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ESTABLISHING DESCRIPTIONS OF BUILDING WORK IN UK

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There is continual need to describe building work. Whether programming, estimating, issuing instructions, writing up a journal or other activity, it is difficult to conceive of project situations where such descriptions are not required. It is therefore surprising to find that there is no standard method of describing the physical effort of construction used in the UK. The descriptions in general use in the UK are derived from SMM/ NRM2 (1922-2013) and from quantity surveyors' methods of working. Despite such descriptions being thought to inform about building work, those nine documents, spanning a century, state that labour and other items are not included, deeming that contractors must allow for them. Coupled with that situation, current tendency toward collaboration between designers and contractors at early stage of design increases the need for a means of communication between the parties which expresses financial consequences of designers' decisions. This paper, via critical literature review and comparison of editions, exposes misunderstandings surrounding the use of SMM/NRM2, looking at why it is criticised for failing to do that which was never intended, how information which it is expected to provide may be given effectively, and how a system of dealing with that additional information can synchronise with the existing. The method of constructing such a system requires that 'work', and the products of that work are defined in a particular manner so that it may be observed and recorded. By document analysis and literature synthesis, the requirements for such definition are examined and suggestions given for further work in the field. It is hoped that development will pave the way for a comprehensive standard method of description of building work that takes all factors of contractors' construction cost into consideration.

Keywords: building work, communication, cost significance, descriptions

INTRODUCTION

A chain of events leads to a need for description of building work; the goal - to supply a product whose quality and price are acceptable to the client. Price is established by listing the 'work' to be done and asking contractors for rates for the items listed. It follows that description of the work should be full and accurate.

Descriptions of work currently supplied to contractors for pricing in the UK stem from the use of SMM/NRM2, and are not 'full' (Lee *et al.*, 2014; RICS, 2013) - hence the part that is supplied is in accord with the rules of those documents and quantity surveyors' methods of taking off and abstracting, but what is not supplied has to be

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estimated by the contractor. Additionally, although the contractor may be aware of the sort of information that is not included, there is no way of discovering the quanta applicable to a specific building unless a further 'take off' is carried out by the estimator.

That situation comes about because quantity surveyors were originally 'measurers', working for contractors, measuring and listing the work in their own individual way. (Thompson, 1968). They had constant contact with builders, sites and operatives were in touch with costs and aware of the causes of cost variation. The change to working for client bodies meant losing contact with builders' cost, becoming more conscious of clients' costs, i.e., builders' prices, and less concerned with either description of the work or builders' profitability. Their way of measuring was included in the compilation of the Standard Method of Measurement of Building Works (SMM) (1922), satisfying contractors' complaints of variation in descriptions which estimators had to price, providing an equal basis for tendering, but containing problems which were not then or now immediately apparent. One is that the descriptions to be priced are not of pieces of work but of measures, e.g., brickwork is given as a number of square metres of a certain thickness of walling, rather than as walls - an abstract concept rather than a piece of work. Another is that the contractor is deemed to have included all necessary labour in the rates despite being given little information about intricacy or practicality of the work. That situation has changed over the years; early editions of SMM appeared to recognise intricacy, indicated in items such as 'plumbing angles', (removed from 5th edition onward); later editions tend to measure fewer items, particularly if they are not 'cost significant', (to the client). Skoyles, (1981), opined that 'For any industry it is necessary that the designer should be aware of the financial consequences of his design decisions'.

Problems such as those mentioned above give rise to contractors' complaints that bills of quantities (BQ) do not describe their work adequately. The knowledge gap resides in the fact that descriptions in contract documents based upon SMM/NRM2 intentionally do not describe some elements of cost, particularly labour. There appears to be no relevant previous research upon the content of descriptions. Work study might be thought to provide answers, but it is pitched at micro level on the one hand, and the 'elements' are selected by the observer on the other, neither of which aid this study in its aim of establishing standard descriptions of building work that can be used for many purposes.

The problem to be solved is to provide descriptions which are full and accurate, leading to prices which are full and accurate. It is necessary to find a way for information previously excluded to be given to estimators such that the intricacy and relative difficulty of the work is expressed, preferably whilst blending with the existing method of measurement so that change may take place smoothly. To do that, determining the effect of information content in the method of measurement when describing building work, and understanding the degree of change in such descriptions over time is important.

LITERATURE REVIEW

Information required for construction comes from various sources: designer's drawings and specification, quantity surveyors' taking-off, experience and training of contractor's site staff, and not least, the training of site operatives. Daltry, (1971) recognises two types, 'technical', contained in drawings, specifications, and bills of quantities (BQ), and 'control', defining operations, sequence, duration, resource

availability, outputs, etc. Descriptions of 'work', wherever sourced, stem from the century of use of SMM/NRM2, (1922-2013), so all who are trained to be quantity surveyors, estimators, cost managers, and so on are inculcated with it. Consequently, all descriptions tend to be in SMM terms, particularly omitting items relating to cost that SMM/NRM2 do not measure.

In synthesising cost, estimators have, in effect, to construct a virtual building, making it essential that the fullest possible information be contained in the descriptions priced. Thus, there is an intimate connection; cost should be established by the information contained in descriptions. Less than full information leads to more uncertainty regarding cost. Singh and Banjoko (1990) make the point that contractors are expected to use the best of cost estimating and control methods whilst their revenue is based on a less accurate method.

Descriptions should be so constructed that contractor's costs can be recorded and feedback from site be checked against them. The RICS (1966) agreed with that view of estimators' needs, stating as a fundamental duty of the quantity surveyor that accurate and adequate information must be given to the estimator so that the exact nature of the work may be understood.

Nelson (1969), proposing criteria for an information system, includes:

1. Should have operation and task units corresponding to real pieces of work
2. Ability to be sorted into aggregations of like materials, labour skills or plant
3. Packages provided for all tasks, identifying resources, restraints, workpiece identification, location and definition
4. Provision for reporting task progress, resources used and stock

Bandi *et al.*, (2014) appear to agree with Nelson about information requirements, and list shortcomings of BQ, identified by over 20 authors, summarised as follows;

1. No help in programming or work sequencing.
2. No grouping by similar operations, type of operation or activities.
3. No work locations.
4. No reflection of design/production interaction or buildability.
5. No information to establish working time of labour or plant.

The Cabinet Office (2011) saw current information as inaccurate, insufficient and indefinite, causing additional expenditure of 20 to 25%. The resulting report led to the production of PAS 1192-2 (CIC, 2013), requiring 'collaborative working', identifying the collaborators as designers and contractors, requiring contract documents to be aligned with 'industry standards', assuring that no additional work will be necessitated because the same information 'has always been produced'. That could be helpful if the previously produced information had satisfied the needs of all users. The assurance that the same information will be given leads to the thought that therefore the same lack of necessary information will be involved, and the information will continue to be 'inaccurate, insufficient and indefinite'.

'Collaborative working' and information management has been examined by a number of researchers (Fisher and Li Yin, 1992; Moore and Dainty, 2001; Anumba *et al.*, 2008; Demian and Walters, 2014; Collinge and Connaughton, 2017), some finding that scant attention appears to have been given to the quality of the information, and that integrated project culture had not developed from the exercise.

For descriptions stemming from SMM/NRM2; the RICS (1966) rule that surveyors can word descriptions in any way they wish provided the required information is included, hence the documents are responsible for the content, not the wording of descriptions. However, over the past 60 years descriptions have tended to become standardised (Fletcher and Moore, 1965; Monk and Dunstone, 1965; Conseil International du Bâtiment (CIB), 1993; RIBA Enterprises, updated monthly). The Q.S Committee of the RICS (Ferry and Holes, 1967), recommended a form of analysis to make for accurate estimating and costing and better use of data produced by quantity surveyors. Lee *et al.*, (2014) warn against “fitting an item to a standard description rather than ensuring that the description fits the item”. It would be beneficial if the current information system were of maximum use to both client and contractor, but whilst the industry does not recognise that it is the system itself which is fragmented, there will be no pressure for improvement. The pity is that when quantity surveyors produce abstracts, information is discarded which contractors could use at a later stage.

The UK is not alone in using descriptions stemming from SMM/NRM. Because of its long standing, SMM has been used as an exemplar for countries around the world. It is in use in Australia, (Rosli *et al.*, 2006), the Caribbean, (Rosli *et al.*, 2006), China, (Yuan and Shen, 2006; Utterback, 2017), India, (Bureau of Indian Standards, 1987), Malaysia, (Bandi *et al.*, 2014), Pakistan, (Rosli *et al.*, 2006), South Africa and other African countries, (Africa Association of Quantity Surveyors, 2015; Siglé *et al.*, 2015) and New Zealand, (Rosli *et al.*, 2006). The USA and Canada use a similar method, based, as are SMM/NRM2, on the premise that information regarding work involved in an item is defined by describing measures of the product of that work, not by consideration of the labour involved. (Project Management Institute, 2006-11).

RESEARCH METHOD

The research method is qualitative in that it consists of two examinations scrutinising in depth the documents germane to the issue in order to determine the effect of information content in the method of measurement when describing building work, and to understand the degree of change in such descriptions over time. The first was to search all editions of SMM/NRM2, looking to see the effect of changes and quantity surveyors’ methods of working.

In the second examination, a comparison has been made between similar sections of the earliest and latest editions, i.e. SMM1 Bricklayer section with NRM2 Masonry to establish some of the differences between them (Table 1). The effect is measured subjectively using a Likert scale of 1 to 5, where 1 represents no effect on the information supplied in descriptions, 2 is a small loss of information, 3 a significant loss, 4 a considerable loss and 5 complete loss. Figure 1 shows these results as a histogram. The information needs of operatives on site highlighted by Nelson’s (1969) criteria, and the work of Bandi *et al.*, (2014) were used as a basis for examining the differences.

Results of Examinations

The results of the two examinations carried out on the documents are as follows:

The most apparent items of the first examination and implied consequences were:

6. Measuring walls, etc., on centre lines. This treats all walls as if they are straight or curved, so does not allow for intricacy of angles and junctions. That

- might be satisfied by separate measurement of each, but there are no such items in any edition.
7. Measuring work in with general items when it must be carried out separately (e.g. beam filling; pointing exposed edges of DPC), thus aggregating differing pieces of work, i.e. pieces of work where one or more depends upon completion of another.
 8. Measurement of items as 'extra over'. This is convenient for measurement but can make for more calculation by the estimator.
 9. Deeming work to be included when it, and its timing, cannot be calculated from the information provided. This passes the requirement for collecting data, together with its attendant cost, to the contractor.
 10. Measuring deductions is not measuring 'works', nor is it necessarily measuring a lack of work, it merely measures lack of materials. Measuring areas around openings would allow for identification of any cost differences.
 11. Measuring and describing net area omits information about overall size or shape.
 12. Arbitrary divisions hide the possibility of actual cost difference, e.g. 'Thickness and width or girth n.e.300mm stated'; 'Thickness and width or girth over 300mm but n.e.600mm stated'; 'Thickness and width or girth thereafter in 300mm stages'. Actual sizes would be more useful.
 13. Excavation given in stages of 2 m. presumably to reflect the extra effort and difficulty involved. A 'standard method' should treat all work in a similar way.
 14. Aggregation of items which are not precisely similar.

The second examination compares SMM1 Bricklayer section with NRM2 Masonry. The resulting table is too long to show here, but Table 1 below gives the first 8 SMM1 Bricklayer items with assessment of the effects. A histogram of the effects is shown in Figure 1.

It can be seen that the greatest effect has been in the complete loss of 62 of the 124 items in the one area of Masonry, (column 5) whereas only 8 have been retained from the original edition (column 1)

The results show that the main ways in which NRM2 has reduced the number of items covered is (a) giving individual architects and quantity surveyors the responsibility for providing information in drawings and descriptions by making them mandatory, thus tending to reduce the 'standard' aspect, (b) allowing many more items to be 'spot' items (because of the number of things not mentioned), again reducing the standardisation of description, and (c) by deeming more information to be included, which means that responsibility for its provision has been removed from the client and added to contractor's risk.

It seems that those changes run counter to the needs of estimators as expressed in RICS (1966). Such changes may have occurred because clients feel the cost of providing information to estimators is too high, some of the information seems to be unnecessary, and much information seems not to be used.

DISCUSSION

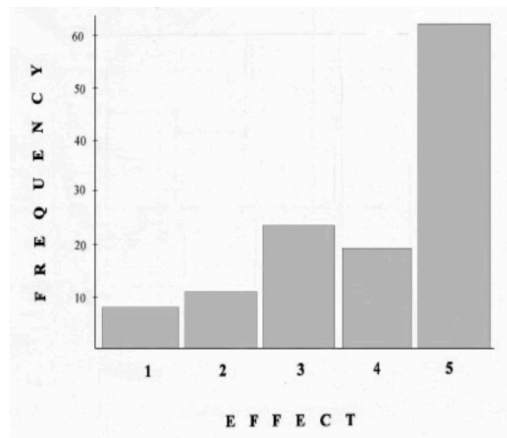
SMM/NRM2 never describe work. They lay down rules for what should be included in descriptions of 'works'. 'Work' and 'works' appearing as singular and plural indicate a noun, as does the regular use of 'the', (adjective, definite article). The word

therefore cannot be describing the physical effort of the verb ‘to work’, it refers to output - ‘a (piece of) work’, ‘the works’. In addition, every edition of SMM/NRM2 indicates that it does not, and is not intended to, describe ‘work’ i.e., the physical labour of construction.

Table 1 Comparison of similar items in SMM1 and NRM2

SMM 1	NRM 2	Effect
(29) Desc bks and mortar also the bond.	Mandatory info. 1, 3, 4,	1
Bkk in rods sup of 272 feet red to 1 ½ B or in yds sup red to 1 B, or if ex 3 ½ B may be yds cu.	Unit, m ² , thickness stated	1
Bkk in retaining walls shall be sep. given	Not mentioned	5
½ B walls in ft or yds. sup, and 1 B walls if faced or fair b.s.	Unit, m ² , thickness stated	1
(30) Footings reqd under London Bldg Act or Bye Laws of Local Authority, msd in acc herewith and inc w. gen bkk	Not mentioned	5
(31) All ddtms msd net sizes of opgs and recesses, inc. ex width of int reveals, no ddt made for ends of lintels, steps and sills	3.3.2.(1)(a) Deemed inc. note 5. Items 1,2,3, note 6	3
No ddtms for strings, sills, lintels and the like n.e. 3” thick	Ditto	3
Ddtms for stonework terra cotta work and concrete lintels above 3” in height	Ditto	3
(32) Bkk in backing to masonry given separately and so desc. inc all cutting and waste for bonding	Items 1,2,3, Level 2 - 4, note 1	4
(33) Bkk in underpinning shall be given sep. and so desc.	Not mentioned	5
Wedge up underpinning, ft. sup. and desc.	Not mentioned	5
(34) Rough cutting in ft. sup inc. waste.	Deemed inc. 1.	5
Cutting various types of bkk given sep.	Deemed inc. 1.	5
(35) Bed plates and sleepers on top of walls in ft. run unless msd with bkk. If > 4 ½” on bed, width stated.	Not mentioned	5
(36) Bkk raising old walls or on girders given sep and ht commencing stated.	Not mentioned	5
Prep. tops of old walls for raising in ft. sup.	Not mentioned	5

Figure 1 Effects of changes in descriptions



With the word having both a noun and a verb meaning, some users of the document may be dissatisfied - they expect it to be useful for work scheduling, programming, and other issues which depend upon labour time and output, believing it to describe ‘work’ in the verb sense.

The fact that it does not take anything from its usefulness in establishing total material requirements, but other of its characteristics deny its direct use on site, e.g. arbitrary aggregation of all sizes of concrete columns above or below a stated sectional area, means site management have to re-calculate the quantity of concrete required for each

cross-section and height for ordering purposes. Similarly, aggregating brick walls of the same material and thickness is no help in allocating the next piece of work, or for ensuring materials are stacked in useful positions.

Production of an artefact may require several items under the existing system, e.g., there may be an item of 'brick walls', others of 'Extra over walls for opening perimeter at jambs', 'Forming cavity', 'attached projections', etc. Items of similar description are aggregated, so that the result is not even a part of an artefact, it can represent several parts of many artefacts, such that the description of an individual piece of work is obliterated.

Descriptions of items produced by current methods are not wrong, they do what they intend - provide common ground for tenderers. Unfortunately, over the past century, the myth has been established that what is supplied is adequate; i.e. contractors should know and allow for everything not described, simultaneously bearing the cost of collecting information but not having the opportunity to reflect that cost in the tender.

In addition to problems of description, there is usage of the word 'cost' to consider. Costs, as far as clients are concerned, are dealt with by quantity surveyors rather than designers, (despite designers being responsible for creating cost), so it is likely that the collaborative effort described in PAS1192-2 is expected to be between clients' quantity surveyors and contractors' surveyors. Quantity surveyors work in terms of client's costs, i.e. contractors' prices set against SMM/NRM2 descriptions, (which exclude descriptions of some items of contractors' cost). If collaboration is to be successful and equitable, it would be more appropriate to be dealing with contractors' costs, not their prices.

The requirement on site is a system of describing what is needed of the operatives, given the physical restraints of the work itself, its starting and stopping points, the limits imposed by specification (e.g., work shall not rise by more than X in any one lift), restraints imposed by Health and Safety Acts upon weights lifted, length of working day, and so on. These are calculable when feedback of such information is available from sites, but in order to obtain that feedback, work descriptions must be in the same terms.

That seems a monumental task, but on every site such duties are carried out daily. They are informal, however, with no standardised method, leading to a lack of records, loss of inbuilt knowledge, failure to learn by past mistakes, re-work and consequent costs. The solution does not lie in further revision to SMM/NRM2, or in legislative measures such as PAS1192-2; to establish a method for universal use, the information is already possessed by the industry informally, but there is no industry-wide attempt (if any) to organise it rationally; if it were to do so, companies could become more efficient, less wasteful, more profitable.

A stumbling block is that contractors expect work to be described, but somebody else should deal with it. The existing system will not be replaced by clients' advisors because it suits the clients' purposes; describing work might be at their cost with no obvious reward. Equally, contractors would find it difficult to co-operate in producing something of overall benefit, but which required close observation of their working practices. A system so produced could be regarded by clients' professional advisors as contravening anti-collusion laws. Because of that, it might need to be instituted by Government, as the major client of the industry.

If clients feel, as suggested earlier, that the cost of providing information to contractors is too high, it might be pointed out to them that they do not know the cost of not providing information - could some costly mishaps of recent years have been due to lack of or incorrect information?

CONCLUSIONS

Current methods do what they say they intend - measure building 'works' - but do not attempt to, and are not capable of, describing building work. For contractors to establish their costs with precision, a method of description is needed which supplements the measurement method with full information about work pieces to be executed, enabling the labour, plant and equipment to be identified, allocated, managed and recorded. It is envisaged that the system will be considerably more detailed than SMM/NRM2, with no items of 'extra over'; nothing that is 'deemed to be included'; capable of being aggregated into SMM-type units or architectural elements as necessary.

The proposed system would incorporate all changes indicated above, plus others found necessary during study, satisfy the information needs of operatives on site, conform to Nelson's (1969) criteria, and deal with the complaints of the numerous authors linked in the work of Bandi *et al.*, (2014). Use of such a system could lead rapidly to the construction of a database of builders' costs connected to a library of descriptions of realistic pieces of work whilst being able to be aggregated to find more accurate averages for use with the Standard Method of Measurement, and perhaps to discover more practical groupings of items.

Benefits could be in avoiding re-work; not repeating that which has been carried out by quantity surveyors; making design costs more apparent, leading to less materials wastage; contractors could find it easier to value variations and be paid for them at the end of the month in which they are carried out, making for improved cash flow. Additionally, it would be possible for all stakeholders to use the system, aggregating whichever parts of it are necessary for their purposes - architects' elements for some needs, into 'similar materials' units for others, into production-based units for use on site. Ongoing work is establishing criteria for such a method of description.

The contribution to knowledge will be in extending the information given to contractors so that they are not only pricing on an equal basis, but with the addition of rational and complete information so that tenders can reflect actual cost.

REFERENCES

- Africa Association of Quantity Surveyors (2015) *Standard Method of Measuring Building Work for Africa*. Johannesburg: Africa Association of Quantity Surveyors.
- Anumba, C J, Pan, J, Issa, R R A and Mutis, I (2008) Collaborative project information management in a semantic web environment Engineering, *Construction and Architectural Management*, 15(1), 1-17.
- Bandi, S., Abdullah, F. and Amiruddin, R., 2014. Recapitulating the issues Concerning the Applications of the Bills of Quantities. *International Journal of Built Environment and Sustainability*, 1(1).
- Bureau of Indian Standards (1987) *SP27: Handbook of Method of Measurement of Buildings Works*. New Delhi: Bureau of Indian Standards.
- Cabinet Office (2011) *Construction Strategy*. London: Cabinet Office.

- Chartered Surveyors' Institution (CSI), National Federation of Building Trades Employers (NFBTE) and the Institute of Builders (IOB) (1935) *Standard Method of Measurement of Building Works (SMM), 3rd Edition*. London: CSI and NFBTE.
- Conseil International du Bâtiment (1993) *CIB Master List of Properties for the Arrangement and Presentation of Information in Technical Documents for Design and Construction*. Rotterdam, Netherlands: CIB.
- Construction Industry Council (2013) *PAS1192-2:2013 Specification for Information Management for the Capital/Delivery Phase of Construction Projects Using Building Information Modelling*. London: British Standards Institution.
- Collinge, W H and Connaughton, J (2017) Mobilizing BIM in a Collaborative Project Environment In: K Walsh, R Sacks and I Brilakis (Eds.) *LC3 2017 Volume II - Proceedings of the 25th Annual Conference of the International Group for Lean Construction (IGLC)*, Heraklion, Greece, 251-258.
- Daltry, C D (1971) *Information Requirements for Site Operations*. Ascot; IOB.
- Demian, P and Walters, D (2014) The advantages of information management through BIM, *Construction Management and Economics*, 32(12), 1153-1165.
- Ferry, D J O and Holes, L G (1967) *Rationalisation of Measurement*. London: Royal Institution of Chartered Surveyors.
- Fisher, N and Li Yin, S (1992) *Information Management in a Contractor: A Model of the Flow of Project Data*. London: Thomas Telford.
- Fletcher, L and Moore, T (1965) *Standard Phraseology for Bills of Quantities*. London: George Goodwin.
- Lee, S, Trench, W and Willis, A (2014) *Willis's Elements of Quantity Surveying 12th Edition*. Chichester: John Wiley and Sons, Ltd.
- Monk, K W and Dunstone, P H (1965) *Standard Library of Descriptions of Building Works*. London: Estates Gazette Ltd.
- Moore, D R and Dainty, A R J (2001) Intra-team boundaries as inhibitors of performance improvement in UK design and build projects: A call for change, *Construction Management and Economics*, 19(06), 559-562.
- Nelson, J I'a (1969) *Instructions to Operatives CP 10/69*. Watford, UK: Building Research Station.
- Rosli, A R, Muzani, M and Siti, N A W (2006) Bills of Quantities - Are they still useful and relevant today? In: *International Conference on Construction Industry*, 25th June. Padang, Indonesia.
- Project Management Institute (2006, re-affirmed 2011) *Practice Standard for Work Breakdown Structures, Second Edition*. Pennsylvania USA: Project Management Institute, Inc.
- Royal Institution of Chartered Surveyors (RICS) and National Federation of Building Trades Employers (NFBTE) (1948) *SMM, 4th Edition*. London: RICS and NFBTE.
- RICS and NFBTE (1966) *Comments and Clarifications on SMM*. London: RICS and NFBTE.
- RICS and NFBTE (1968) *SMM, 5th Edition (Metric), Incorporating Fitted Carpeting, 1970*. London: RICS and NFBTE.
- RICS and NFBTE (1979) *SMM, 6th Edition*. London: RICS and NFBTE.
- RICS and Building Employers Confederation (BEC) (1988) *SMM 7th Edition*. London: RICS and BEC.

- RICS (2013) *NRM2 - RICS New Rules of Measurement: Detailed Measurement for Building Works*. Coventry: RICS.
- Singh, G and Banjoko, O O (1990) The development of a rational bill of quantities, *Construction Management and Economics*, 8(1), 31-47.
- Skoyles, E R (1981) *Production Orientated Tendering: A Résumé and Re-Examination for the Early Eighties of the Issues Involved*. London: RICS.
- Surveyors Institution (SI), the Quantity Surveyors Association (QSA), the National Federation of Building Trades Employers of Great Britain and Ireland (NFBTE) and the Institute of Builders (IOB) (1922) *Standard Method of Measurement of Building Works*, London: SI, QSA, NFBTE and IOB.
- SI, QSA, NFBTE and IOB (1927) *Standard Method of Measurement of Building Works 2nd Edition*, London: SI and NFBTE.
- Thompson, F M L (1968) *Chartered Surveyors, the Growth of a Profession*. London: Routledge and Kegan Paul Ltd.
- Utterback, M (2017) *Construction and Projects in China: Overview*. Available from <https://uk.practicallaw.thomsonreuters.com> [Accessed 10/12/2017].
- World Economic Forum (2016) *Shaping the Future of Construction: A Breakthrough in Mindset and Technology*. Geneva: World Economic Forum.
- Yuan, F and Shen, J (2006) *Scope of Construction Contract in Chinese Bill of Quantities Evaluating Mode*. Hong Kong: Chinese Research Institute of Construction Management.