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A Profile of Nigeria's Software Industry

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Table of Contents

ABSTRACT	1
INTRODUCTION	2
A. INDUSTRY GENERAL PROFILE	4
FIRM LOCATION AND OWNERSHIP	4
PERSONNEL AND JOBS.....	5
B. OUTPUT AND MARKETS	8
CUSTOMERS	8
OUTPUTS: PRODUCTS AND SERVICES.....	9
C. SOFTWARE PROJECTS AND PROCESSES.....	10
PROJECTS AND MANAGEMENT	10
SOFTWARE PROJECT METHODS.....	10
SOURCES OF PROCESS/METHOD IMPROVEMENT	12
D. CONCLUSIONS ON STRATEGIC POSITIONING FOR NIGERIA'S SOFTWARE INDUSTRY.....	13
REFERENCES	16

A Profile of Nigeria's Software Industry

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Abstract

This paper reports a survey of Nigeria's software industry – an industry that has been disappointingly neglected to date in work on software in developing countries, despite Nigeria's size and both economic and political importance. The survey found there are more than 100 firms active in the industry, principally clustered around the South-West of the country and virtually all private-owned. Most firms are small enterprises (11-50 staff) and most professional staff have at least a first degree. Customers are drawn almost exclusively from the private sector and from the domestic market: software exports are few and far between. The majority of work focuses on providing services – such as installation, customisation and training – related to imported packages, and there are signs of decline in development of locally-written software. Strategic analysis of the industry according to Heeks' quadrant model shows that Nigeria needs to bolster such local development work. For this to happen, firms must target market segments with some degree of protection from imports. They must also strengthen their software development practices, something that will be partly dependent on improvements in the provision of software education by local universities.

Introduction

There has been a rapid global diffusion of information technology (IT) not just in industrialised but also in developing countries. Despite this, there are few signs of substantial IT-related benefits accruing to developing countries. The gap between the huge expenditure/expectations associated with IT and the failure to realise clear socio-economic returns from such investments is the main trigger for the research project reported here, which seeks to understand the development of software – and development of a software sector – in one particular developing country: Nigeria. This research focus comes partly because, within the software development process, may lie clues to the poor return on IT investment seen in developing countries. The focus also comes partly because the software sector, being part of the IT production complex, is seen to make a much more direct link between IT and development benefits than IT consumption (Heeks 2002).

The work reported here is the core survey data from the research, which takes a "landscape view" of the Nigerian software industry, sketching out the main features of that industry and then determining its strengths and weaknesses.¹ This, in turn, will be used as the basis for analysing the strategic positioning of Nigerian software firms, using a software strategic model (Heeks 1999).

The survey – using questionnaire plus interview follow-ups – was conducted during the period 1998 to 2001 to cover the whole of Nigeria. The software industry population could not be predetermined because there was no prior empirical data but a total of 103 firms were identified by the survey². This represents a sub-set of all the total number of firms identified: only those companies that develop, modify and/or implement software were included. Of these firms, two-thirds were only involved in IT activities, while one-third were involved in multiple business sectors including IT: a reflection, perhaps, of a lack of true specialisation in software among firms in the sector. On the basis of the survey, we estimate the actual total number of active software firms in Nigeria to be between 130 and 150.

Nigeria Background

Nigeria, a federal republic in West Africa, consists of 36 states plus a Federal Capital Territory. It contains about one fifth of black Africa's population and exports are dominated by oil. It has a "typical" African state profile in terms of human development indicators (see Table 1: adapted from ITU (2002) and UNDP (2003)), and also in terms of technological infrastructure where – despite high diffusion growth rates in recent years – the penetration rates for digital technologies remains low.

¹ The overall research project covered more than just this survey; it included action research on a software development project and analysis of software development using activity theory.

² Where a company had more than one branch, it was only counted once via its head office.

Table 1: Technology Development Indicators for Nigeria and Other Countries

Indicators	Developing Countries		Developed Countries		
	<i>Nigeria</i>	<i>Ghana</i>	<i>United Kingdom</i>	<i>Finland</i>	<i>United States of America</i>
Population (2001):	116.9m	20.9m	60.1m	5.2m	285.9m
Human Development (2002):					
Life expectancy at birth (years)	51.7	56.8	77.7	77.6	77.0
Human Development Index value	0.462	0.548	0.928	0.930	0.939
Education Index	0.58	0.62	0.99	0.99	0.98
Information Technology (2002):					
PCs per 100 inhabitants	0.33	0.68	37	447	63
Internet hosts per 10,000 inhabitants (Total)	0.09 (1030)	0.14 (313)	485 (2.87m)	2343 (1.22m)	3729 (106m in 2001)
Internet users per 10,000 inhabitants (Total)	16.7 (200k)	19.4 (41k in 2001)	4062 (22m in 2001)	5089 (2.65m)	5375 (155m in 2001)
Telephony (2002):					
Mainlines Per 100 inhabitants	0.58	1.16 (in 2001)	58.74 (in 2001)	54.73	65.89
Mainlines Per 100 inhabitants-CAGR ³ (%) 1995-02	5.9	21.0	2.7	0.1	1.3
Mobiles per 100 inhabitants	1.36	0.93	84.49	84.50	48.81
Mobiles per 100 inhabitants-CAGR (%) 1995-02	99.5	77.5	36.2	22.9	22.6

³ CAGR = Compound Annual Growth Rate

A. Industry General Profile

Firm Location and Ownership

80% of Nigeria's software companies were located in the South of the country; only 20% were found in the North (see Figure 1 and Table 2). This may reflect economic and educational factors, with the South having higher levels of earnings, literacy and educational attainment than the North (Soriyan *et al* 2000). As well as the overall North-South divide, the software industry also appeared unevenly distributed by state, with just 14 out of the 36 states plus the Federal Capital Territory (Abuja) registering the presence of a software firm. These firms were found in cities with a bias again towards economic and educational factors, with firms seeming to prefer locations that – while not necessarily best in terms of infrastructure – were commercial hubs where human resources were available. This was most markedly reflected in the concentration of firms in Lagos – Nigeria's commercial heart despite its infrastructural constraints, and home to roughly half of all software firms identified – as compared to Abuja which, as Nigeria's relatively new capital, has good infrastructure but limited commercial opportunities and a small labour market.

Figure 1: Software Company Distribution in Nigeria

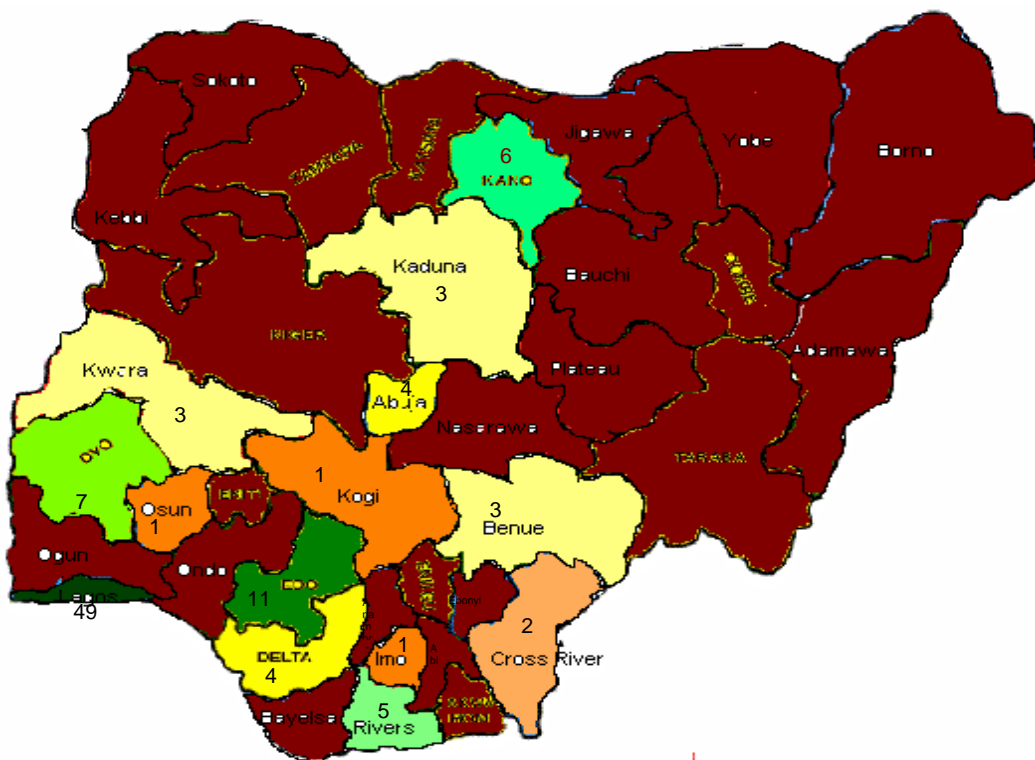


Table 2: Software Company Distribution by Zone and by State in Nigeria

Geographic Zone	State	No. Firms	State Percentage	Zone Percentage
South East zone	Imo	1	1%	1%
South South zone	Cross River	2	2%	
	Delta	4	4%	
	Edo	11	11%	
	Rivers	5	5%	22%
South West zone	Lagos	52	49%	
	Osun	1	1%	
	Oyo	7	7%	57%
North Central zone	FCT/Abuja	4	4%	
	Benue	3	3%	
	Kogi	1	1%	
	Kwara	3	3%	11%
North West zone	Kaduna	3	3%	
	Kano	6	6%	9%
Total	14 states	103	100%	100%

Ownership models were not diverse – 96% of the firms identified were Nigerian-owned (of which one was a government parastatal and all the remainder private sector), and just 4% were foreign-owned.

Personnel and Jobs

The software companies were mostly small in size: a typical software company has 11-50 staff. Very few of the companies had more than 250 employees: such companies had more than one branch and were often involved in business activities other than software development. On average, 1-20% of staff were female while 10% of firms employed no women.

IT professionals in the software companies were distributed as follows:

- 43.7% of the companies had 1-5 IT professionals,
- 27.2% had 6-15,
- 23.3% had 16-50, and
- 5.8% of firms had more than 50 IT professionals.

We can use these figures to estimate an average of something like twenty IT professionals per firm (though with significant variance). Companies with more than 50 IT professionals had two or more branches in most cases.

The average age of the IT professionals was in the 20-29 years range. 89% of the companies had no IT professionals over 50, and 85% had none under 20 years of age. The great majority of IT professionals in software firms had a first degree or equivalent, and many had a further degree; an indication that a university degree alone may no longer be seen as a sufficient threshold for entry into professional practice in software development activities (see Table 3).

Table 3: Qualifications of IT Personnel in Nigerian Software Firms

Highest Qualification	% of Personnel with Qualification
Secondary school qualifications only	15%
First degree or diploma or equivalent	36%
First degree plus Masters degree	23%
First degree plus Masters plus professional qualification	23%
PhD	3%

The percentage of staff in each job category in the software companies was as presented in Table 4.⁴ As can be seen from the modal category, a typical software firm had from one to five personnel in each of the five job categories. The average work experience of IT professionals was one to five years; few companies said they had staff with less than one year's experience.

Table 4: Distribution of Job Designations in Nigerian Software Companies

	Valid Percentage in Software Companies					<i>Other Categories</i>
	<i>Data entry clerk</i>	<i>Engineer or Technician</i>	<i>Programmer</i>	<i>System Analyst or Designer</i>	<i>Manager or Project manager</i>	
No response	41	10	19	13	9	64
1 – 5	42	60	56	70	79	20
6 – 15	11	19	18	13	12	11
16 – 50	7	12	6	4	0	3
51 – 100	0	1	0	2	0	2
Valid Total	60	92	80	89	91	36

Respondents were also asked to estimate how much staff time was allocated to the following activities:

- Training and education: this included everything from computer appreciation classes through training on data processing to training programmes on specific software packages. Often those packages were not developed by the firm concerned but were imported "standards". In some cases, companies did not own copies of the software and thus could only provide training in the abstract.
- Software systems installation: this typically meant installation of an imported package for a customer who lacked necessary skills and so required the firm to load the software and to then set particular package parameters to the customer's needs.

⁴ 'Other Categories' includes jobs like marketers, instructors or trainers, package implementers, and consultants.

- Long-term support to installed sites: this was often a continuation of the previous activity, providing technical or user support by phone or visit when customers ran into difficulties. Such services were provided for both locally-developed and imported packages.
- Package development: this covers the development of software products by a Nigerian firm. These were not the shrink-wrapped package of the type common in global markets but, as discussed later, were more a type of configurable "semi-package".
- Tailoring: this service arises in situations where different software packages (or different versions) are in use in an organisation and causing problems, making it necessary to reload or update systems and applications.
- Customisation: this is required when an acquired product does not fit the customer's particular requirements; the Nigerian software firm was then brought in to help modify the product (if locally-developed) or its modifiable components (such as reports, tables, interfaces, etc for an imported product) to try to meet those requirements.
- Consulting: this service was provided mostly on request and could include a wide variety of activities such as software project management, support, software development, software system acquisition and integration, and business process reengineering.
- Marketing: the active promotion of goods and services.

The results are shown in Table 5. These represent averages across the whole industry and thus they hide very great variations (for example between firms that principally focused on training vs. those working mainly on package development).

Table 5: Staff Time Spent on Particular Activities in Nigerian Software Companies

Activity	Staff Time Spent
Training & education	21%
Software systems installation	18%
Long-term support to installed sites	17%
Package development	16%
Tailoring/Customisation	11%
Consulting	10%
Marketing	7%

B. Output and Markets

Customers

A typical software company had between 11 and 50 customers (the average was 36 though a few firms involved with package installation had several thousand). There was a strong concentration among these customers. Almost all were private sector, with 84% drawn from the service sector (transportation, financial services, IT and other business services), 4% from the infrastructural sector (mining, oil, construction, electricity, gas, water supply, etc), 4% from manufacturing (production of food, textiles, machinery, etc), 1% from agriculture, and the remainder drawn from other sectors. There was a surprising lack of government/public sector organisations as customers (reflected above in the limited number of firms found in Abuja, where federal ministries and several other public sector organisations are headquartered).

As shown in Table 6, the size of customer organisation served did vary.

Table 6: Size of Customer Organisation Served by Nigerian Software Firms

Customer Type Served	% of Firms Serving
Micro-enterprises (1-10 staff)	10%
Small enterprises (11-50 staff)	16%
Medium enterprises (51-250 staff)	20%
Large enterprises (251-5,000 staff)	14%
Very large enterprises (>5,000 staff)	6%
Medium and large enterprises	13%
Other mixed sizes	21%

There was a significant concentration on the domestic market: three-quarters of customers were Nigerian firms based in Nigeria while the majority of the one-quarter of customers identified as "foreign" were actually representatives or joint ventures of multinationals also based in Nigeria. Software exports were therefore few and far between.

Different ways were employed to retain existing customers and improve the number of new customers. Of the four foreign-owned software firms in the sample, three used advertising or sales personnel to address marketing while one relied mainly on recommendation from existing customers. Within the much larger Nigerian-owned group, 11% used advertising, 35% used human networking ("who you know" or recommendations), and 54% used both. Overall, what was notable was the importance of personal relationships and connections in retaining and winning business for Nigerian software firms.

Outputs: Products and Services

Software companies worked on a broad variety of platforms, products and languages. Perhaps not surprisingly, there was a preponderance of work on networked PCs with relatively few firms servicing customers using mainframes or minicomputers. Relational databases were found in many firms, sometimes used alongside object-oriented or hybrid object—relational databases. Few firms made use of assembler language; several used fourth-generation languages.

The balance of work on local and imported applications is described in Table 7. In either case, the applications involved were predominantly found in three domains: payroll, accounting, and human resource information systems.

Table 7: Main Services Provided by Nigerian Software Firms

Main Service Provided	% of Firms
Servicing imported applications	51%
Developing and servicing local applications	25%
Servicing and developing local and imported applications	24%

On the one hand, this does show a fairly healthy level of local application-oriented activity. On the other, it means that three-quarters of firms relied wholly or partly on services – such as installation or modification – related to foreign packages. There was no indigenous development of software tools, and there was certainly a perception of growing penetration of the market by foreign products that were displacing locally-developed applications. As a result, for example, we found firms developing local applications shifting focus to provide software services such as training or Internet-based services.

C. Software Projects and Processes

Projects and Management

The number of software projects (which can also be interpreted as meaning "software contract") being handled by a software firm at any one time varied from one to a hundred, with an average of twelve. Average duration for these projects was around six months though, again, there was significant variance across firms (see Table 8).

Table 8: Average Length of Software Projects in Nigeria

Average Length of Project	% of Projects
Less than six months	48%
About one year	31%
More than one year	10%
A couple of years	5%
Several years	6%

Software development in the industry was organised as team work. The members were drawn mainly from the developing company and the customer organisation. Sometimes consultants were hired by the customer to represent their interests in the project team. The project or implementation leader was responsible for the implementation of the project, giving direction, assigning jobs to team members and identifying and attending to project issues. In 90% of cases the software firm selected as project leader a senior manager and/or IT staff member from their own organisation; in the remaining cases, the team was lead by a staff member from the customer side.

Software Project Methods

The Nigerian software firms surveyed were asked about the types of method they used on software projects. Reported types of software development method are summarised in Table 9. This shows significant use of formal methods but with a strong tendency to rely on in-house-developed methods rather than industry standards. Questions were also asked about risk analysis methods and about more general project management methods: in both cases companies mainly reported using formal methods developed in-house.

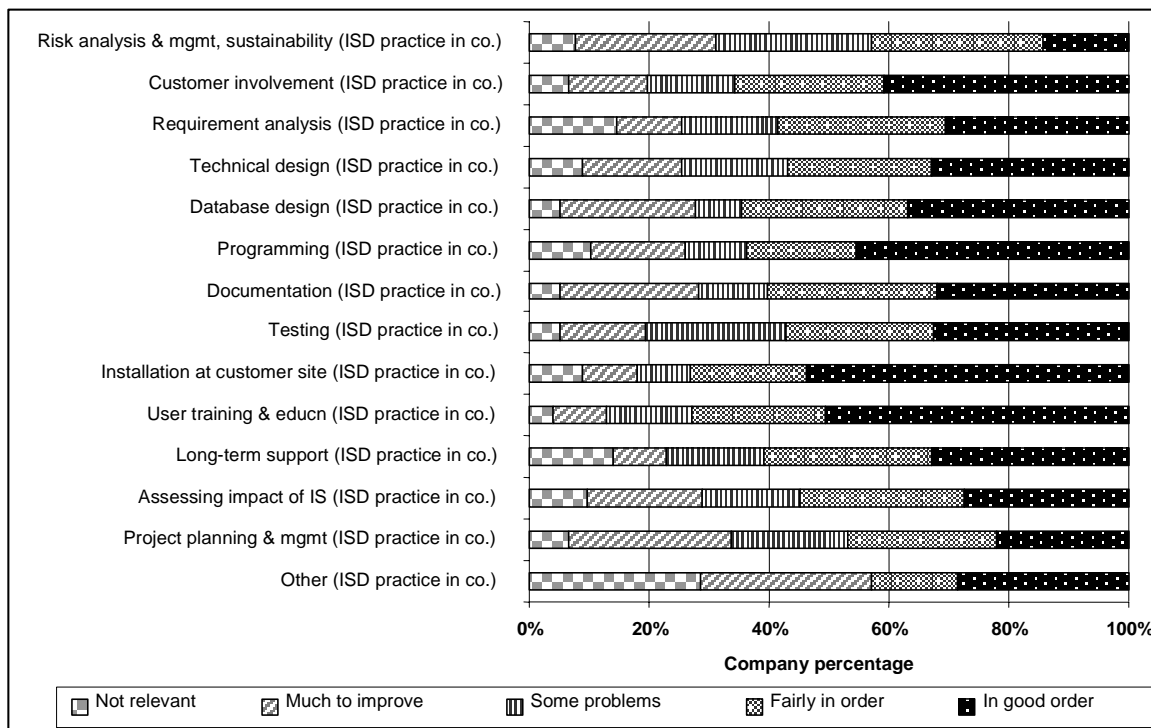
We were not able to ascertain, however, how formal these "formal" methods were in practice but we do hypothesise that the strength of in-house development of methods might reflect a number of factors. First, a lack of awareness of more general methods. Second, a need to modify Western methods to suit particular local requirements. Third, and related, the limited scope for applicability of standard methods (which are appropriate for "standard" projects and problems) when software firms often find themselves facing non-standard projects and problems.

Table 9: Nigerian Software Development Methods

<i>Development Method Used</i>	Analysis & Design	Programming	Testing	Documentation
No method / No standard	2%	1%	1%	0%
Informal method or Case-by-case method	14%	18%	18%	12%
Formal method developed in-house	48%	49%	62%	65%
Formal traditional method (SSADM, etc) or Formal method from outside source (e.g. textbook or software vendor)	3%	21%	9%	12%
Formal object-oriented methodology (UML, etc)	16%	n.a.	n.a.	n.a.
All methods except 'No method'	17%	11%	10%	11%

Software company respondents were also asked to reflect on the quality of various project processes and methods. Results of this rating activity are shown in Figure 2.

Figure 2: Nigerian Software Industry Assessment of Software Project Processes and Methods



These results present quite a mixed picture but there is some justification in drawing a conclusion that the relatively more technical and lower-skilled tasks – programming, installation, training – are seen as relatively less problematic. By contrast the more managerial and higher-skilled tasks – such as risk analysis and project planning and management – are seen as relatively more problematic. As discussed below, this then

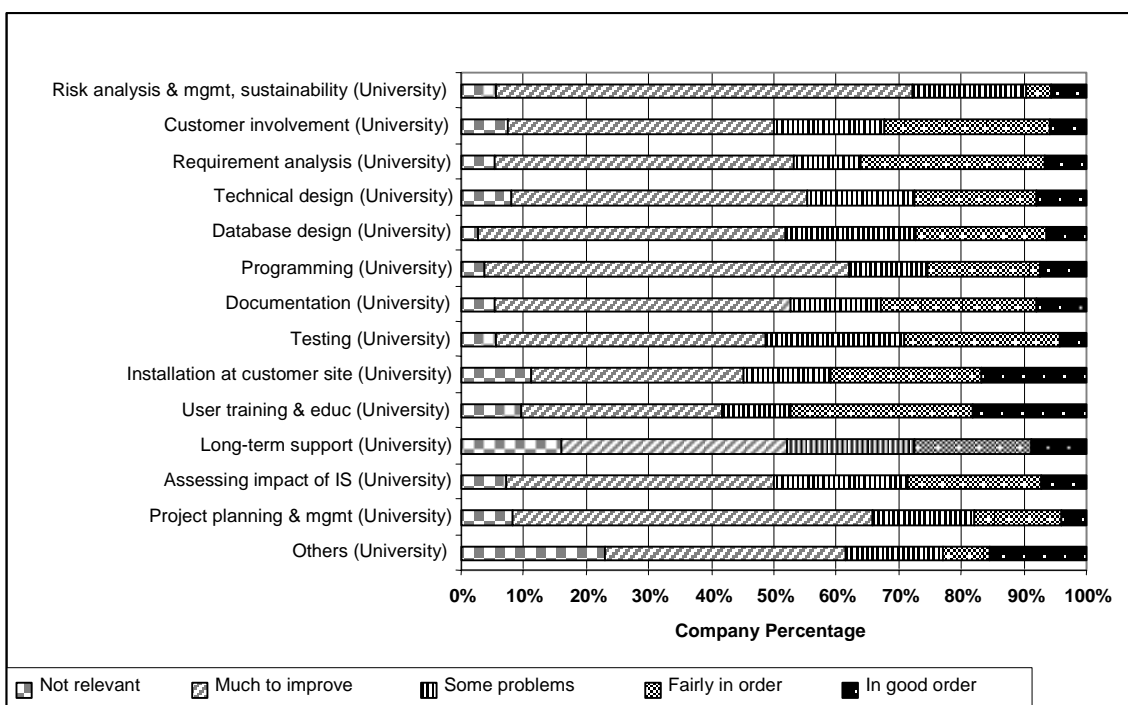
presents problems for those firms seeking to break away from simply providing limited value-added services for imported packages.

Sources of Process/Method Improvement

One obvious way in which to address the perceived shortcomings in software processes and methods is through training and education. Our survey therefore asked respondents in Nigerian software firms to rate the quality of education and training provided by Nigerian universities: the major supplier of education for IT personnel hired by the firms.

The results are presented in Figure 3: they indicate a fairly poor impression of universities' ability to produce the kind of competencies that software firms require, especially those competencies that companies themselves feel they most lack. This, in large part, explains why most newly-hired staff were given additional training by the firm – either on-the-job or overseas – before they were seen as ready for practice.

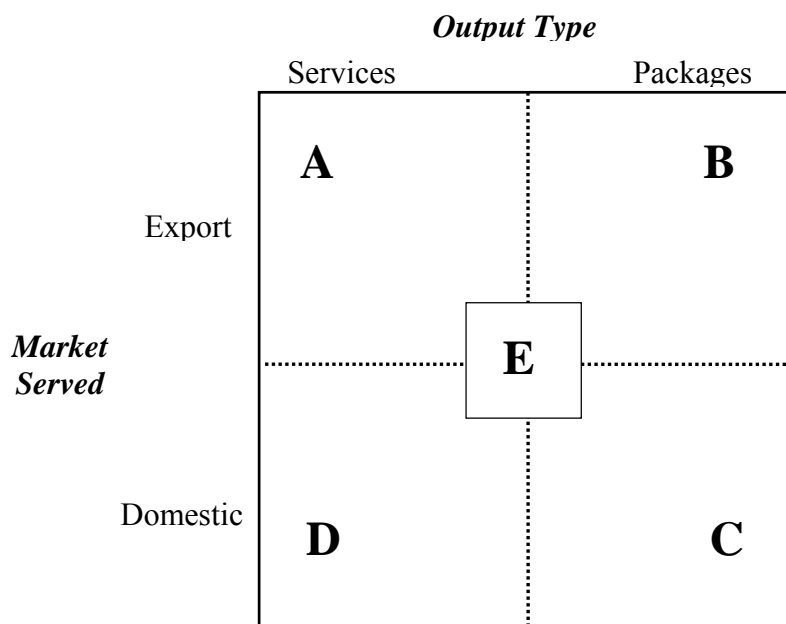
Figure 3: Nigerian Software Industry Assessment of University Software-Related Education



D. Conclusions on Strategic Positioning for Nigeria's Software Industry

Heeks (1999) presents five strategic positions that may be occupied by software firms and sectors in developing countries, as summarised in Figure 4. India, for example – much discussed as a developing country "giant" in software terms – has achieved much of its success through a focus on quadrant A.

Figure 4: Strategic Positioning for Developing Country Software Firms/Sectors



What of Nigeria's software industry: where does it fit into this model? We can firstly largely eliminate those positions – A, B and to some extent E – that involve exports since we found little evidence of exports from Nigerian firms and few plans by firms to explore exportation. This is in line with findings from more general review, which show the serious barriers to software exports that exist for most developing countries, particularly for "second-movers" like Nigeria (Heeks 1999).

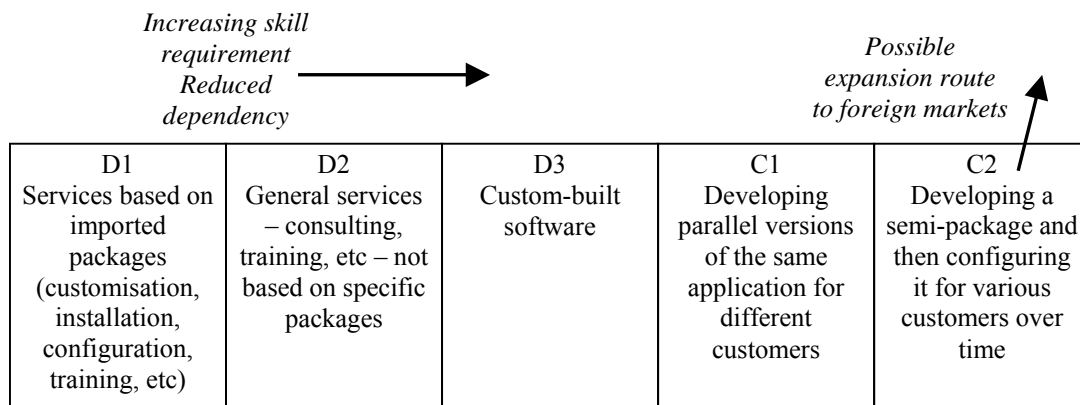
As noted above, the Nigerian software market is dominated by imported packages. However, this has not meant the Nigerian firms are simply retail outlets for those packages. Instead, the imported packages form the base for further software services to be offered by those firms. In part, this servicing derives from contextual differences: the fact that software packages developed in and for industrialised country markets are not exactly applicable in developing countries without some adjustment (Avgerou 1996). Perhaps in larger part, though, locally-provided services derive from the fact that many packages – products such as Microsoft Access – are "shells" or "skeletons" that must at least be populated with user-specific data and, at most, can be programmed with user-specific interfaces and processes.

All of this type of value-added services to imported packages lies firmly in quadrant C of the model. We have noted that this is the dominant type of activity within the

industry, and that there are signs of firms moving away from software development (lying in quadrant D or on the C/D borders) towards this type of foreign package-based work. However, this does not represent the totality of activity within Nigeria's software industry. We also find some firms custom-building software applications from scratch, and others creating what can be called a "semi-package" or "configurable package": something originally written for one customer that is then sold-on as a core of code with particular functionalities that can be configured for other customers. As with all Nigerian software industry activity, such applications were found especially in relation to payroll, accounting and human resource information systems.

Rather than conceiving the industry in terms of the discrete quadrants identified in the model shown in Figure 4, then, we may prefer to identify a continuum of activities overlain on the quadrants, as illustrated in Figure 5.

Figure 5: Continuum of Activities in Nigeria's Software Industry

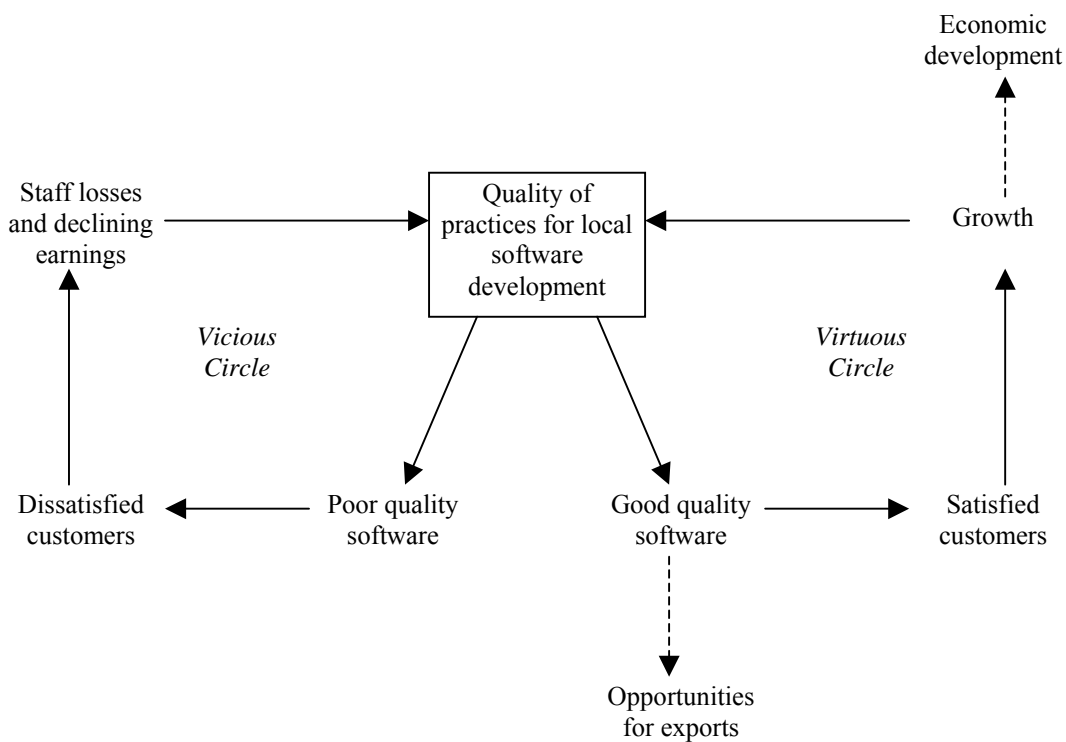


Overall, then, the Nigerian industry is dominated by activity towards the left-hand end of Figure 5 (D1 and D2), yet these may be seen as the weakest positions – ones that require least skill and which are somewhat economically undermining since they promote the import and use of foreign software. By contrast, positions towards the right-hand end of the continuum (e.g. the two in quadrant C) both require and develop broader sets of skills, reduce dependency, and are likely to provide greater earnings-per-head.

One strategic action should therefore be the identification of market segments in which C-type activities can flourish. As yet, for example, "semi-packages" are being produced in a very narrow set of areas: payroll, accounting and HR for the private sector. There are many other market segments that could be better exploited; segments that enjoy some level of protection from package imports through the specificity (including Nigeria-specificity) of their requirements. Examples in the private sector might include applications specific to sectors like hotels, transport, and manufacturing. In the public sector, which seems to have been significantly underserved to date by Nigerian software firms, many applications will have this specificity, from government ministries to health and utilities.

However, development of these strategic positions can only be properly achieved if software project processes and methods are of sufficient quality. Without that quality, there will be shortcomings in locally-produced software, which will turn customers off, and push the industry further towards a basis on foreign products: a vicious circle, as illustrated in Figure 6. On the other hand, if that quality can be built, then locally-produced software will be more effective than imports in meeting customer requirements. In that case, a virtuous circle can be created in which local software enjoys a growing market and feedback loops of learning and improvement that take it from strength to strength.

Figure 6: Vicious and Virtuous Circles for Development of Local Software in Nigeria



In part, responsibility for the path ahead lies with the software firms themselves. In part, too, though, responsibility lies with local educational establishments – particularly universities – which must "raise their game" in terms of the relevance and quality of the skills they provide so that the foundation for a vibrant and competent local software industry can be assured.

Acknowledgements

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