studies of Science*, xxviii, (1998), 548. Effective bureaucratisation of fiscal revenue required standardisation of measurement units and suppression of local ones; William J Ashworth, *Customs and excise: Trade, production, and consumption in England, 1640-1845* (Oxford, 2003); James C Scott, *Seeing like a state: How certain schemes to improve the human condition have failed* (New Haven & London, 1998). Historically, sovereign states had an interest in measurement standardisation as it led to higher state revenues; Hendrik Spruyt, *The sovereign state and its competitors: an analysis of systems change* (Princeton, 1996), 159-163.

⁶ Daniel R Headrick, *The tools of empire: Technology and European imperialism in the nineteenth century* (New York, 1981), 204; Gyan Prakash, *Another reason: Science and the imagination of modern India* (Princeton, 1999), 161; Bruno Latour, *Science in action: how to follow scientists and engineers through society* (Cambridge, MA, 1987), 250-254.

and measures. Even attempts to establish institutions of governance and colonial rule proved inadequate in achieving standardisation. It is only by intersecting Foucauldian ‘governmentality’ with notions of planned economic development that germinated in the 1920s can we explain why India’s metrology could ultimately be reformed during the post-colonial period but not before.

Furthermore, the link between metrology and the state allows the historian to probe how the sites and characters of calculability shifted during this period. Historical literature has established that technologies of the state were employed to make social and economic entities calculable in particular ways.⁷ The shifting character of calculability is usually understood in terms of increased values of quantification and precision. The history of metrological reforms sharpens the focus on how calculability was also shaped in culturally appropriate ways. The cultural context, as this paper demonstrates, needs to be understood in its plurality. There is the context of popular culture, where notions of tradition or custom dominated how most people used measurement units in everyday activities. Then there is the context of a ‘culture of objectivity’, which was concerned with increased precision, quantification and technocracy in public life, in industrial enterprises and in the scientific approach. Finally, the cultural context also needs to incorporate the very notion of ‘Indian science’ and the simultaneity of both ancient Hindu philosophy as well as western scientific approaches within this notion. As this paper shows, all these different notions of ‘culture’ mattered in varying degrees to the different groups laying claim to the

⁷ Scott, *Seeing like a state*; Theodore M Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. (Princeton, New Jersey, 1995); M Norton Wise, (ed.) *The Values of Precision*. (Princeton, New Jersey, 1995); T Frangsmyr, J L Heilbron, and R E Rider (eds.), *The Quantifying Spirit in the 18th Century*. (Berkeley, California, 1990); Timothy Mitchell, *Rule of experts: Egypt, techno-politics, modernity* (London, 2002).

measurement technology. In turn, metrological reforms helped to consolidate certain cultures, such as quantification within state and industrial bureaucracies. In India, metrological reforms were possible when a nationalist state invoked 'tradition', in addition to quantification, to enforce measurement standards in the context of planned economic development

In this paper, metrology is understood to be more than just a technology directed towards economic coordination (cost minimisation, market integration, etc.).⁸ Metrological standardisation was also intended for governing, ruling and development. This paper makes its most important contribution in this latter context. The place of metrology in the development of modern states, such as India, is only indistinctly visible in the historical literature. The analysis in this paper focuses on contemporary understanding of governance, economic development, and cultural appropriation and how they shifted during this period. Particular emphasis is laid on how contemporaries 'framed' the issues concerning metrological standardisation. Framing involves highlighting bits of information about a subject (and excluding others), elevating the salience of that bit of information and making it more meaningful or memorable.⁹ The analysis presented here shows how individuals emphasised certain aspects of metrology, including its importance in reducing chaos, introducing scientific

⁸ Considerable literature exists on standardization and economic coordination, although studies of metrological standards in this context are sporadic; for example Paul A David, 'Clio and the Economics of QWERTY,' *The American Economic Review* lxxv, (1985); Charles Kindelberger, 'Standards As Public, Collective and Private Goods,' *Kyklos* xxxvi, (1983); Stefano Ponte, and Peter Gibbon, 'Quality Standards, Conventions and the Governance of Global Value Chains,' *Economy and Society* xxxiv, (2005).

⁹ William A Gamson and Andre Modigliani, 'Media Discourse and Public Opinion on Nuclear Power: A Constructionist Approach,' *American Journal of Sociology* xcv (1989); Erving Goffman, *Frame Analysis: An Essay on the Organization of Experience*. (Cambridge, MA, 1974); Robert D Benford, and David A Snow, 'Framing Processes and Social Movements: An Overview and Assessment,' *Annual review of sociology* xxvi (2000); Robert M Entman, 'Framing: Toward Clarification of a Fractured Paradigm,' *Journal of communication* xliii (1993).

techniques, in planning and development, in eliminating trade barriers, in modernisation of industry, in recovering cultural heritage and so on. The metrological reforms needed to be framed in ways that made sense within social contexts that mediated everyday economic relationships..

This paper presents a new narrative of metrological reforms, with a focus on modern India. Demystifying India's metrology was essential to the British colonial rulers in terms of understanding the country they ruled: standardising metrology was also the key in devising their administrative mechanisms. These standardisation projects asserted the coloniser's authority and power. They also profoundly influenced the logic, concepts and practices by which the Indians themselves began to perceive everyday measurements after the nineteenth century. For example, the introduction of a measure like the *acre* by the East India Company (EIC) during the Ryotwari land revenue settlement in South India had a 'vast semantic sweep' as Raman argues: it made measurements commensurable between Indian and European measurement systems and simultaneously separated land conceptually from other 'inputs' to cultivation such as labour.¹⁰ The practice of systematically recording measurements – be it land or agricultural produce like grain or cotton – reconceptualised and extended traditional accounting spaces. Such spaces included both those that had historically developed within India's trading economy as well as newer ones such as the colonial *cutcherry* (or office).¹¹ The intersection of these mobile technologies – metrology and

¹⁰ Bhavani Raman. *Document Raj: Writing and Scribes in Early Colonial South India*. (Chicago and London, 2012), 70-74. Traditional land measurements in India accounted the variability of working differing parcels of land through 'plough standards' that incorporated labour inputs as well. Similar measurement practices existed in medieval European societies; Kula, *Measures and men*, 29-43.

¹¹ Miles Ogborn. *Indian Ink: Script and Print in the Making of the English East India Company*. (Chicago and London, 2008), 33-34, 50-52. For other Asian cultures, see Seth

documenting – laid the foundations for standardizing the complex and numerous calculable spaces in India after the nineteenth century. The British regulated measurement objects such as coinage and time, but were content to leave local weights and measures unregulated and relatively untouched.¹² It was the Indian nationalists who were more aggressive than the colonisers in standardising and regulating India's metrology. They swept away traditional modes of measurements including the vast array of local weights and measures. Simultaneously, they situated the new metrology within India's apparently long tradition for decimal arithmetic.

The first section shows how heterogeneous ideas about the enforcement of weights and measures existed within the colonial state, even as the British mapped what Prinsep called the 'thousand distinct foci' of local measurement units.¹³ In successive efforts to tighten governance and reduce barriers to internal trade, the colonial rulers adopted a typical Benthamite approach to metrology by introducing metrological standards through legislation, similar to the legislative changes introduced in Britain during the nineteenth century.¹⁴ But it was the awakening of nationalism, discussed in the second section, which I argue will allow historians to situate the narrative of metrological standardisation within the shifting priorities of the state in terms of economic planning. During the 1930s and 1940s the rationale for

Jacobowitz, *Writing Technology in Meiji Japan: A Media History of Modern Japanese Literature and Visual Culture*. (Cambridge, MA, 2015), 19-42.

¹² Curtis, 'Moral Thermometer', for a parallel case of Canada. Elsewhere, colonists were less successful in standardising currency in the presence of local resistance; Sophie Mew, 'Trials, Blunders and Profits: The Changing Contexts of Currencies in Sierra Leone.' *The Journal of Imperial and Commonwealth History* xliv, (2016).

¹³ James Prinsep, *Coins, Weights and Measures of British India* (London, 1858), 109.

¹⁴ Jeremy Bentham, *Theory of Legislation*. 2nd edn, trans. R Hildreth. (London, 1871), 412-3; Julian Hoppit, 'Reforming Britain's weights and measures, 1660-1824' *The English Historical Review*, cviii, (1993).

standardisation shifted from removing internal trade barriers (a colonial objective) to introducing economic planning (a nationalist objective). Post-colonial policy based on the principles of economic planning developed from a complex interaction of economic and political factors since the 1920s.¹⁵ As this paper shows, measurement standardisation was tied to this developing political economy. And yet, the picture remains incomplete unless the divergent views within the nationalist movement are accounted for, especially in terms of the potential for social disjuncture weights and measures reform involved. When we place metrological standardisation within the framework of post-colonial India's modernisation a more complete mosaic emerges. This forms the focus of the third section. A fundamental reconstitution of traditional measurement forms - that mediated social and economic exchanges in a multitude of different ways - required appropriating a global measurement technology (the metric system) in a manner that made sense within India's culture. This 'cultural appropriation', as Arnold calls it,¹⁶ made metrological standardisation possible in the 1950s. The metric system - that was reputedly devoid of social meaning¹⁷ - had to be appropriated in culturally sensitive ways, as Nehru's remarks reveal. The abstract or 'thick' nature of the metric system made it possible for Indian nationalists to mould this technological system to suit a particular social meaning within the context of modernising India.¹⁸

¹⁵ Pramit Chaudhuri, 'The Origins of Modern India's Economic Development Strategy,' in Mike Shepperdson and Colin Simmons (eds.) *The Indian National Congress and the Political Economy of India 1885-1985*. (Aldershot 1988), 272-281. Sukhamoy Chakravarty, 'Nehru and Indian planning' *South Asia Research*, ix, (1989).

¹⁶ David Arnold, *Everyday Technology: Machines and the Making of India's Modernity* (Chicago and London, 2013).

¹⁷ Kula, *Measures and men*, 120-123.

¹⁸ I am indebted to Hector Vera for our continuing conversations on this subject.

India's metrological reforms suggest that this is a case with a distinctively Indian flavour, with its nationalism and cultural appropriation of the metric system. And yet, this case resonates with other similar attempts at metrication elsewhere in the Anglophone world. For example, Australia, Canada, South Africa, Singapore and several other colonies in Africa and the Caribbean successfully reformed their metrology on the basis of the metric system between 1950 and 1980. Similar attempts were made in Britain and the United States in the 1970s: they were only partially effective. Many of these episodes still await a detailed historiographical treatment like the one presented here. However, the importance of culture, changing notions of state governance and economic development, and global standardisation can be discerned in all such cases. India's metrological reforms were initiated as a result of the colonisers tying its economic resources to the British Empire. Standardisation stemmed from globalisation. The nationalists completed this project, appropriating an internationally standardised technology. This allowed India to independently participate in a global economic system characterised by increased institutionalism and cooperation after the 1950s. But it took a uniquely Indian approach to modernity to inch towards the metre between 1833 and 1956.

II Company rule and colonial legislation (c1833-1914)

The people who ruled colonial India had to grapple with the prospect of deciphering, standardising and eventually regulating the vast array of measurement units used in different parts of the country.¹⁹ James Prinsep wrote that domestic or market weights were 'localised in a thousand distinct foci under as many modifications of prices,

¹⁹ The East India Company directed officials to send 'models' of weights and measures to Patrick Kelly in London; British Library (BL) *India Office Records* IOR/F/4/610/15087.

customs and modes of calculation and subdivision. Here [i.e. in India] all is vague.²⁰ Others such as Francis Buchanan or Patrick Kelly noted how, like Europe, there was a multitude of local weights and measures.²¹ Most locally used units were understood to be based on the ancient 'Hindu' metrology, others on units used in the Mughal Empire, some of which were of Persian or Hebrew origin. The orientalist discovered that many measurement units were similar to those used elsewhere in Asia, particularly China. Such studies suggested to the Western writers that India's connection to the world economy, her trade links and foreign rule in the past added to the multiplicity of measurement units used in everyday life.²²

In the early years of colonial rule, there was little effort to impose or enforce official standards. The principle that a legal standard need not be imposed on all local transactions (i.e. those not involving the state) had been accepted in Britain at least since the 1760s and reaffirmed by the 1824 legislation introducing the Imperial measurement standards.²³ Jeremy Bentham, articulating the need for standardised weights and measure in his *Theory of Legislation*, accepted the difficulty of enforcing standards and questioned the necessity of doing so. He considered it sufficient to furnish each community with a legal standard, impose penalty on those falsifying the

²⁰ Prinsep, *Coins, Weights and Measures*, 109.

²¹ Francis Buchanan, *A Journey from Madras* (London, 1807); Patrick Kelly, *The Universal Cambist, and Commercial Instructor* (London, 1811).

²² There existed a litany of directories, dictionaries, descriptions and tables of India's weights and measures for the commercial trader, including Thomas MacCaulay, *Indian Traders Complete Guide to Coins, Weights and Measures*, (Calcutta, 1819); Thomas Thornton, *East Indian Calculator* (London, 1823); James Bridgenell, *Indian Commercial Tables of Weights, Measures and Money*, (Calcutta, 1852).

²³ *Second Report of the Carysfort Committee on weights and measures*, House of Commons Reports (1738-1765), ii. 456; *Report from the Committee on Weights and Measures*, Parliamentary Papers, iv. 1821, 291; 'Act for ascertaining and establishing uniformity of weights and measures,' 5 Geo. IV c.74., xvi.

standard, and declare contracts according to other standards to be null and void. ‘But this last [step] would not be necessary,’ he wrote: ‘the two first would suffice.’²⁴ Such thinking permeated British legal metrology and shaped the metrology in most parts of the Anglophone world until the twentieth century. Bentham differed from his French contemporaries and their metric standardisation attempts in France in the 1790s. He admired their efforts (‘a service truly honourable’) but considered leaving standards adoption to ‘public convenience’ as being more practical.²⁵ The French approach to legal metrology was in contrast to the British approach. The French reformers intended to remake French citizens into ‘rational economic actors’, believing that state intervention would transcend ‘each individual’s reluctance to surrender his or her own familiar measures.’²⁶

The Bengal Presidency Code Regulation VII of 1833 introduced the ‘authoritative’ standard of weight: the company rupee. ‘The principal European mercantile establishments as well as native merchants have already adjusted their weights to the new system’, wrote Prinsep, anticipating no inconvenience in the continuing use of the old ‘bazar weights.’²⁷ The 1833 Bengal metrological reforms were held as a model for similar reforms in the Madras and Bombay presidencies. When the Chamber of Commerce in Bombay wrote to the Government in Bombay in 1837 about ‘the complication of [different weights and measures] on the most simple

²⁴ Bentham, *Theory of Legislation*, 413.

²⁵ Bentham, *Theory of Legislation*, 412-3.

²⁶ Alder, ‘Revolution to Measure’, p. 54.

²⁷ Prinsep, *Coins, Weights and Measures*, 103. ‘Bazar weights’ were generally used in trade with and between European traders, which the 1833 Bengal code superseded. These weights had themselves superseded the ‘factory weights’ that were more prevalent in commercial transactions in the 1780s.

commercial transactions’,²⁸ it set off a chain of correspondence between the various administrative departments about how best to deal with the situation. Henry Prinsep suggested that Bombay adopt the 1833 Bengal Presidency code and the standard *Rupee* weight to solve their predicament.²⁹ Subsequently, the Bengal standard *Rupee* was introduced in the various parts of the Bombay constituency between 1840 and 1845, such as in the cantonment bazars of Poona, Ahmedabad, Belgaum and Ahmendnagar, as well as within the collectorate of Dharwar.

The situation in Madras Presidency, on the contrary, remained unchanged until at least 1856. Throughout the Presidency ‘systems of weights and measures in general use are not yet based on any specific unit, but are still in great confusion’, claimed an official report.³⁰ Meanwhile, Bayley, of the Madras Civil Service, developed a proposal to introduce a common metrological system applicable to ‘the whole of our Indian Territories’, which was sent to the EIC Directors in London.³¹ Bayley’s proposals were designed to assimilate the English units used locally, approximate the existing ‘native system’ and to combine both these with the ‘metrical system’ of decimal subdivisions. Accordingly his linear measure was the English *yard* or *foot*, the

²⁸ Skinner’s letter to Government of Bombay 4 Feb. 1837; *Papers connected with the Reform of weights and measures*, Government of Madras, (Calcutta, 1864), British Library (BL) IOR/V/27/602/2, hereafter *Madras papers*.

²⁹ Prinsep’s letter to Government of Bombay, 2 Aug. 1837, *Madras Papers*. Henry Prinsep was the Secretary to the Government of India and the brother of James Prinsep.

³⁰ Report by Col W H Skyes of 12 Nov. 1856, *Madras Papers*.

³¹ Letter from Court of Directors to Govt of India 11 Mar. 1857, *Madras Papers*. EIC paid for the printing of Bayley’s pamphlets.

land measure was the *acre*, decimally subdivided, and the Indian *seer* measure for weight as well as capacity.³²

Reactions to Bayley's proposal were mixed. The British mercantile community in India pushed for metrological reforms in strong terms.³³ The consensus view of the Madras Chamber of Commerce was that 'English weights will in practice continue to be used as at present in all government and mercantile transactions'.³⁴ Colonel McCally, the Commissary General, was ambivalent in his support for the introduction of standards based on local measurement units, arguing that 'native dealers' who did business with Europeans were conversant with the English system: 'standard [Company] weights and measures [are in] universal use in all dealings'.³⁵ J D Sim, writing on behalf of the Revenue Board stated that attempts to unify measurement units without compulsory legislation 'would be useless'.³⁶ Mirroring this view, the Bombay and Madras chambers of commerce preferred some degree of 'compulsion' of a uniform measurement scale. Both presidency governments as well as the Government of India rejected compulsory enforcement of standardised measurement units.

The Revenue Board also had specific concerns about some of the standards proposed by Bayley. For instance, they objected to the *Indian maund* the proposed

³² W. H. Bayley, 'Suggestions for a uniform system of weights and measures throughout India', *Madras Journal of Literature and Science*, ii new series (1857), 183-213.

³³ Much of this support stemmed from practical issues of preventing 'fraud or imposition', or promoting 'fair dealing', rather than in support of some higher notions of governance or universality.

³⁴ Letter by chairman of Madras Chamber 13 Nov. 1858, *Madras Papers*.

³⁵ McCally's letter 3 Nov. 1858, *Madras Papers*.

³⁶ Revenue Board letter 25 Feb. 1859, *Madras Papers*.

weight standard, which the railway companies were made to use. The Board preferred the use of *ton* in commercial transactions, as the Bengal *maund* was unknown in the Madras Presidency. The railway companies too presented a strong opposition to being coerced into using an ‘invented’ standard unit of weight such as the *Indian maund*. The EIC directors pushed for ‘some plan to secure uniformity while the railway system [was] still in its infancy.’³⁷ The Madras Railway Company (MRC) maintained that if a *maund* has to be used on the railways then it should be *Madras maund* of 25lbs, rather than the Bengal standard.³⁸ Each group thus aired different opinions about the proposed standards based on the multitude of local commercial practices they uncovered in their respective spheres. The railway companies and the state bureaucracy (in India and London) clashed once again between 1873 and 1875 over the issue of using the metric system by the railways.³⁹

The bickering between different groups extended to the use of decimal divisions of standardised measurement units. Objecting to decimalisation, McCally wrote that ‘it would be a great inconvenience for “natives” of India to forego their favourite computation of eights, twelfths, and sixteenths of articles, whether they are sold by weights or measures.’⁴⁰ In contrast, Charles Gover, a specialist on Indian folklore, claimed that ‘the French [metric] system is almost identical to that which formerly existed in India’, and which remained in fragments in ‘every district.’⁴¹ Similar attempts to recover India’s apparent decimal past would re-surface in the 1920s, as

³⁷ Revenue Board report, 25 Feb. 1858, *Madras Papers*.

³⁸ Letters from MRC, 10 Apr, 1856 and 26 May 1858, cited in Revenue Board report 25 Feb. 1858, *Madras Papers*.

³⁹ *Public Works: Metric System on Indian Railways 1871-75*, BL IOR/L/PWD/5/4, coll. 20.

⁴⁰ McCally’s letter 3 Nov. 1858, *Madras Papers*.

⁴¹ Charles Gover, *An Uniform Metrology for India* (Madras, 1867), pp. ii, 13.

shown in the following section. Such exchanges illustrate the contentious nature of metrological standardisation during company rule and the opposing views of colonial administration, colonial businesses and British bureaucrats.

Even after company rule was replaced by imperial rule in 1858, legislation and official codes remained ineffective in establishing a uniform legal metrology in India. The Silberad Committee of 1913 stated that the weights and measures in India had never been settled upon on an organised system.⁴² The legal status of many common British imperial measurement units was occasionally questioned between c1860 and 1930. When, due to pressure by British merchants, especially the Lancashire textile merchants, the Indian government introduced an Indian Merchandise Marks Act in 1887, they realised that enforcing transgressions under this legislation was difficult as there was no legal status of the British imperial ‘yard’ under Indian law.⁴³ The Customs authorities faced similar issues when classifying goods or imposing tariffs.

The result was a hybrid system of measurement standards introduced by successive legislation that existed until the inter-war years based on select Imperial measurement units and equally select numerous local measures used in various parts of the country. In 1946, we thus find units such as *maunds* and *seers* (legal measures) in use alongside *heaps* and *baskets* (customary measures) with a variety of regional units in use including *tooku*, *kandi* and *shekda* in the marketing and distribution of commodities such as fish.⁴⁴ All of this existed alongside the ‘foot-pound’ Imperial

⁴² *Report of the Weights and Measures Committee 1913-14*, Government of India, Simla, 1914, 7.

⁴³ *Report of the Committee of the Bengal Chamber of Commerce*, Calcutta, 1889, 82.; Lal C Verman and Jainath Kaul (eds.), *Metric Change in India* (New Delhi, 1970), 34.

⁴⁴ *Report on the Marketing of Fish in India*, Government of India, Calcutta, 1946, 49.

measures used in heavy industries who often used machinery imported from Britain, as in the case of steel mills in Roorkee. Such hybridisation was positively encouraged by successive legislation by the colonial administrators.

Throughout this period, the idea of organising Indian weights and measures on the international metric system persisted. The idea of metric or decimal measures dates back to Bayley's 1857 plan discussed earlier. Later efforts of Colonel Stratchey in the 1860s and 1870s are another important chapter in this story.⁴⁵ The Weights and Measures Bill of 1871, that would have introduced metric units to India based on Stratchey's plan, did not become an Act due to the untimely death of Richard Bourke, Earl of Mayo, the Viceroy of India in 1872, who was an ardent supporter of metrication.⁴⁶ Metric reformers were considered 'dissenters' and apart from the 1871 Bill there was no official push towards decimalisation or metrication until the 1930s.

This brief, synoptic discussion shows how the British rulers sought to intrinsically link the nascent political economy of India to that of the metropole via its metrology, even though they differed assiduously about how that link should be expressed in terms of legal standards. Simultaneously, administrators had to deal with more mundane, practical issues of measurements, primarily associated with internal trade and commerce. The state continually negotiated between the two extremes: that of creating unified 'spaces' of metrological standards and staving off pressures from commercially minded groups. The colonial state's unwillingness to enforce legal standards ultimately resulted in incomplete attainment of either objective. It is

⁴⁵ *Proposals for new standards of weights and measures*, Report of Committee, Government of India, Simla, 1867.

⁴⁶ See letter from earl of Mayo to duke of Argyll, Secretary of State for India, 6 April 1870, BL IOR/L/PJ/3/1108.

unhelpful to view the state's record in this matter as half-hearted, uncaring, or as one of 'failure' as portrayed by the nationalists: there were strong pressures for enforcing standards within the state apparatus. However, the Benthamite ideals of achieving uniformity of weights and measures for 'satisfaction of individuals, termination of disputes and prevention of frauds' remained elusive.⁴⁷ The impetus to create economic and social spaces incorporating the 'moral arithmetic for uniform results' had to wait until the Indian nationalists picked up the debate in the 1920s.⁴⁸

III Nationalism and Economic Planning (1920-1946)

There is little evidence to suggest that indigenous groups distinctly added their voices to the metrological debate before c1930. British administrators and merchants largely shaped the discourse on uniformity and standardisation of measurement units. By 1934 the idea of economic planning had firmly taken root within the Indian nationalists. Ideas about development through industrialisation, such as those expressed by Indian intellectuals such as Sir Visvesvaraya earlier in 1920 in the context of post-war recovery, received greater traction amongst the nationalists, especially in the context of the affects of the Great Depression.⁴⁹ Goswami suggests that the nationalists, influenced by the economist Friedrich List, had already begun to think about the 'spatially bounded nation' – the subcontinent - as the sovereign subject of economic

⁴⁷ Bentham, *Theory of Legislation*, 412.

⁴⁸ *ibid.*, 2; compare Bentham's ideas about 'moral arithmetic' and standardization with his ideas about a 'moral thermometer' that results 'only in vague approximations'. Curtis, 'Moral Thermometer', explores the latter in colonial Canada.

⁴⁹ M Visvesvaraya, *Reconstructing India* (London 1920); N S Subba Rao, *Some Aspects of Economic Planning* (Bangalore, 1935); Raghavendra Chattopadhyay, 'The Idea of Planning in India, 1930-1951' (Australian National University PhD Thesis, 1985).

development.⁵⁰ The debate on metrological reforms was made a part of the planning process between 1938 and 1945 and firmly shifted ground towards industrialisation through technological advancement from an earlier emphasis on internal markets and commerce. Notwithstanding a few dissenting voices, there was also a remarkable degree of consensus between the nationalists regarding metrological standardisation, whatever their differences may have been on other matters, such as capitalism as opposed to socialistic industrialisation.⁵¹

In this period, we see glimpses of how metrology became a technology of development rather than remaining a technology of governance as it had during colonial rule. Governance may be understood in terms of both the reach of the state as well as its role in dismantling barriers to internal trade and commerce. The term describes integration of domestic markets as well as the rule of socio-economic spaces. Economic planning was married to governance through a more sophisticated understanding of the ‘new’ science of statistics in its multiple senses: objectification through quantification in addition to mapping, coding and recording.⁵² As this section shows, ideas of statisticians such as Mahalanobis intersected with colonial administrators such as Meek. The appropriation of metrological standardisation by the nationalists was one of the results of this intersection. However, the culture of science was not limited to the attainment of greater precision, quantification of governable objects or the standardisation of technologies. To the Indian nationalists developing a

⁵⁰ Manu Goswami, ‘From *Swadeshi* to *Swaraj*: Nation, Economy, Territory in Colonial South Asia, 1870 to 1907,’ *Comparative Studies in Society and History*, xl (1998), p. 617.

⁵¹ Claude Markovitz, *Merchants, Traders, Entrepreneurs: Indian Business in the Colonial Era* (Basingstoke, 2008), 12-16, for the power struggle within the National Planning Commission between opposing groups with the ideological differences on achieving planned development.

⁵² Deepak Kumar, *Science and the Raj, 1857-1905* (Delhi, 1995), 235. Colonialism involved coding and decoding cultures in addition to exploration and classification.

culture of science also meant the recovery of India's past tradition and achievements in mathematics. For metrology, this awakening brought together thinkers, reformers, scientists, and industrialists who increasingly became involved in the planning process.

Addressing the 35th session of the Indian National Congress at Nagpur in 1920, C Vijiaraghavachariar, reminded the assembly about ancient Hindu achievements regarding science and civil administration.⁵³ As one of the key framers of the 'swaraj constitution' presented at this session, Vijiaraghavachariar stressed that India had 'invented the system of decimal fractions and algebra, Aryabhatta discovered the solar system before Copernicus [and] the system of civil administration was perfected to a degree rarely reached in modern times.'⁵⁴ Invoking the achievements of ancient India in this way was designed to give greater legitimacy to the idea that sovereign authority emanated from the people being ruled rather than from the ruler. The recovery of Indian scientific tradition must be situated in the context of Indian scientists protesting against what Kumar terms as 'colonial claims to superior [Western] knowledge.'⁵⁵

The principle of self-determination advocated by the nationalists in all things political and social was also extended to the standardisation of measurement systems. Reflecting on this period, A K Acharya would write in 1958 that 'all along [proposals for metrological reforms] cropped up and withered away in officialdom of an alien government.'⁵⁶ Shyama Prasad Mukherji argued in 1933 that 'sooner or later this

⁵³ Presidential Address, Indian National Congress, 26 December 1920, reprinted in *Indian Annual Register*, 1921 ii, part iii, 113.

⁵⁴ *ibid.*, 125.

⁵⁵ Kumar, *Science and the Raj*, 229, 213-222.

⁵⁶ Anil Kumar Acharya, *History of Decimalisation Movement in India* (Calcutta, 1958), 2.

world would have only one language of measurement, namely the metric system. There is no sense, he said, in waiting for England to give the lead.’⁵⁷

The need for standardisation and metrication in this period was given further prominence by P C Mahalanobis, who would play a prominent role in post-independence economic planning. He wrote about the application of the ‘statistical method’ in industrial processes and claimed that without the metric system, industry could not develop the required statistical methods.⁵⁸ The Indian Science Congress Association, in its 21st session at Bombay (1934) urged the Government to standardise a system of weights and measures, and adopt the metric system. In 1936, at the 8th Indian Industries Conference at Lucknow and again at a meeting of the Associated Chamber of Commerce in Calcutta, there were calls for major reforms to the existing standards of weights and measures used in trade and industry.⁵⁹ Indian industry and scientific associations had thus begun putting pressure on the colonial government for metrological reform.

Meanwhile, the colonial rulers were still focussed on governance issues connected with metrology, in contrast to the developmental thinking discernible amongst the nationalists. The 1913-14 Weights and Measurement Committee (the Silberad Committee) report was followed by several other official inquiries into the state and use of measurement standards. For instance, the 1917-19 Indian Cotton Committee sought to standardise how cotton was weighed in the different provinces,

⁵⁷ Cited in Acharya, *History of Decimalisation*, 3.

⁵⁸ PC Mahalanobis, ‘The application of the statistical method in Industry’, *Science & Culture*, i (July 1935), 73; also cited in Acharya, *History of Decimalisation*, 3.

⁵⁹ Minute from E&O Department to Governor-General, 18 Aug. 1939, BL IOR/L/E/8/910; Acharya, *History of Decimalisation*, 4.

whereas the 1926-27 Royal Commission on Agriculture reported of the ‘disabilities’ that cultivators faced due to the chaotic condition of the weights and measures. Similar arguments can be found in the *Report on Marketing of Wheat* (1937) and *Report on Marketing of Linseed* (1938). A century of legislative efforts, since 1833, to standardise weights and measures by voluntary adoption had not really paid dividends in terms of standardising the measurement units actually used in internal trade and commerce.

A remarkably detailed picture of the measurement practices from this period survives in the form of a report by the Board of Economic Inquiry titled *Condition of Weights and Measures in the Punjab*. This detailed survey established that a major issue was the accuracy of the instruments used to weigh or measure: only about 51% of the instruments inspected were found to be accurate. Significantly, in 40% of the cases the surveyors found that measurement of agricultural produce was done ‘roughly so as to get an idea of the amount of produce carried.’⁶⁰ Such reports further crystallised the official view that measurement standards and practices were chaotic, non-standardised, and that buyers usually were at the disadvantage in commercial transactions: ‘the whole situation cries out for early reform.’⁶¹

In 1939, the Government of India introduced the Standards of Weight Act, the provisions of which were to be enforced by corresponding legislation by provincial governments. This quirky and cumbersome arrangement involved basically legalising hybridised measurement units commonly used by the railway companies. The official view was that although standardisation through legislation was demanded by industry

⁶⁰ Board of Economic Inquiry, *Condition of Weights and Measures in the Punjab*, 1936, vi.

⁶¹ *ibid.*, xi

and commerce, there was scope for diversification to meet local conditions: ‘time is not ripe for a uniform system all over India.’⁶² Such diversification was precisely of concern to those Indian nationalists calling for reform and standardisation.⁶³

The Legislative Assembly (that formed the lower house of the Imperial Legislative Council of British India) debated the provisions of this legislation. The objections of the elected (Indian) members, such as they were, were systematically deflected by (the mostly British) government officials, who gave assurances that provincial legislation would be able to enforce standardisation through corresponding local laws and regulations. Reactions across the country differed widely to this central legislation: support in Bombay was strong for enforcing standards, whereas the view in Bengal was considerably more cautious regarding enforced standardisation.⁶⁴

Later Indian writers were quite critical of what they saw as a wasted opportunity by the colonial government. Acharya wrote that ‘this attempt at standardisation [making a hybrid combination of British and Indian standards and avoiding the metric units altogether] did not satisfy the intelligentsia.’⁶⁵ The official history of post-independence metric reforms similarly casts a critical eye on this period: ‘this attempt at standardisation could not satisfy the progressive elements, which, with increasing political awareness in the country, had started making themselves heard more and more.’⁶⁶ Such views, expressed after the decision to introduce the metric system in

⁶² Minute from E&O Department to Governor-General, 21 Sept. 1938, BL IOR/L/E/8/910.

⁶³ See for instance, *The Statesman*, 31 Dec. 1936.

⁶⁴ Minute from E&O Department to governor-general, 18 July 1939, and other correspondence, BL IOR/L/E/8/910, *Indian legislation to define standards of weight*.

⁶⁵ Acharya, *History of Decimalisation*, 4.

⁶⁶ Lal C Verman and Jainath Kaul (eds.), *Metric Change in India* (New Delhi, 1970), 44.

India was made in 1956, were designed to recall the struggle and difficulties that reformers had to undergo to modernise India's metrological system.

Critically, the nationalist discourse on metrological reform found its way into the fledgling attempts at economic planning during the interwar years. In 1934, the legislative council of the United Provinces (UP) commissioned an economic development plan. When this was published in 1937 as the *Report on Economic Planning in the United Provinces*, it contained a section on the standardisation of weights and measures for agricultural marketing. The framers found this a necessary provision of the plan to 'check fraudulent practices' and enable the 'licensing of dealers of agricultural crops.'⁶⁷ No further details were provided. The Board of Economic Enquiry helped to prepare this plan, and as noted earlier, had compiled an exhaustive survey of measurement standards used in Punjab. Chattopadhyay argues that by early 1930s, when the question of economic planning cropped up, the government had taken 'special interest in augmenting its statistical organisations.'⁶⁸ The Board of Economic Enquiry's uncovering of measurement practices in Punjab, or its linking of standardisation of weights and measures to economic planning in UP, was part of this broader shift in government attitudes. Meek (Director of Commercial Intelligence and Statistics) stressed that it was the duty of the government to examine continuously the factual positions relating to economic conditions in India.

Meek's allusion to the importance of 'statistics' was quite different from the manner in which Mahalanobis used the term 'statistical method' in this period. Meek referred to 'factual information' within the economy and society, whereas Mahalanobis

⁶⁷ *Economic Planning in the United Provinces* (Allahabad, 1937), 54.

⁶⁸ Chattopadhyay, 'Idea of Planning', 49.

alluded to the application of scientific principles to the control of industrial production, processes and research. Nevertheless, measurement standardisation, including uniformity of units of weights and measures, figured prominently in whichever way the term ‘statistics’ was used. Entangled with the planning aims was the political issue of fraudulent, inaccurate and non-standard weights and measures used in marketing of agricultural produce. The politicisation of the problems in agricultural markets intersected with the developmental thinking that had begun to permeate the government departments. Such intersections are why measurement standardisation figured in the economic planning documents, such as the one for the UP in 1937. Standardisation subsequently crept into several other national planning documents before the transition of political power in 1946-47.

The Indian National Congress emerged as the dominant political party in many of the Indian provinces following the 1937 assembly elections. As the party participated in local administration and formed provincial ministries, it embraced the ideas of national planning and detailed surveys, just as the government in India had done a few years earlier. At the Wardha conference in August, the concept of national planning was mentioned for the first time in the party’s official documents.⁶⁹ Economic planning came to be known as ‘industrial planning’: Subhas Chandra Bose grudgingly emphasised industrialisation at the Haripura Congress in 1938 and talked of devising ways of ‘minimising its evils’. From such reconceptualization emerged the National Planning Committee (NPC) and the planning reports that were progressively published between 1945 and 1948.

⁶⁹ Cited in Chattopadhyay, ‘Idea of Planning’, 90.

The manufacturing industries subcommittee of the NPC, headed by Ambalal Sarabhai (the industrialist and an ardent supporter of Gandhi), stressed that standardisation of weights and measures on an all-India basis should be ‘carried out at an early date’ to achieve a uniform system of weights and measures throughout the country. It further recommended that an ‘institution similar to the British Standard Institute should be established at a central place [and] if other conditions permit, the Metric system should be adopted.’⁷⁰

The subcommittee on technical education and research similarly emphasised the case for metrological reform and how measurements units were to be taught in higher education: ‘continuation of British measurement units can be easily avoided.’⁷¹ This planning group, headed by M N Saha and H L Roy, were emphatic that arithmetic with British units ‘unnecessarily absorbs a considerable portion of the time devoted to mathematics without any proportionate gain.’ Their solution was to reform the units on the basis of the centesimal (or decimal) system.

Following a hiatus during the early 1940s, discourse around metrological reforms resurfaced by the middle of that decade. The Indian Decimal Society, formed in 1944 lobbied the government of India, the press, chambers of commerce and others to popularise the cause of both decimalisation of currency as well as the metrification of weights and measures.⁷² The government of India introduced the Decimal Currency

⁷⁰ ‘Manufacturing Industries,’ *Report of the Sub-Committee on National Planning* (Bombay, 1947), 75.

⁷¹ ‘General Education and Technical Education and Developmental Research,’ *Report of the Sub-Committee on National Planning* (Bombay, 1948), 141.

⁷² Acharya, *History of Decimalisation*.

Bill in the legislative assembly in February 1946 to amend the existing Indian Coinage Act that apparently ‘received wide support.’⁷³

On the contrary, such a move for currency decimalisation (and metrication of weights and measures) led to vocal protests from Mohandas Gandhi and like minded social reformers: Gandhi derided the ‘experiment of decimalisation’ as he called it. Rang Biharilal of the Benares Hindu University thought that decimalisation in India was premature and a retrograde measure. ‘Indian weights and measures are scientific and uniform and based on the sub-division of the unit into 16 parts. This makes the calculation of prices and fares automatic and easy,’ he argued.⁷⁴ The example he cited was that of the *seer* (volume measure) which when halved gave $1/2$ *seer*; subsequent halving gave a quarter *seer* ($1/4^{\text{th}}$), an *ollock* ($1/8^{\text{th}}$ *seer*), a *chhatak* ($1/6^{\text{th}}$), and so on.⁷⁵ Such halving and quartering fit in very well with the oral tradition of arithmetic taught in Indian schools and used widely by the less educated or less literate populations.⁷⁶ Mashruwala similarly argued that division (in daily computation of prices and quantities) by decimals would be cumbersome and difficult for a population used to oral or mental arithmetic. ‘To the illiterate, the *chauthai* (quarternal or halving) system is much simpler and has several advantages over the decimal system...the use of

⁷³ P K Pant, *Memorandum on the Introduction of Metric System in India* (New Delhi, 1955) 2.

⁷⁴ Rang Biharilal, ‘In praise of halves’, *Harijan* x, no. xx (1946), 198.

⁷⁵ Biharilal gave other examples: 1 Yard = 2 cubits = 4 spans = 8 first measures = 16 *girahs*.

⁷⁶ D Senthil Babu, ‘Memory and Mathematics in the Tamil Tinnai Schools of South India in the Eighteenth and Nineteenth Centuries’, *The International Journal for the History of Mathematics Education*, ii (2007), 24, especially the teaching of the *Encuvati*, a table book involving multiplication of grain measures; Street hawkers used verses to determine calculations for rates and quantities, *Lok Sabha Debates*, v. (New Delhi), 28 July 1955, col. 8818. Adrian E Tschoegl, ‘The international diffusion of an innovation: The spread of decimal currency’ *The Journal of Socio-Economics*, xxxix, (2010), for practical and cognitive reasons for persistence of non-decimal methods of sub-division across diverse societies.

decimals pre-supposed wide literacy and the use of paper and pen', he argued.⁷⁷ Such arguments convinced Gandhi that decimalisation was manifestly against the interests of the poor. He concluded that 'the poor would be sacrificed as usual in the interests of modern trade i.e. the rich merchants.'⁷⁸ He further appealed to the nationalist leaders to consider the silent view of the Indian public. 'In India, public opinion has very little force and the opinion of the millions who will be the sufferers is inarticulate,' he wrote.⁷⁹

Gandhi's objection was a hugely influencing factor that temporarily halted further reform. Acharya would describe it as a 'bolt from the blue, a fatwa [that] ruthlessly criticised the decimalisation movement.'⁸⁰ Several years later when this issue was debated in the national parliament in 1955, those who opposed decimalisation referred to Gandhi's objections made in 1946. In subsequent correspondence with the Indian Decimal Society, Gandhi toned down these objections and 'agreed to keep an open mind.' Acharya recalls this correspondence in his notes.⁸¹

Despite Gandhi's objections, metrological reform had become part of the nationalist's vision for industrialisation. They had claimed this technology for development. It was no longer to be solely an instrument of state governance, however incompletely the colonial rulers had used it to govern and rule. But, for metrology to

⁷⁷ Kishorilal Mashruwala, 'Decimalization of weights and measures', *Harijan*, x, no. xxxvi (1946), 349.

⁷⁸ M K Gandhi, 'Decimal Coinage and its costs', *Harijan* x, no. vii (1946), 53-54.

⁷⁹ *ibid.*, 53-54. Compare concerns raised by McCally in 1858; see note 42 above.

⁸⁰ Acharya, *History of Decimalisation*, 6.

⁸¹ Acharya, *History of Decimalisation*, 7; *Lok Sabha Debates*, v. 29 July 1955, cols. 8841-42.

be put to work for industrial development, key institutional changes were required, as the following section shows.

IV Independence and Industrialisation (1946 -1962)

In the post-independence period, the manner in which the nationalists co-opted metrology as a technology of development became more apparent. Developmental issues dominate the metrological discourse compared to the governance issues that had informed this discourse during colonial rule. Even so, this ideological shift had to be effected in politically and culturally sensitive ways in the independent nation. India's new rulers attempted a socio-cultural reconstitution that transcended technocratic institutions of governance. This reconstitution resonated with Nehru's vision for the modernization of India, one based on science, industry and technocracy.⁸² An economic system built on such a vision of modern India, and on the principles of universality and equality (as he understood them) was irresistible to Nehru.

As this section shows, the coming together of science, industry and technocracy was framed in several interesting ways during the 1940s and 1950s. The emphasis on India's adoption of an international metrological standard was designed to signal the country's transition from a colonial world system to the alternative global system based on international cooperation on scientific, technological and economic issues. The work of the Indian Standards Institute (ISI), discussed below, and its connections with international institutions was framed in this context. India's technological base for development was part of international epistemic communities of technology of which

⁸² Nehru relied on experts and tended to subordinate civil servants to the 'superior rationality of scientists and economists'; Sunil Khilnani, *The idea of India* (London, 2004), 81-88. Also, Prakash, *Another reason*, 203-214.

metrological standardisation was one aspect.⁸³ Another way of framing involved the cultural appropriateness of adopting an international metrological standard. The inventiveness of ancient Indians in developing and using decimal arithmetic was juxtaposed with the decimal metric system's appropriateness for technological development based on precision. Such framing implied that 'Indianising' the metric system was culturally more appropriate than unifying metrology on the basis of the British imperial units, with all the colonial baggage attached to it. Such constructionist framing proved to be compelling in coalescing political support when metrication was debated in the national legislative assembly in the 1950s. The institutional infrastructure for metrological reforms, however, was already in place by the 1940s.

In 1946 Nehru issued a joint press statement as the President-elect of the 34th Indian Science Congress, which unequivocally supported the 'comprehensive policy of decimalisation in India.'⁸⁴ Once the Interim Government was formed in September 1946, one of its immediate acts was to set up the ISI.⁸⁵ The institute wasted little time in drawing up plans for metrological reform and published a detailed design of decimal currency and metric weights and measures by 1949. The ISI firmly attributed the lack of weights and measures standards to the ineffective colonial government: 'failure of [previous] attempts displays a tragic lack of unity of purpose between [the British government in London] and the then Government of India'.⁸⁶ There were dissenting

⁸³ John Gerard Ruggie, 'International Responses to Technology: Concepts and Trends.' *International organization* xxix, (1975), 569-570.

⁸⁴ Cited in Pant, *Memorandum*.

⁸⁵ Resolution No. 1-Std(4)45, 3 Sept. 1946. This is the day after the Interim Government took over administration. The institution itself was inaugurated five months later in February 1947, six months before India became an independent nation.

⁸⁶ *Report of the Indian Standards Institute: Special Committee on Weights and Measures*, (Delhi 1949), para 1.2.

voices on the direction of Indian reforms. S L Kirloskar, a prominent industrialist with extensive interests in the engineering sector, and chairman of ISI's own engineering division council, said 'the metric system would affect gear design, the thread system, the key-ways, etc. in the existing machines, so much so that the whole of the engineering industry would be thrown into a chaotic state.'⁸⁷ Such cautionary voices were few and ISI put its considerable organisational weight behind the metrication project.

As India grappled with post-partition turmoil and the throes of becoming a republic, reforms were once again placed on the back burner until the mid-1950s. Nehru's later writings on this subject would reflect his strong views about metric reforms, industrialisation and modernisation. 'I have been a convinced advocate of the metric system for many years. The sooner we do it the better. We are on the eve of large-scale industrialization', he wrote in 1955.⁸⁸ Nehru's enthusiasm for the metric system was nonetheless tempered by the enormity of the enterprise of standardisation. 'We are on the whole a conservative country and it is not very easy to change old-established customs...I know the difficulty of convincing people in favour of a change when they are used to working along certain well-established lines. But the price of change has to be paid.'⁸⁹

⁸⁷ *Report of the Indian Standards Institute*, para 6.27. Engineering sectors that had traditionally developed using the British imperial system were resistant to metric change, even in Britain as well as in the USA. The major source of resistance was the enormous cost of conversion set against mostly un-estimable gains from conversion to metric units.

⁸⁸ Cited in Verman and Kaul, *Metric Change in India*, 71-72.

⁸⁹ Pant, *Memorandum*, Foreword by Nehru.

There are parallels between Nehru's statements and the intentions of the French scientists in the 1790s as they were designing the metric system of measurements.⁹⁰ His vision for India's 'tryst with destiny' required convincing people to shed old habits and adopt new ones. One of these was to use uniform measurement units in their daily activities. The old habits of measurements were not only shaped by feudal institutions but were also the result of hybridisation and haphazard standardisation during its colonial history as noted earlier. India had to break away from its medieval as well as its colonial past if it were to embark on its large-scale industrialization, as perceived by its central planners. Pitamber Pant, who spearheaded India's transition to a modern metrology in the 1950s, wrote: 'By adopting the metric system India would enter a long list of countries with an international language of measures. It will be a symbol of her resolve to rid herself of all fetters that have hampered growth⁹¹'.

Notwithstanding this desire to break away from such metaphorical chains, many of the issues that had helped to frame the discourse in colonial India returned to shape the discourse in the 1950s. These included India's cultural heritage and celebrating its historical contribution to mathematics (i.e. decimals), and the importance of standards for a developing economy based on industrialisation. To this was added another aspect, that of India's place in the international community, its reputation and its desire to learn from the 'mistakes' of other nations (especially Britain). Such a discourse is considerably more visible in the press after independence than in the colonial period. Although English-language dailies such as *The Statesman* or *Pioneer* covered the

⁹⁰ The French people resisted the new measures which had to be forcibly imposed. Kula, *Measures and men*, 264. Alder argues that the vision of the French *savants* was to use the metric system to remake French citizens into 'rational economic actors'. Alder, 'Revolution to measure', 54.

⁹¹ Pant, *Memorandum*, 1.

debate before c1940, the coverage of metrological reforms by *The Times of India* (TOI) is significantly more robust in the 1950s. The voices of government officials, technocrats and the industry were supplemented with those of laypersons. It is this latter group that is distinct in this period, airing individual views in the TOI on issues of metrology, and who were usually absent from an earlier period. Nonetheless, the numbers of individuals writing to the English-language dailies is tiny compared to officials who dominated the discourse, and pushed for reform. Being educated (and English-speaking), this group also formed a small proportion of India's population who exercised their opinion in other ways (e.g. passive resistance).

The framing of the metrological reforms was not limited only to the 'adoption' of a global standard. Rather the arguments for metrological reforms stressed the contributions that Indian technocrats made to international standardisation. In its coverage of the activities of the ISI in 1950, the TOI gave particular prominence to the work of the institution on the metric system, and to the appointment of Lal C Verman (ISI's director) to the vice-presidency of the International Standards Organisation (ISO).⁹² The newspaper stressed India's international reputation in science, technology and standardisation again in 1958 when it proudly claimed that 'the introduction of metric weights will make India the first commonwealth country to change over to the new system.'⁹³ Indian scientists contributed to the standard-setting activities of the international scientific and technological organisations such as the International Civil Aviation Organisation, World Meteorological Organisation and others related to shipping, cargo and transportation. These scientists recalled how metrological standardisation enabled India to become better integrated in the global economic

⁹² *The Times of India* (hereafter *TOI*), 27 Mar. 1950, 5.

⁹³ *TOI*, 27 June 1958, 8.

institutions even though external trade formed a small proportion of India's post-colonial economy.⁹⁴ Metrological reforms were also framed in the context of import substitution in diverse industrial sectors such as the manufacture of electrical cables and paper manufacturing. Import substitution formed a strong case for metrological reform by framing metrication as vital for coordination within domestic industry but also for the import of technology necessary to make import substitution feasible.⁹⁵ Metric change was harder to achieve in the textile industry. Although some in the industry were keen to move to the international 'tex' system of yarn measurements based on the metric system, the British 'counts' system of yarn numbering was too well entrenched in this sector. The government allowed its use even after metrication in 1956.⁹⁶

In contrast, media coverage presented Britain's continued failure to move to the metric system as an example of the dangers of delaying metrological reform: 'the experience of UK shows that the time is now opportune in India to introduce [decimalisation].'⁹⁷ Letters to the TOI made comparisons with other countries, including China, Japan, the Soviet Union, Germany, France, other European nations, and Brazil. Metrication will bring India 'in line with large number of countries that have adopted this system,' wrote one correspondent.⁹⁸

⁹⁴ See L S Mathur, 'Metereology'; G S Arya, 'Civil Aviation'; G S Singh, 'Shipping' in Verman and Kaul (eds.), *Metric Change in India*.

⁹⁵ See Y S Venkateswaran, 'Electrical Cables Industry', 433; R Ramaswamy, 'Paper Sizes', 437-8 in Verman and Kaul (eds.), *Metric Change in India*.

⁹⁶ P N Nayar, 'Trade and Industry' in Verman and Kaul (eds.), *Metric Change in India*, 245-6. A. W. Bayes 'Tex: Universal Yarn Numbering System,' *Journal of the Textile Institute Proceedings*, xlviii, (1957), 258.

⁹⁷ 'Metric System for Weights and Measures', *TOI*, 31 Mar. 1957, i.

⁹⁸ 'Letters', *TOI*, 2 Nov., 1948, 6.

The indigenous character of the metric system featured prominently in the public discourse in the 1950s. Just as the nationalists had invoked Aryabhata's discovery of decimal numerals as evidence of India's ancient scientific culture, post-independence discourse attempted to appropriate the metric system of weights and measures as an Indian invention. TOI quoted Nehru as stressing that by adopting the metric system and decimal coinage "we are not adopting something alien to India. We are going back to something which was originally the product of Indian genius."⁹⁹ S Ranganathan, a senior bureaucrat in the ministry of commerce, wrote in a special report for the TOI that the discovery of the number zero and place-value system by Aryabhata 'led further to the decimal system which is the real basis of the metric system. In this system, we reckon weights and measures exactly as we count numbers'.¹⁰⁰ Thus, leading up to and following the political decision to unify India's metrology on the metric system, official discourse continued to emphasise the view that measurements in decimal arithmetic were the 'natural' way of counting in India. The government publication on the metric system emphasised 'the adoption of metric system by India is quite natural. It is, in a way, our own indigenous system returning from its conquests abroad.'¹⁰¹ Apart from helping 'mankind [count] numbers in tens',¹⁰² India's discovery of decimal place value made calculations quick and easy and were 'acclaimed all over the world.'¹⁰³ One correspondent to the TOI wrote that the compulsory use of decimal coinage and metric system in India after 1958 had

⁹⁹ TOI, 1 Apr. 1957, 1.

¹⁰⁰ TOI, 31 Mar. 1957, iii.

¹⁰¹ *The metric system of weights and measures* (Ministry of Information and Broadcasting, Government of India, 1957), 5-7.

¹⁰² TOI, 31 Mar. 1957, iii, special feature on metric reforms.

¹⁰³ 'Metric System for Weights and Measures', TOI, 31 Mar. 1957, i,

‘facilitated quick calculation and saved some space in account books.’¹⁰⁴ Such rhetoric was quite contrary to that of Gandhi and other social reformers writing in 1946, as well as the observations of colonial administrators, such as McCally writing in 1868, and traditional modes of mathematics education in India.

There was, however, a limit to the extent of indigenisation of the metric system achieved in this period. The issue of language, nomenclature and terminology of the new measurement units had cropped up early in the post-independence debate. Invariably, there were strong opinions regarding the retention of internationally accepted terminology (e.g. metre, kilogram, litre). Some politicians asked the government to develop suitable terms for the vast majority of Indians who would be compelled to use terms in an unfamiliar language in everyday settings. Contrasting opinions aired in the legislative assembly debates were assiduously reported by *TOI*. The official government position was to retain the international terms as they were simple to pronounce and used by all other countries using the metric system (with the exception of China and Japan). Crucially, the government felt it would be ‘impossible to find terms in any [of the Indian] languages which would be acceptable to a majority of people.’¹⁰⁵ The politics of language was threatening to creep into the metrological debate. S N Das¹⁰⁶ proposed the use of Sanskrit terms instead of metre, centimetre, kilogram, etc. Jasoria¹⁰⁷ was against the coining of ‘jaw-breaking’ Sanskrit terms.

¹⁰⁴ ‘Letters’, *TOI*, 24 June 1960, 8.

¹⁰⁵ *Lok Sabha Debates*, x. 8 Dec. 1956, col. 2205, Statement by Nityanand Kanungo, Minister for Consumer Industries. Also, *TOI*, 9 Dec. 1956, 10.

¹⁰⁶ MP for the northern province of Bihar with a Hindi speaking majority.

¹⁰⁷ MP from the newly created province of Andhra Pradesh in south India, where the use of Sanskrit and Hindi was resisted. Andhra Pradesh was one of the first provinces created primarily on a linguistic basis from the erstwhile Madras Presidency. See, Robert D. King, *Nehru and Language Politics of India* (Delhi, 1998), 111-117.

Achutan,¹⁰⁸ who argued that international terms should be retained and propagated through radio, press and educational institutions, supported him. Nehru had singed his fingers on the issue of the national language after 1947 and treaded carefully on this issue. He had managed to avoid making Hindi the ‘national’ language. It was only the ‘official language’ of the new nation after 1947, and English was also to be used for the official business at least until 1965. He conceded the use of ‘naya paisa’ for the decimal currency, but supported the retention of international terminology for the metric measurement units.¹⁰⁹ In this context, the language issue was quickly resolved without disturbing the fine balance between communicability and the iconicity of the nomenclature by introducing Indian terms of metric measurement units.¹¹⁰

Such positivistic and constructivist discourse also demonstrates the thrust placed on having to educate the Indian public about the Indian-ness and advantages of the metric system. When Nehru put his weight behind the enterprise of metrication in India, he had realised the challenges in convincing people of its advantages. ‘It is important that full publicity should be given to the advantages of the metric system and the people should understand how they will profit by it’, he cautioned. ‘I know the difficulty of convincing people in favour of a change when they are used to working along certain well-established lines.’¹¹¹ Where he erred somewhat, and was challenged

¹⁰⁸ MP from Kerala, another southern Indian province, where the use of Sanskrit and Hindi was also resisted. Kerala was formed in 1956 following the States Reorganisation Act.

¹⁰⁹ The Indian Coinage (Amendment) Bill of 1955 that introduced decimalisation of currency had originally proposed to subdivide the Rupee into 100 ‘cents’. Nehru had firmly stated in the assembly that the new coin should be called the ‘naya’ (meaning new) paisa. *Lok Sabha Debates*, v, 28 July 1955, col. 8826.

¹¹⁰ King, *Nehru and Language*, 110; Nehru struggled to grasp the nationalistic and patriotic symbolism of language apart from its function as a communication device.

¹¹¹ Pant, *Memorandum*, 1955 Foreword by Nehru.

in the Lok Sabha debates, was regarding his lack of ‘consulting’ the country about the decision and why the government bureaucracy had independently made a decision regarding metrication. Nehru countered with a blunt statement: ‘in a matter of [metrication], rather scientific, technical kind, one does not normally consult the country. We must take the responsibility for it and explain it to the country. If we think it is right, then it is right.’¹¹² Nehru laid out his vision in a clear statement in the Parliament.

‘We have got what are called thinking machines [that] do the work in five minutes which may take a corps of people six months to do. All this cannot be done unless there is some definite system like the metric system. [E]specially in connection with the Second Five Year plan, if we do not start the process of change now, it will seriously affect our developmental and planning work and impede it in various ways. [Metric system] is essentially an Indian system so far as its origin is concerned. It should be our pleasure and pride to revert to something which originally saw the light of day in the mind of an Indian genius or geniuses. This is a sentimental argument.’¹¹³

Nehru’s view reflects his particular understanding of India’s history and its achievements. The achievements that he wanted India to make, in technology (his ‘thinking machines’), and in social and economic development (the Five Year plans), were, in his view, possible by linking ancient genius and modern scientific thinking.

¹¹² *Lok Sabha Debates*, v. 28 July 1955, col. 8824; *TOI*, 29 July 1955, 8.

¹¹³ *Lok Sabha Debates*, v. 28 July 1955, col. 8820-8826.

India's modernity was to be profoundly different from 'conservative England'.¹¹⁴ The adoption of the decimal metric system was to be simultaneously an act of embracing India's ancient past and severing its link with a more recent colonial past.

Nehru's framing of the issue above also reflects the language of economics that the Indian nationalists had co-opted. Metrological standardisation was explicitly tied to the notions of productivity and efficiency, as in Nehru's statements above. Such framing by government actors became more visible in the post-colonial period compared to an earlier discourse.¹¹⁵ Verman, as the director of ISI, explained the role of the institution and the economic importance of its standard-setting activity to the general public in a paper published by the TOI. He explained how the new metric measurement standards had the potential to increase productivity and lower production costs by standardising sizes of engineering parts.¹¹⁶ The co-ordinating role of measurement standards was also emphasised by others, such as Venkatachalam from the ministry of industry. Writing in the context of paper manufacturing and the construction industry, he explained to the general reader how standardising sizes would have a cascading beneficial impact on all domestic industrial and retail sectors.¹¹⁷ The technology of development was thus presented as a technology of economic coordination via the popular press in India.

¹¹⁴ The renowned scientist, Maghnad Saha stressed how 'only a few backward and conservative countries have not adopted the decimal system. Conservative England has kept her obsolete pound, shilling and pence, and feet and inches.' *Lok Sabha Debates*, v. 28 July 1955, col. 8793.

¹¹⁵ The exceptions are the arguments for standardization proposed by British commercial and mercantile groups, presented in the first section earlier.

¹¹⁶ *TOI*, 30 Sept. 1958, 14.

¹¹⁷ *TOI*, 24 Nov. 1958, ii.

Once the decision to introduce the metric units as the only legal measures was announced in 1957, the government adopted a sustained programme of publicity involving mass communication with a largely illiterate population. The government-owned radio station, All India Radio ran a series of programs on the metric system during the transition period between 1958 and 1962.¹¹⁸ New curriculum for school instruction was prepared, and new textbooks and handbooks were prepared for teachers regarding instruction of decimal system in schools.¹¹⁹

Implementing reforms also depended on the government's ability to manage the costs and process of converting from the older measurement units used in commerce and trade. This partly determined the 'urgency' of the decision to changeover to the metric system. Ranganathan's article in TOI in 1957 explained this issue of escalating conversion costs to the general public in the following way:

'Various industries dealing with the scientific instruments of measurements are still in an infant stage. If the change-over were to be postponed to a later date when a great deal of equipment would already have been geared to the existing system of measurement the cost of converting would be very much greater.'¹²⁰

The planning for metrological reform between 1955 and 1957 coincided with the announcement of India's second-five year plan in 1956. When the draft of this second plan was reproduced by TOI on 10 February 1956, it also carried the announcement of

¹¹⁸ For example, Broadcasting programmes, *TOI*, 20 Sept. 1960, 9; 30 May 1956, 7.

¹¹⁹ *TOI*, 27 June 1958, 8.

¹²⁰ *TOI*, 31 Mar. 1957, i.

the government's decision to make the metric units the legal measurement standards.¹²¹ However, as the date for conversion approached the inadequate supply of new weights made conversion difficult.¹²² In addition to a substantial shortfall in the numbers of new instruments made available by the government's own suppliers, most people waited until the deadline to begin converting. As a result, demand for new weighing and measuring instruments in the new metric units far exceeded supply: 'short supply of metric weights presents difficulties to some traders', reported TOI.¹²³ The piecemeal introduction of metric system in different parts of the country between 1958 and 1962 added to the confusion. Local authorities preferred to wait until 'complete metrication' to make changes, for instance, to school curriculum, with the effect that old measures were still being taught in many schools in 1962. Nonetheless, the railways, who had resisted metric units in the 1870s, were one of the first to change over to the new system; being nationalised and under state control it was now possible to get this sector to convert through strong state pressure.¹²⁴

Ultimately, notions of progress, economic development, science and uniformity shaped post-independence discourse on metrological reforms. T T Krishnamachari, Minister for Commerce and Industry, said in 1955, 'when we want progress, when we want an economic system which will benefit the entire country, naturally, the [metric] weights and measures and the [decimal] coinage should go along with it.'¹²⁵ Verman, the director of ISI, similarly argued that 'the adoption of a scientific system uniformly

¹²¹ 'Draft outline of 2nd Plan', *TOI*, 10 Feb., 1956, 6.

¹²² *TOI*, 2 Oct. 1960, 10.

¹²³ *TOI*, 3 July 1959; 2 Oct. 1960; 3 Dec. 1960.

¹²⁴ S L Kumar, 'Railways' in Verman and Kaul, *Metric Change in India*.

¹²⁵ *Lok Sabha Debates*, iv, 22 Apr. 1953, col. 6058. *TOI*, 23 Apr. 1955, 1.

applicable all over the country was [timely] for in this direction lies the best interest of the country for an orderly development of prosperous economy.’¹²⁶ The metric measures became the legal measurement units from October 1958 onwards, and were made mandatory and exclusive legal units after 1962. With this, it appeared that the Indian government had managed to finally unify the legal metrology of India, in a way that the British colonial government never did. Verman writing in 1970 claimed that in trade and commerce ‘as complete a change has been achieved as might be desired,’ and that ‘the common man has proved extremely receptive to the new idea and fact of change.’¹²⁷

V Conclusion

This paper began by examining the notion that metrology was a constitutive element of state formation. It concludes with a view that, in India’s case, the intersection of standardisation, industrial policy and economic planning proved a more compelling environment for metrological reform than the establishment of institutions of governance and rule introduced in the colonial period. Integration of domestic markets and removal of barriers to internal commerce remained insufficient factors for standardising weights and measures in India. It was not until the notion of planned or directed economic development based on industrialisation took root amongst the Indian nationalists that the idea of enforcing uniform national standards really began to take shape. The ability of the state to enforce measurement reforms must be understood in conjunction with the changing normative notions about the state and the role it *should* play in mediating economic life. Following the awakening of economic

¹²⁶ *TOI*, 30 Sept. 1958, 14.

¹²⁷ Verman and Kaul, *Metric Change in India*, 456-57.

nationalism by the turn of the nineteenth century, the discourse on regulating and reforming legal metrology shifted from ‘reducing market barriers’ to ‘economic planning’.

Some historians have claimed that by allowing the diversity of India’s weights and measures to persist, British inaction encouraged ‘colonial modes of appropriation throughout the sub-continent.’¹²⁸ Such assessments of the impact of non-standardisation should first take into account the social and economic logic of customary measurement units that ordered pre-industrial economic relations, in India.¹²⁹ Nandalal Bose’s murals, created for the Haripura Congress in 1938 on Gandhi’s urging, celebrated the traditional modes of measuring, whilst simultaneously tying rural life to the nationalist project of ‘swarajya’ or self-rule. The nationalist state’s ability and willingness to trammel these traditional ways of social exchange must be evaluated in this context.

By the end of the eighteenth century, the EIC had already altered the logic of agrarian order in many parts of India through projects such as the land revenue administration. Quantities, estimation, measurement and control became essential features of regulation by the nineteenth century. And yet the ‘measuring public’ embodied forms of tribute in their measurements, not just new spheres of taxation, according to D Senthil Babu: ‘the sphere of day-to-day transactions involved measures that reflected occupational engagements, cognitive negotiation of quantities, and

¹²⁸ Debdas Banerjee, *Colonialism in action: trade, development, and dependence in late colonial India* (New Delhi, 1999), 51.

¹²⁹ Kula, *Measures and men*, describes a rich tapestry of socially constituted measuring units. Also, William Crooke, *A glossary of North Indian peasant life* (Allahabad, 1879 [Reprinted Delhi, 1989, Shahid Amin (ed.)]), 167.

estimation.’¹³⁰ Such cultures in India required a well-developed not primitive appreciation of mathematics embodied in a highly developed institution of schooling. In South India these institutions, called ‘tinnai’ schools, had developed oral traditions of mathematical education reliant on memory rather than forms of writing. An ordered, standardised and uniform metrology competed with, or threatened to sweep away, much of this social order as much as it potentially averted the colonial modes of appropriation.

The technocratic rationale of an ordered uniform metrology had to be bolstered with the cultural authority of Indian science. Even as standardisation, quantification and formal representation began permeating modern life in India, the work that created these objects has remained invisible or been deleted in the descriptions of its development.¹³¹ Standards have generated a strong element of global order in the modern world, facilitating co-ordination and co-operation on a global scale.¹³² Measurement standards in particular have contributed to the creation of a ‘standardised cognition.’¹³³ This paper has shown how metrology has historically tied Indian economic and social spaces to international spaces: in antiquity through trade, during colonial periods through governmentality and after independence through international standardisation.

¹³⁰ Senthil Babu, ‘Memory and Mathematics’, 17.

¹³¹ Susan L Star and Martha Lampland, ‘Reckoning with Standards’, in Martha Lampland and Susan L Star (eds.) *Standards and their stories* (London, 2009), 9.

¹³² Nils Brunsson, and Bengt Jacobsson. ‘The Contemporary Expansion of Standardisation.’ in *A World of Standards*. Nils Brunsson and Bengt Jacobsson (eds). (Oxford, 2000), 1.

¹³³ Lawrence Busch, *Standards: Recipes for Reality*. (Cambridge, MA, 2011), 146.

Still, the nationalistic reforms to metrology involved reconstituting a global technology into a culturally acceptable form that resonated with India's tradition of scientific achievements from a distant past: a history that was recovered and retold from the 1920s onwards. The emphasis laid on the Indian origins of the decimal system, and the fact that it underpinned the metric measurement units, was used in discourses to lend legitimacy to the adoption of the metric system. Ultimately, it was by sweeping away custom and traditional ways of mediating exchanges that the Indian nationalists could tie local ways of measuring to a centrally regulated modern and scientific standard. Thus, while standardisation ushered in equality in one sense - one set of rules for all - it simultaneously dismantled traditional institutions and customs that had worked for both the literate and illiterate alike. The new metrology was inevitably skewed towards the literate and the educated, as Gandhi had feared.¹³⁴

This case study also gives cause to rethink the links between metrology and the state. Those who ruled India - company officials, colonial bureaucrats, and nationalist technocrats - all attempted to shape India's metrology. If metrology is indeed a technology of government, we need to understand the manner in which different groups lay claim to this technology. This paper demonstrates that to some groups metrology was a technology to achieve industrialisation and economic development: they found the appeal of the metric system irresistible. To others it was a technology to mediate social relations: they valued the traditional modes of measuring. Many social observers were concerned with the exploitative nature of variable measures, particularly where the uneducated masses were concerned: they demanded standardisation preferably based on existing modes of measuring. Others still saw

¹³⁴ The impact of the new metrology after 1957 is not discussed in this paper, but is a fertile area for future inquiry.

metrology as a technology that coordinated commercial and economic exchange: they were willing to work with hybridised, flexible measuring units. The reconstitution of India's metrology was the interplay between these contending interests. In the end, the metric system could be made to address many (if not all) of these claims. It provided a more compelling alternative of mediating economic exchanges in an industrialised world in ways that traditional modes of organising weights and measures did not. Whether it made the measurement system any more equitable remains to be seen.

The process of standardisation remains unfinished in India. In 2007, an article in the journal *Current Science* by a physics teacher complained that many science books in schools still continue to use old measurement standards (i.e. Imperial British units): 'since in science metric measures are the only recommended system of units to be used, we should try to be more serious in sticking to this system.'¹³⁵ It appears that Indians, like the British or Americans, are still inching towards the metre in the twenty-first century.

¹³⁵ B Chakrabarti, Fifty Years of the Metric System in India and its adoption in our daily life', *Current Science*, Vol xcii (2007), 391.