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## **Efficiency in the provision of production specifications for the South African construction industry**

*Peer reviewed*

### **Abstract**

In most developed countries production specifications are based on national standardised specification systems, such as the National Building Specification or NBS (Great Britain), the National Specification System or NATSPEC (Australia), Master Specification Systems or MasterSpec (United States of America and Canada), General Materials and Workmanship Specifications or AMA (Sweden), and the National Standard Building Specification or STABU (the Netherlands). Standard specifications are primarily designed to shorten descriptions in the texts of new projects, whether in respect of descriptions on architectural or engineering drawings and technical specifications or descriptions in bills of quantities, schedules of rates, etcetera. In some countries the development of computerised specification systems has reached the point that these systems are supplanting the traditional word processing method. These systems are also providing links or interfaces to other information systems of the construction sector, such as design, products and cost information systems, etcetera.

The South African construction industry, however, lags behind these countries that have been involved in the development of construction information systems or processes over the years. A call is therefore made to improve the efficiency of providing production specifications, as inadequate project information has been identified as one of the major causes of inefficiency in the building process.

**Keywords:** Specification, classification systems, construction information, interoperability, standardisation.

### **Abstrak**

In meeste ontwikkelde lande word konstruksie inligtingstelsels gebaseer op nasionale gestandaardiseerde spesifikasiesistelsels, soos die National Building Specification of NBS (Groot Brittanje), die National Specification System of NATSPEC (Australië), Master Specification Systems of MasterSpec (Verenigde State van Amerika en Kanada), General Materials and Workmanship Specifications of AMA (Swede), en die National Standard Building Specification of STABU (Nederland). Standaard of algemene spesifikasies bevat instruksies en/ of vereistes betreffende die uitvoering en gehalte van werk en verkort beskrywings in ander verkrygingsdokumente, soos byvoorbeeld beskrywings op argitekts of ingenieurstekeninge en tegniese spesifikasies of beskrywings in hoeveelhedslyste en skedules van tariewe. In sekere lande het die ontwikkeling van gerekeniseerde spesifikasiesistelsels die stadium bereik waar konvensionele woordverwerkingmetodes vervang word met 'n objekgeoriënteerde benadering vir die organisering van konstruksie inligting sonder menslike intervensie. Hierdie moderne stelsels voorsien ook skakeling of integrering met ander inligtingstelsels wat in die konstruksiesektor gebruik word, soos byvoorbeeld met produksie, tender en koste inligtingstelsels.

Die Suid Afrikaanse konstruksiebedryf het egter 'n agterstand teenoor lande wat oor jare reeds met die ontwikkeling van konstruksie inligtingstelsels of prosesse gemoed is. Dit is algemene kennis dat gebrekkige projekinligting een van die hoofoorse van oneffektiwiteit in die bouproses is, en die feit kan nie weg geredeneer word nie dat integrasie van inligting op tekeninge en in spesifikasies die hoogste prioriteit onder die veeltal betrokkenes in die veld van konstruksie inligting behoort te geniet.

**Sleutelwoorde:** Spesifikasie, klassifikasiesistelsels, konstruksie inligting, integrasie, standaardisering

## 1. Introduction

**P**roduction specification can be defined as written information prepared by the design team for use by the construction team, the main purpose of which is to define the products to be used, the quality of the work, any performance requirements, and the conditions under which the work is to be executed.

It is common knowledge that many of the problems on construction sites are caused by poor or missing information. Effective communication of high quality specification information between designers and constructors is therefore essential for the satisfactory execution of construction projects.

The main thrust of the research undertaken by Maritz (2003) for a PhD thesis was an investigation into the establishment of a code of practice for the classification of construction information on which production specifications, bills of quantities, etcetera can be based. The study has shown, inter alia, that the evolution in the classification or specification processes, which form an indispensable part of the overall procurement process, has become stagnant in South Africa and that little use is made of the benefits that the advancement in construction information technology (CIT) offers.

The Construction Industry Status Report, which was prepared by the Council for Scientific and Industrial Research (CSIR, 2002) for the Department of Public Works (DPW), corroborates the findings of the abovementioned study. The objective was to report on the status, capacity and performance of the construction industry against development criteria. The report focused on a number of issues, two of which were:

- **Standardisation of contract information** in order to determine the percentage of contracts awarded on criteria other than price, as well as how many contracts meet the principles of modern forms of contract; and
- **Customer satisfaction** with construction products, delivery time, and quality of service and product.

The summary of the findings on the first issue revealed that little uniformity in procurement practices exists and proposed that the Construction Industry Development Board (CIDB) should not only have to develop best practices to promote uniformity, but would also need to ensure that ongoing training programmes for both

clients and professionals are available to keep people abreast of the latest best practices.

On the second issue it was reported, *inter alia*, that traditional methods of preparing design specifications seem to pose a large problem in both the architectural and engineering domains, and neither clients nor contractors were satisfied with design specifications. Professionals were of the opinion that the quality of specifications is still good, but that it is becoming increasingly difficult to produce quality specifications within the set time and budget constraints. This confirmed the general opinion that work processes are not up to international standards amongst a large contingent of professionals.

The above shortcomings were further emphasised by the following concluding remark:

*Clients and contractors perceive that consultants have lost a significant amount of expertise and capacity in developing specifications and documentation in the building sector. This leads to inaccurate specifications that result in a high level of design variations that in turn lead to an adversarial and time consuming approach in dealing with variation orders.*

The next section of this article attempts to assess whether professionals in the South African construction industry agree with the view expressed in the above citation and outlines an overall analysis of these specific research issues and focal points within the framework of the research that was conducted by Maritz (2003).

## **2. Research approach**

For the collection of information from secondary sources an extensive review of related literature was carried out, and a selected number of classification and specification systems in use in other countries were reviewed. The developments in the field of classification were then examined in detail by reviewing the latest literature published in conference papers and on the Internet, by attending seminars in the United Kingdom (UK) and Australia, and by making contact, either on a personal level or through correspondence, with some of the leading players in this particular field of the industry.

The review process was supplemented throughout by the personal observations and experiences of the author, which have spanned a period in excess of three decades and which have occurred at the cutting edge of the industry.

A two-stage descriptive survey (Leedy, 1997: 196- 197; Cooper & Emory, 1995: 121) was ultimately chosen for the data generation and analysis. The first-stage survey process comprised obtaining qualitative data through structured interviews from a pre-selected sample of senior academics and practising quantity surveyors in the UK. "Open-ended" questions regarding the current trends in compiling procurement documentation and systems for the classification of construction information were set on a non-standardised schedule (Zikmund, 2000: 310-312). Certain tendencies were identified and some of these were used for the second-stage survey. The second-stage survey process, which produced mostly quantitative data, comprised the design, pre-test and administration of a structured questionnaire that targeted architectural, quantity surveying and consulting engineering practices to obtain their view on the effectiveness of the procurement processes (which included the drafting of production specifications and the management of information for construction).

### **3. Review of the literature on international and local (South African) specification systems**

The International Construction Information Society (ICIS) published two very comprehensive reports (ICIS Report No. 1, 1995; Mindt Report No. 2, 1997) that set out to compare the specification systems in 13 selected countries in Europe and elsewhere. These reports show that there were no substantial differences between the specification systems; they all covered more or less the same basic construction works, their structure followed the chronology of a construction project, and their main users were consultants and contractors. Further development of all the systems investigated seemed to be in the same direction and followed the technologically most advanced systems (more specifically those of Switzerland and the Netherlands). A common goal was the continuous integration of computer technology, mainly by providing interface facilities with other construction information systems.

Since the publication of the abovementioned reports there have been further advances in CIT and changes in computer-aided design (CAD) applications. Practically every design office now has a computer and access to the Internet. Recent developments have made it possible to build a virtual prototype of a project (i.e. a 3D model) on a computer. This enables errors, omissions and coordination problems in the production drawings to be identified and rectified before work starts on site.

Most of the specification systems investigated, however still use a word processor environment, which means that a 'delete unwanted text' or 'cut and paste' technique is used to draft a production specification. This has the result that the information is only interpretable by humans. In relational systems, bits of information can have a meaning that is 'understood' by a computer through definition of attributes and possible ranges of values, so that the information can be interpreted by the system and processed without human intervention. It was found that, although much work and research have been done in this regard, workable outcomes and full implementation would only be achieved in the next generation.

The review of the literature on the application and development of specification systems for the South African construction industry that follow, draws a distinction between the private and public sectors. This has been done because of the distinct differences in procurement methods that have existed between these two sectors over the years.

### **3.1 Private Sector**

Traditionally, production specifications for private works – whether general, particular, or both – were produced solely by the designer (architect/engineer), normally by making use of in-house general and project particular specifications. Because of the absence of a national standardised specification system upon which these specifications could be based, they differed in style and format between the various firms.

In recent years, however, the quantity surveying profession has become increasingly involved in the drafting of production specifications on private sector works. The designer generally issues only annotated drawings, occasionally accompanied by specific model

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specifications, to the quantity surveyor for measuring purposes. The Standard System of Measuring Building Work (SSM 1999) (ASAQS 1999b) in the section General Instructions prescribes that:

*Quantity surveyors shall prepare bills of quantities containing clear and complete descriptions, leaving no reasonable doubt as to their intent and meaning; and*

*Descriptions must contain all the essential information necessary for pricing.*

Without a proper and comprehensive production specification from the designer, the quantity surveyor is obliged to insert additional preambles in his bills of quantities, either as a complete section at the beginning of the document, or as part of the various bills (trades).

It appears that quantity surveyors have taken cognisance of these changed circumstances as the Association of South African Quantity Surveyors (ASAQS) has produced model preambles for the building industry in an effort to meet the foregoing requirements. The 1999 edition of the Model Preambles for Trades (ASAQS 1999a) is currently the most frequently used document on major private building works, especially in instances where a quantity surveyor has been appointed as part of the professional team, and where bills of quantities form part of the building contract.

### **3.1.1 Development and status of the Model Preambles**

During the late 1970s the ASAQS produced the first standard preambles document (ASAQS, 1980) that had as its basic function the abbreviation of descriptions in the text of bills of quantities. This document was revised in 1989 to accommodate coastal conditions where these differed from inland conditions. Further editions followed in 1992, 1995 and 1997 with relatively minor amendments.

A more representative committee, which included members from the South African Institute of Architects (SAIA) and the local Master Builders Association (MBA), representing the Building Industries Federation of South Africa (BIFSA), was formed when the next edition was due. As a result of the interaction between the various sectors, an intensive examination of the entire document was carried out. This culminated in the publishing in 1999 of the current edition of the Model Preambles.

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According to Cahill (2002), the present chairman of the Model Preambles Committee, the committee is currently dormant, but will presumably be revived when stocks of the current edition run low. In the meantime the chairman's only task is to respond to queries and to keep note of various points raised by users of the document for possible inclusion in the next revision.

### **3.2 Public Sector**

The Green Paper on Public Sector Procurement Reform contains seven specific proposals regarding uniformity in contract documentation. Two of these relate specifically to specification matters, namely:

- Construction standards; and
- Specifications.

Watermeyer (1997) raised the following issues on the above-mentioned proposals:

- There should be a complete separation in contract documentation between conditions of tender, conditions of contract, specifications and terms of payment (including methods of measurement).
- Government should play a leading role in the standardisation of contract documentation and contract options and set an example in this regard for the private sector.
- Construction standards common to all disciplines should be developed for engineering and construction works contracts.
- The whole tendering process should be made more accessible to emerging enterprises by ensuring that tender documentation is:
  - 'user-friendly' and easy to comprehend;
  - free of unduly onerous requirements and conditions;
  - standardised.

The current call according to Watermeyer (2002), is to simplify documentation. Simplification needs to deal with issues such as language, style, presentation, layout and numbering. At its core is coherency in documentation and structure. For example, project

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specifications and special conditions of contract should be drafted in such a manner that amendments to standard documentation can be readily detected.

The White Paper on Creating an Enabling Environment for Reconstruction Growth and Development in the Construction Industry addresses several aspects of procurement insofar as the construction industry is concerned, one of which was the establishment of the CIDB. This led to the promulgation of the Construction Industry Development Board Act 38 of 2000. This Act tasks the CIDB with, *inter alia*, the promotion and implementation of policies, programmes and projects aimed at procurement reform and standardisation and uniformity in procurement documentation, practices and procedures. The Act also empowers the CIDB to publish best practices, promote standardisation of procurement processes within Government's procurement policy framework, and allows the CIDB to initiate, promote and implement national programmes and projects aimed at the standardisation of procurement documentation, practices and procedures (Watermeyer, 2001).

### **3.2.1 The PW 371 Specification of Materials and Methods to be used (PW 371)**

The fourth edition of PW 371 (DPW 1993) is the current primary specification document in use on most public building works. The DPW is the official body responsible for the publication and revision of the document. It was last revised in 1993 after the first edition was published in 1982. The format and application of the document are similar to that of the Model Preambles described above and the document therefore has the same limitations on its usage. This document is one of those identified in the aforementioned Green Paper that is in need of revision to make it acceptable.

### **3.2.2 SABS 1200 and SABS 0120 documents**

The SABS 1200 and SABS 0120 series of specification documents were developed for civil works and are exclusively used for this purpose. These documents will be withdrawn once a new specification for construction works that encompasses both civil and building works has been drafted. A working group has been constituted to develop this new specification, which will be referred to as SABS 2001: Standardised Specifications for Construction Works. Only after SABS

2001 has been completed (it is anticipated that it will be developed in a phased manner and may take several years to complete), and the South African Institute for Civil Engineers (SAICE) has published its new measurement and payment system, will it be possible for SABS 1200 and SABS 0120 to be withdrawn or phased out.

### **3.3 Commercial specification systems**

A number of commercial product library information systems have come onto the South African market in recent years for specific applications in the construction industry, mainly as a result of the advancement in CIT. The initial objective of these systems was to replace the libraries of catalogues with complete on-line product information that would be accessible to designers, estimators, quantity surveyors, contractors, etc. Some of the systems that have been developed to date are integrated with specific bills of quantities production programmes, with the information on products and services being classified according to the usual trade-format approach prescribed in the SSM.

The information that is provided in these systems about products aims to be complete, i.e. without a need for further reference to hard copy catalogues. Thus information such as place of manufacture, materials from which the product is made, complying standards, warranty details, application methods, etcetera are all provided. In addition, model bill descriptions of all likely items to be encountered for the specific product range are often provided and can thus be conveniently downloaded by the person responsible for the measurement. However, Figure 1 shows that these systems are not used much in the construction industry.

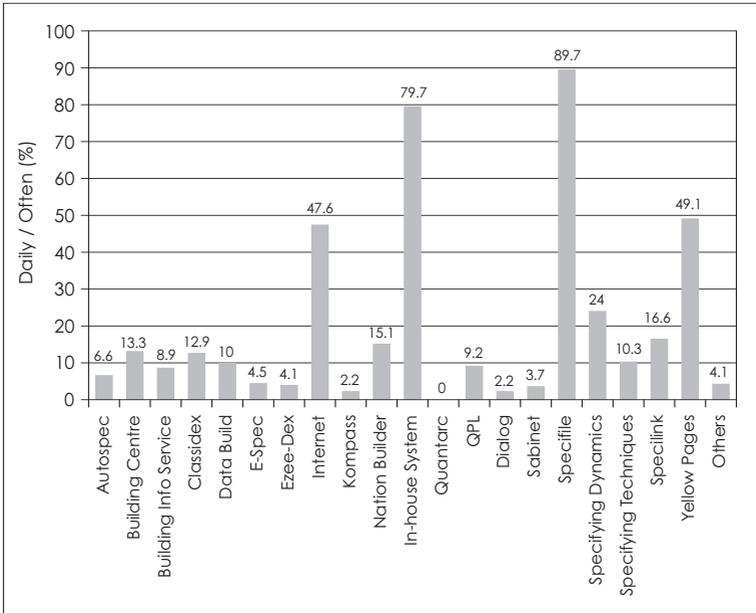


Figure 1: The regularity of use of available product information sources  
Daily / Often  
Source: Maritz 2003: 164

#### 4. Trends indicated by data collected in the Maritz study

Respondents in Maritz's empirical study were requested to rate hypothetical statements, conclusions and recommendations in accordance with a five-point rating *Likert* scale in the first part of the questionnaire. At the end of each series of questions the respondents could state their own point of view by using the space provided for 'open-ended' responses. The questionnaire was compiled with several objectives in view, but the discussion in this article on the trends indicated by the data collected is limited to the objectives dealing exclusively with specification matters. The discussion is further limited to the drawing of abbreviated inferences and conclusions only.

Table 1: Specific expertise and appropriate experience are essential requirements that the drafter of specifications should possess

	Total	Graphical presentation				Type of respondent			
		30	60	90	120	150	Architect	Quantity surveyor	Engineer
Total responses	268						163	66	39
Strongly disagree %	0						0	0	0
Moderately disagree %	3						2	0	1
Undecided %	14						10	3	1
Moderately agree %	92						59	19	14
Strongly agree %	159						92	44	23
Mean	4.52						4.48	4.62	4.51
S D	0.65						0.67	0.57	0.68

Source Maritz 2003 141

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All three disciplines supported the statement (sample mean = 4.52) that the specification drafter should be in possession of specific expertise and experience.

Gelder (2001: 10) identified the following five desirable features of specification methods:

- Compatibility with the form of contract;
- Clear-cut responsibility for design;
- Internal consistency, both technically and contractually;
- Capacity to obtain a good price for the work;
- Ability to integrate and coordinate services, especially with structural and other services elements.

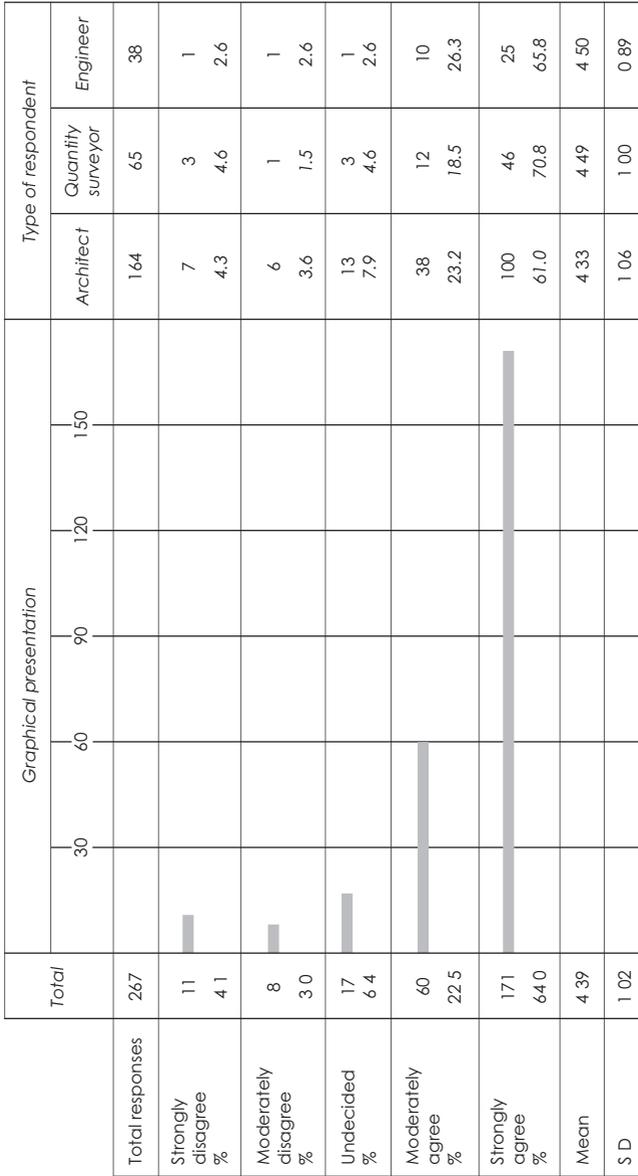
Designers (architects and engineers) are deemed to have expert knowledge with regard to the abovementioned specification matters, and should, generally, be more capable than quantity surveyors of preparing and managing project specifications. Quantity surveyors would, generally, not have received the basic training required for drafting proper specifications, as little emphasis is placed on this aspect in their curriculum. Quantity surveyors are mostly forced by the circumstances to provide 'something' in bills of quantities, or other types of procurement documents, in an effort to avoid later claims by the contractor that might result in cost overruns on budgets submitted to the client.

Smallwood (2002: 8) comments that "... *design effectively defines the work to be done.*" The designer should therefore take the leading role during the design and construction phases concerning specification matters to ensure effective supervision of standards of workmanship and quality of materials, which has to be measured against the project specification and design.

In his doctoral thesis that investigated, *inter alia*, the effectiveness of the procurement process in South Africa, Grobler (2000: 368) confirms the importance of proper supervision by stating:

*Quality control personnel must ensure that products are constructed according to drawings and specifications. (It seems so obvious, but quality control failed to prevent the many documented catastrophic failures in recent history).*

Table 2: There should only be one comprehensive and up-to-date national building specification in South Africa



Source: Maritz 2003: 149

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The designer, and not the quantity surveyor, should have the responsibility for preparing the specification, and should, in addition to the quality control process, visit the site regularly to ensure that critical elements are constructed according to the design, and that construction techniques are sound and safe. These functions clearly belong to the designer and not to the quantity surveyor.

All three disciplines supported the statement (sample mean = 4.39) that there should be only one comprehensive and up-to-date specification system in South Africa.

In the 'open-ended' responses following the statement two respondents noted the following:

*The industry should standardise nationally (with as much as possible 'internationalisation' to optimise the functioning of industry on a competitive basis and to cater for globalisation). All professions should contribute.*

*The aim should be to standardise and unify the present diversification that exists.*

The private sector will only be enticed to make use of public sector documents if these documents embrace best practices that are superior to the documentation that they currently utilise. Conversely, the public sector will only make use of private sector documentation if such documents adequately serve their requirements in the reformed procurement environment. This article contains an earlier reference to government's proposal that the various systems currently utilised by the different public authorities be amalgamated into one, and also to the fact that government has no plans to revise the standard specifications within the foreseeable future. It seems, therefore, rather certain that the initiative to produce a single system would have to come from the private sector.

The sample mean (4.05) of the total for all respondents indicates that the respondents agreed with the statement.

In the 'open-ended' responses following the statement a respondent noted the following:

*One body controlling specifications must be in place that shall set standards throughout the country information must be obtainable and updated through the Internet.*

Table 3: The national building specification should be handed by an appointed committee under the auspices of an umbrella body such as the CDB

	Total	Graphical presentation				Type of respondent			
		20	40	60	80	100	Architect	Quantity surveyor	Engineer
Total responses	269						165	66	38
Strongly disagree %	12 4.4						8 4.9	2 3.0	2 5.2
Moderately disagree %	15 5.6						7 4.2	4 6.1	4 10.5
Undecided %	38 14.1						23 13.9	9 13.6	6 15.8
Moderately agree %	86 32.0						55 33.3	20 30.3	11 29.0
Strongly agree %	118 43.9						72 43.7	31 47.0	15 39.5
Mean	4.05						4.07	4.12	3.87
S D	1.10						1.09	1.06	1.21

Source: Maritz 2003: 152

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The positive support from the sample on the above statement would therefore suggest that the respondents would be in favour of some intervention and cooperation by public authorities, such as the recently established CIDB. In developed first-world countries, such as the UK, Sweden, the Netherlands, and the USA, the respective industries can probably afford to pay high subscription charges for the benefits of using a comprehensive and up-to-date specification system. However, the situation in South Africa should rather be compared with that of other developing nations, such as Singapore. According to Goh and Chu (2002), such developments in Singapore are joint exercises between the government and private organisations, constituent bodies, etc.

## **5. Conclusions and recommendations**

It is estimated that the potential for continued work by the local construction industry in the area of specification drafting is of such a scale that one or more working groups would have to spend a vast amount of time on it. Decisions by all the industry role players will therefore be needed in respect of the most important priorities, such as the status of the proposed work sections; the extent and status of the information to be provided; the possible use of the information; and the financing of the work. In this regard the following salient aspects will have to be considered:

- Owing to the rapid progress of computer technology and its widening range of application areas, the demands of the various construction parties for interfacing possibilities between different programmes will increase. The following three technologies will be of particular significance for the exchange of information:
  - Integrated knowledge-bases and data-bases for CAD, enabling all construction parties to work simultaneously on a proposed building model;
  - Computer-based communication networks;
  - Electronic data interchange.
- The increasing development of international standards, and their integration into national systems, will automatically lead to assimilation of the technical content of the various systems into local applications.

- International projects are increasingly being executed by individual professional firms or contractors or as joint ventures with overseas partners, and local systems have to be readily adaptable for international use. Harmonisation of the different systems will be necessitated, due to growing international competition and globalisation, and to the growing use of CIT. It is anticipated that as more and more specifiers and other users discover the advantages of data-based information systems compared to computerised typewriters or the 'cut and paste' method, they would prefer to use these systems in order to rationalise and increase the efficiency of their work.
- There should be only one comprehensive and up-to-date national building specification system covering all types of construction work. Especially on small or medium-sized projects contractors often earn additional money from variations requested by the employer during the construction period due to specifications only covering the basic necessities and therefore being incomplete. It is recommended, however, that the system should be divided into manageable parts, keeping building works separate from civil works, for instance. This is the case with most other international systems, such as the Swedish and Australian systems.
- It is recommended that for production specifications to be effective, and to have widespread application, it should be linked or integrated to:
  - National (SABS/STANSA) standards, codes of practice and other technical approval documents;
  - Cost information systems;
  - Product information systems (proprietary product specification by manufacturers);
  - Design systems;
  - Measurement systems.
- It is finally recommended that a national standard for classification of construction information or code of practice be established. Production specifications should follow this classification standard for the structuring of work sections and their subdivisions.

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