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SCHOOL OF COMPUTING & INFORMATICS

A FRAMEWORK FOR MOBILE CONTENT BUSINESS

BY

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Submitted in partial fulfillment of the requirements of Master of Science in Information Systems

DECLARATION

This project as presented in this report is my original work and has not been presented for any other university award.

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This project has been presented in partial fulfillment of the requirements of Master of Science in Information Systems of the University of Nairobi with my approval as the University Supervisor

Signature: _____ Date: 23/07/2012
Tony Omwansa

DEDICATION

This work is dedicated to my late grandfathers, Joseph Mathai and Isaac Ndurumo, both very dedicated and kind men. Despite not having had the advantage of formal schooling, they truly believed in the value of education.

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I would like to thank God for providing the energy, time and resources to complete this work.

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ABSTRACT

Faced with increasing competition on the revenue channels of voice and SMS, mobile network operators (MNOs) logically need to evaluate alternative sources of revenue. One of the emerging sources of revenue is mobile content. Whereas MNO have been offering mobile content, it has usually been done as a basic revenue share agreement between MNO and a Premium Rate Service Provider (PRSP) in an exclusive relationship. This study comparatively reviews 5 frameworks by using the framework of STOF (Services, Technology, Organization and Finance) as the base framework. Comparison is done against the Zachman framework, Telemanagement Forum (TMF) Frameworx®, Open Group Architecture Framework TOGAF® and the Government of India Mobile Governance framework. An updated STOF framework is proposed and tested by collecting responses from an MNO operating in India and 17 countries in Africa as well as 2 Kenyan MNOs. The revised framework can be applied in the development and running of a mobile content business value-chain that draws upon academic research and is validated by business practicalities.

LIST OF FIGURES

ACRONYMS

2G	2nd Generation (GSM)
3G	3rd Generation (GSM)
3GPP	3rd Generation Partnership Project
A-GPS	Assisted GPS
API	Application Programming Interface
ARPU	Average Revenue per User
BSS	Business Support Systems
CAB	Charging, Accounting and Billing
CAPEX	Capital Expenditure
CCK	Communications Commission of Kenya
CDMA	Code Division Multiple Access
CDR	Call Data Record
COPS	Common Open Policy Service
CRANE	Common Reliable Accounting for Network Element
CRM	Customer Relationship Management
CSD	Circuit-Switched Data
EDGE	Enhanced Data Rate for GSM Evolution
EPROM	Entrepreneurial Programming and Research on Mobiles
GIS	Geographical Information System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications (Groupe Speciale Mobile)
GSMA	GSM Association
HSDPA	High Speed Downlink Packet Access
HSPA	High Speed Packet Access
HSS	Home Subscriber Server
HSUPA	High Speed Uplink Packet Access
HTTP	Hypertext Transfer Protocol
I-CSCF	Interrogating Call State Control Function
ICCMP	Inter-Carrier Content Management Platform
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPTV	Internet Protocol (IP) Television
ITU	International Telecommunications Union
LTE	Long Term Evolution
MCSK	Music Copyright Society of Kenya
MMS	Multi-media Messaging Service
MMSC	MMS Center
MNO	Mobile Network Operator
MVNO	Mobile Virtual Network Operator
MP3	Moving Pictures Expert Group (MPEG) 3
NGN	Next Generation Network(s)
OPEX	Operating Expenditure

OSS	Operations Support System
P-CSCF	Proxy Call State Control Function
PRSP	Premium Rate Service Provider
PPP	Public Private Partnership
QoS	Quality of Service
RADIUS	Remote Authentication Dial In User Service
S-CSCF	Serving Call State Control Function
SDP	Service Delivery Platform
SIM	Subscriber Information Module
SIP	Session Initiation Protocol
SMPP	Short Message Peer-to-Peer (SMPP)
SMS	Short Message Service
SMSC	SMS Center
SNMPv3	Simple Network Management Protocol version 3
SOA	Service Oriented Architecture
STK	SIM ToolKit
TACACS	Terminal Access Controller Access Control System
TIPHON	Telecommunications and Internet Protocol Harmonization Over Networks
UMTS	Universal Mobile Telecommunications System
USSD	Unstructured Supplementary Service Device
VAS	Value Added Service(s)
VPN	Virtual Private Network
WAP	Wireless Application Protocol
WCDMA	Wide-band CDMA
WiMAX	Worldwide Inter-operability for Microwave Access

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CHAPTER 1 INTRODUCTION

Beginning late 2008, mobile telephony operators Econet (subsequently renamed Essar Telecom Kenya) and Orange entered the Kenyan market that was hitherto being served predominantly by Safaricom and Celtel (later acquired by the Zain Group and subsequently sold to Airtel). A number of rapid, successive tariff changes, promotions and new service offerings followed thereafter. Tariff options like Vuka and flat rate options of as low as KSh. 1/- per minute also quickly emerged. There was a general atmosphere of reactive moves from the two established market players. For example, Safaricom responded by offering the voucher-based Jibambie tariff which was initially to last until 31st December, 2008 but was extended until 31st January, 2009. The effect of this top-up based tariff was to finish off other Safaricom tariffs like Jambo, Super Taifa, Super Tariffic and Saasa which had been in existence for less than a year. Celtel announced the lowest cross-network charges for the first time in Kenyan history but later announced a loss of USD 90 Million. Orange pursued initiatives such as Family& Friends, a preferential tariff where a subscriber enjoys significantly lower rates when calling frequently called numbers. There were also promotions where SMS were free.

In short, within a period of roughly four months, each Mobile Network Operator (MNO) in Kenya pursued numerous and diverse pricing options to address a changing market landscape. The pace of the competition on voice and SMS front was to further heighten in August 2010 when Airtel, now under new management, slashed prices by up to 50% and the other operators matched this move. The trend in 2011 and 2012 has also been one of constant price changes, lowered revenue from voice and market uncertainty in telecoms.

The rapid price changes on the voice and SMS revenue channels have served to focus attention on mobile value added services (VAS) and it is on this front that MNOs are making forays into new areas such as money transfer services, utility payment services and internet bundles.

From the graph below, it is expected that going forward, MNO's will have even less leeway to perform upward pricing decisions as prices are steadily heading downwards driven by market forces. In particular, it is projected that voice and SMS revenues will decline even further leaving MNOs searching for the compensatory revenues from data revenues, specifically mobile content and applications. Efforts have already been

witnessed across operators: Airtel and Orange are in the process of rolling out 3G services and Safaricom, which already has 3G, is steadily growing its WiMAX network. MNOs are also pursuing bundling of data services where subscribers are enticed to purchase x number of megabytes of usage at a preferential price, with the proposition that the bigger the bundle, the lower the unit cost of a megabyte.

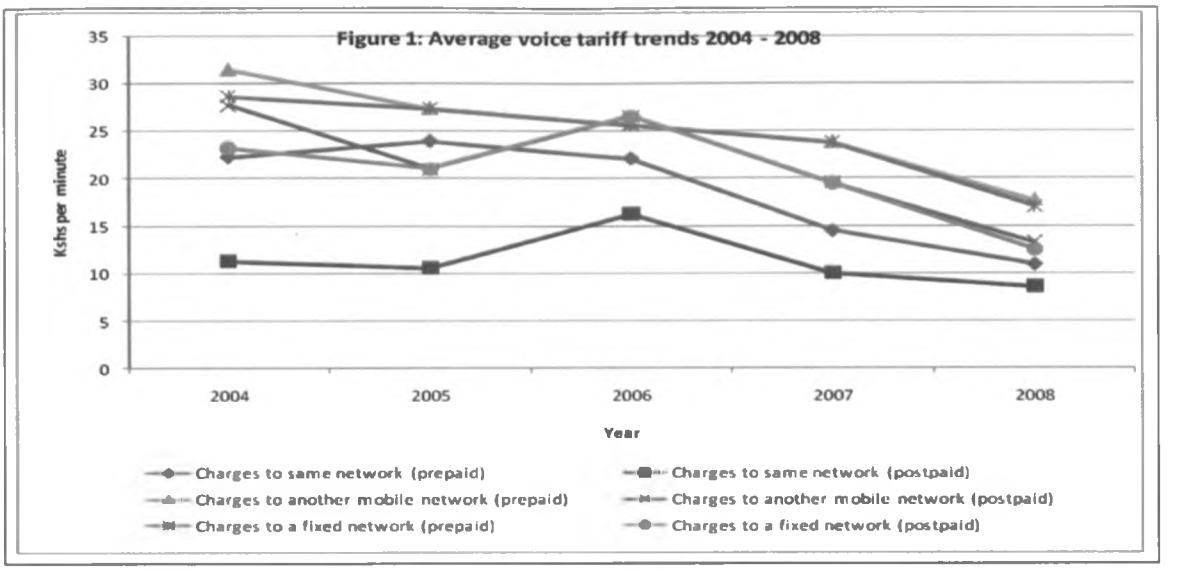


Figure 1 Trend of Call Charges
Adapted from Communications Commission of Kenya, Review of Implementation of Interconnection Determination No.1 of 2007

1.1 General Statement of the Problem

In light of higher competition, MNOs are increasingly re-evaluating pricing of their services and diversifying products from mainstream voice. This comes with its own set of risks. For example, the diverse product portfolios sometimes constitute a risk as changing the composition of one revenue stream can have a cannibalizing effect on the other streams. Likewise, a strategy that is out of touch with the competitive environment can have a negative impact on subscriber perceptions and render the firm unprofitable in the long run. Arriving at optimum (attractive yet profitable) service offering in manner that is fast, efficient and reliable is thus essential.

The landing of the fiber-optic cable in Kenya and other African points of presence has been viewed as an important event in the business of mobile broadband. It happened at a time when, worldwide, revenue from voice and SMS (two of the main services which have formed the forte for most mobile operators) are on the decline leaving mobile

content access via broadband technologies as one of the possible frontiers to generate new revenues. The challenge is that mobile content requires more refined framework (as opposed to traditional linear retail voice proposition of "use this much and pay this much") and calls into play revenue share arrangements, engagement of content developers and marketers and the set-up of processes to manage the entire value chain end to end. To navigate this frontier, there is need to employ an appropriate framework.

1.2 General Scope and Application of Study

This research applies to the evaluation of frameworks for GSM mobile content.

1.3 Problem Statement

As the number of mobile network operators increases and with higher levels of tele-density, mobile telephony companies have to contend with more competition. Voice and SMS, traditionally the main revenue-earners are on a decline. Customers are also realizing that the additional competitors in the MNO industry provide them with more choice hence the demands for lower prices. The advent of audio and video mobile technologies such as internet via WAP, MMS, ring-back tones and wall-papers is thus appearing as one avenue that can be a win-win situation for content developers, mobile network operators and subscribers alike. The evolution of mobile technologies from analog to digital and especially GSM progression from 2G, EDGE, 3G and now LTE provides an increasing field of opportunities. However, for these opportunities to be realized, proper frameworks need to be put in place to manage the development, distribution and pricing of mobile content. Mobile operators thus have to move from being providers of a bit pipe (mere access to the internet) to developing a sustainable value-chain that presents relevant and affordable mobile content in order to sustain customer interest and return a fair value on investment, hence the need to put in place a well grounded and adequately tested framework.

1.4 Purpose Statement

The purpose of this study is to evaluate several of the existing frameworks that would be applicable to mobile content, propose improvements and test the improvements by presenting them to a business setting.

1.5 Significance of the Study

Apart from the basic benefits accruing to content developers and mobile network operators, mobile content, when well developed, distributed and priced, presents an opportunity to make advances in social-economic development by contributing to areas such as education, commerce and health. Closer home, with the growing mobile penetration in Kenya, mobile technologies present channels for distribution of content that can be used to empower the Kenyan citizenry, provide opportunities for e-entrepreneurs and further grow MNO revenues (hence benefiting shareholders and the government which receives taxes from the same).

1.6 Objectives of the Study

a) Evaluate existing frameworks that would be applicable to mobile content
b) Identify improvements to the frameworks
c) Present and test recommendations on new framework/amended framework by obtaining and analyzing responses from a select group of management in a telecommunications setting.

1.7 Basic Assumptions and Limitations of the Study

Content accessed using other digital and non-digital channels e.g. personal computers, television, outdoor advertising has not been reviewed in this study. This work has been limited to GSM mobile content; issues specific to CDMA networks and other forms of mobile communication networks e.g. WiMAX have not been addressed. Primarily, this limitation of scope has been arrived at with the conscious acknowledgment that the GSM standard is the dominant technology in the area of mobile communications. The distinction between mobile applications and mobile content has not been made hence the term content as used in this work, refers to both content and applications.

CHAPTER 2 LITERATURE REVIEW

2.1 Mobile Communications using GSM

According to the GSM Association (GSMA), GSM is an open, digital cellular technology used for transmitting mobile voice and data services. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS. The system operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. By putting in place a harmonized frequency spectrum across most of the globe, GSM's international roaming capability allows users to access the same services when traveling abroad as at home. This gives consumers seamless and same number connectivity in more than 218 countries. Review of statistics from the GSMA website indicates that terrestrial GSM networks now cover more than 80% of the world's population.

The GSM standard provides a common set of compatible services and capabilities to all mobile users across Europe and several million customers worldwide. Lin and Pang (2005) noted that at its heart, GSM has five critical components namely services, quality of service, radio frequency utilization, network and cost.

Services: It is especially important to have service portability, ability to use the service in standard mobile phones (mobile stations) in all participating countries and exploit roaming features.

Quality of Service (QoS) and Security: GSM aims to have the QoS at least twice as good as previous analog technology. It also uses encryption for security.

Radio Frequency Utilization: This technology aims to offer a high level of spectrum efficiency through concepts such as frequency re-use and capability to operate in the entire allocated frequency band.

Network: Use of a standard numbering plan based on ITU recommendations and avoiding modifications to existing public networks.

Cost: In all areas, GSM aims to choose system parameters that limit the cost of the entire system with a deliberate focus on keeping the mobile stations cheap.

Relation of GSM Standard Components to Content

The above components are relevant to mobile content as follows:

Service: Portability of service means that delivery of content can be standardized.

Quality of Service: In order to provide attractive experience, QoS parameters are important for mobile content.

Radio Frequency Utilization: The concept of frequency re-use, which enhances coverage, is important in ensuring that wide coverage is achieved. The wide GSM coverage lends itself to economies of scale.

Network: given the standardized network operations, developers of content from different regions, countries or even continents can find market for their content on a varied array of GSM networks. The challenge is commercial arrangements and not necessarily technological limitations.

Cost: Especially in low per-capita income countries, cost is a major barrier. Having an affordable communications network means that the cost of transmitting content is not prohibitive hence better revenue margins for content developers and mobile network operators.

2.2 History of Mobile Content

From the advent of GSM, content has primarily been delivered through SMS. It can also be delivered through the voice channel e.g. by use of Interactive Voice Recognition (IVR) systems but SMS is dominant. With the advancement of data and IP communications, GSM naturally evolved from the basic circuit-switched-data (CSD) which was accessible via dial-up options and moved to faster speeds progressively marked by milestones such as GPRS, EDGE, 3G, HSPA and now LTE, according to Tanenbaum (2002).

	bits per second (bps)
CSD	9.6
GPRS	40
EDGE	120
3G/WCDMA	384
HSPA	1,000
LTE	100,000

The evolution of the data technologies further provided avenues for transmission of more enriched content thus moving from text to audio and video. Although SMS has not been replaced as a major channel of content, it has been heavily supplemented by the likes of

WAP and MMS. The availability of smart phones and development of light browsers has thus further embedded data communications as a far more robust and flexible way of availing content to subscribers.

2.3 Applications of Mobile Content

Worldwide, mobile content has various applications. Some of them include education, entertainment and e-commerce solutions. Concepts such as m-commerce are also gaining ground and can also be facilitated by use of mobile applications such as SIM-based toolkits (STK). De Reuver (2009) states that mobile services can relate to any type of service offered over a mobile device, connection and/or session and that based on the value proposition, mobile services can broadly be classified into information, communication, entertainment, transaction and business services. Mobile content spans easily across the information, communication and entertainment categories, in a sense bringing the phrase mobile edutainment to mind.

The question of relevance of content is pertinent. Scott et al (2004) argue that some of the content being offered to the poor populations of Africa lacks relevance. They cited examples of horoscopes and football results. Instead of such content, they proposed development of locally designed, mobile-based solutions by local technology entrepreneurs with a bias towards political and socio-economic advancement. While acknowledging the difficulty of predicting the future, they envisioned that within the 2004-2014 period, mobile phones would offer a range of data based services and highlighted some of the emergent applications as market and other agricultural information and financial services using either voice or text. Such development would be accompanied by convergence of mobile telephony with other digital technologies. This study however did not evaluate pricing and/or matters of revenue. Neither did it evaluate the various stakeholders and arrangements that would be necessary to succeed in delivering relevant, affordable and appropriate mobile content.

Kiptalam and Rodrigues (2010), in a study that evaluated Internet utilization in urban and rural schools in Kenya, also noted that there were low proportions of teachers (18.4%) with access to local web-based training programs. 24.5% of teachers had access to local web portals. This is as a result of lack of locally relevant material online. In both rural and urban settings, it was noted that finding or accessing information was the top purpose

for over 75% of teachers. The rising use of mobile broadband was also established - 73% of the students owned a mobile phone and 52% of these students were using mobile phones to access the Internet. It would thus appear that the problem is not one of mobile devices availability or network infrastructure and coverage – mobile content is lacking.

2.4 Mobile Content Consumption

In proposing a framework for mobile entertainment consumption, Subramanya and Yi (2006) identified user-related factors and technology related factors as the parameters influencing the content consumption. Specifically, under user-related factors, interactivity, sharing, locating content, tariffs and cost, billing and payments as well as user interface were considered important. Content generation, content transport and content rendering fell under technology related factors and together the user-related parameters and technology-related factors act in tandem to define the content consumption experience. Subramanya and Yi (2006) concluded that the emerging 3G and post-3G technologies would further spur the production and consumption of "enormous" amounts of content on mobile devices. They also concluded that proper frameworks of mobile content consumption would effectively stimulate content development and deployment in a cost-effective manner and result in better consumption experience by users. Their proposed framework however was intended for designers and developers of mobile content and services. It did not address other stakeholders e.g. MNOs and regulatory entities who are all interested parties in mobile content.

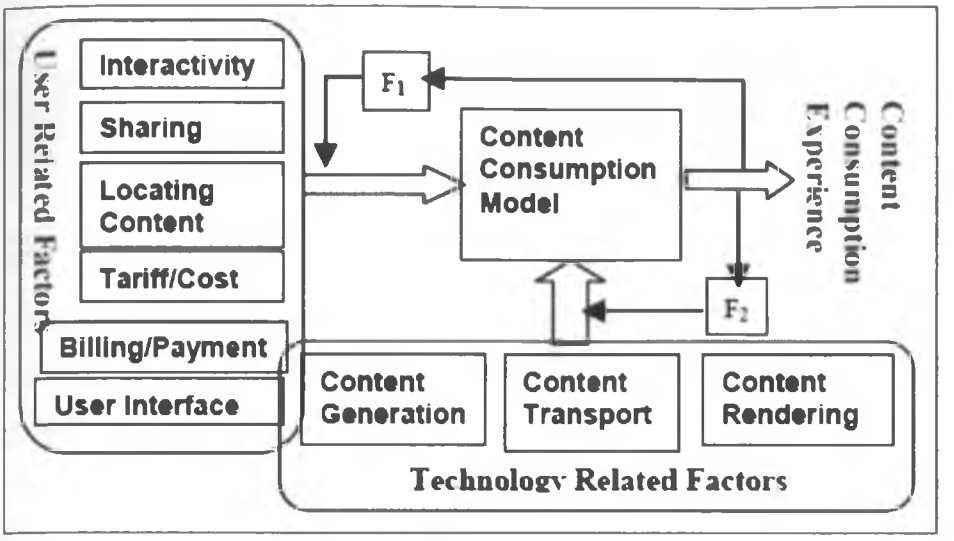


Figure 2 Factors influencing mobile content consumption
Adapted from Subramanya and Yi (2006)

In the work referenced above, it was noted that the following are important:

- Content tariffs
- Pricing parameters and especially competitive pricing models / options
- Use of cost amortization
- Accurate billing
- Provision of various payment options

They concluded that as much as the emerging NGN technologies are expected to champion the production and consumption of considerably higher amounts of content on mobile devices, frameworks of mobile content consumption would play an important role in content development and deployment in a cost-effective manner and better consumption experience by users.

If we home in on the Kenya case, Premium Rate Service Providers (PRSPs) are principally the main sources of mobile content. PRSPs sell content using a subscription-based premium model where they enter a revenue share model with MNOs. The content is delivered to the end subscriber over the MNO's network infrastructure and the end subscriber is billed by the mobile operator. This is a typical store-operations type of transaction.

The value chain is thus:

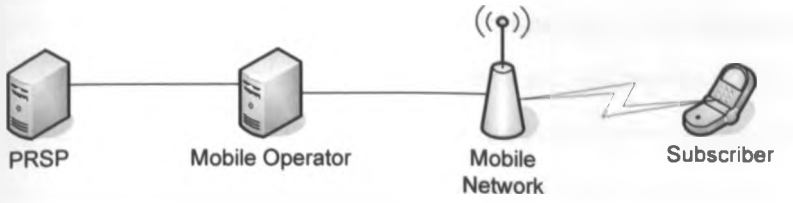


Figure 3 Basic Content Chain in Kenya

There is room for improvement in enriching the pricing options of mobile content. Cattelan et al (2006) proposed a platform for free trade of digital content. The free-trade platform allows users to market and resell copies of digital content to other users at a commission. Due to this motivation, such resellers would end up driving higher sales, to the benefit of operators and content providers. In addition, the digital music business was worth at least US $1.1bn as early as 2005 and this would form a considerable market spurred further by an innovative business arrangement which works on the basis of content resale.

Some of the benefits that would accrue from such a business arrangement include: shrinking operational costs for service providers by shielding them from marketing costs; ability to collect information from the whole universe of transactions and this can be used in data mining and further improving pricing schemes; quality improvements on the mobile content; recruiting a powerful marketing and sales force that then creates a viral marketing effect; ability to exploit social interactions to push up sales volume and also allowing content authors to start their own production with minimal investment. This work however did not evaluate user experience arising from such an approach. Neither did it evaluate/test potential or actual take-up from network operators or even content developers.

2.5 Technological Trends in other Mobile Markets

Whereas it is possible that the African markets will not necessarily adhere to every development in the West, we have reviewed the developments in other markets to identify the current trends in the area of mobile content. Worth attention is the debate concerning the merits and demerits of walled gardens versus open MNO. De Reuver

(2009) stated that MNOs have been maintaining control not just on the communication network but also on the customer, customer data and transactions and that in order to be admitted to the portal, content providers are obliged to meet several conditions regarding branding and technology. In contrast the fixed Internet environment is much more opened up and content providers and internet service providers have no relationship at all. It thus would be of importance to review the walled-garden operation mode that MNOs are mostly operating in.

2.6 Walled-garden vs. Open MNO and the Role of GSMA in Standardization

Luukkainen et al (2009) state that for a long time, open APIs have been utilized by Internet Service Providers (ISPs) such as Google, Flickr and Yahoo. The same approach has been proposed for MNOs but MNOs have difficulties in justifying the opening of the walled garden. The main notable challenge has been the lack of valid business case i.e. MNOs have struggled with proving the benefits arising from opening up their networks and whether such benefits outweigh the risks. They further noted that whereas some open API trials were in place such as BT's Ribbit, Vodafone's Betavine, O2's Litmus and Orange's Partner, the most common APIs were limited to basic messaging. The vast majority of the other APIs had significant variations leading to a situation where a service developed for one operator will not work for another operator. In this particular study, Luukkainen et al (2009), the attraction for open APIs was identified to be in: accelerating service creation and innovation; attracting developers and end-users; creating stickiness; and realization of additional features for the main business.

Grégoire and Islam (2009) also noted that telecommunications world prefers walled-garden business model due to one primary reason - control over the end users. Such a style of operation seemingly provides customer and revenue control, control over the subscribers' information, QoS and security. It might also appear to reduce the CAPEX and OPEX cost and allow for faster introduction of consistent service offerings across the entire subscriber base. The contrarian view to this is that in the long-term, a walled-garden business model brings a number of key shortcomings, such as the cost and price of QoS and service customization in addition to limiting the subscribers' choice. These drawbacks especially become real when appetite for third-party services has fully

developed. Consequently, many end users are at risk of decamping from the walled-garden MNO model and shift to public Internet alternatives. From this, it appears that whereas a short-term premise is that ARPU will increase or be held constant, the long term portends losses for both the MNO and the end-users - the former suffers reduced ARPU and the latter is offered reduced choices. The service ecosystem is also deprived of the opportunity to increase participants. Frameworks for mobile content management need to be cognizant of this risk.

2.7 Reasons for Walled-Garden Approach

Luukkainen et al (2009) noted the continued prevalence of walled-garden style of operations in the MNO world is driven by a number of factors. Even with the fore-mentioned benefits of an open MNO model and despite the multi-faceted applicability in education, entertainment and utility, there are still reasons for the continued operation of MNOs as walled gardens and these are discussed below. It appears that the draw-backs are broadly in the technological, commercial and regulatory spheres.

Difficulties in Proving the Positive Financial Momentum of Open APIs

Being a business, MNO management teams are naturally expected to prove the business case for opening up their networks to other business entities just as they do with any other business initiative. Whereas the return on voice and SMS interconnection arrangements is easily proven, content is more complex and hence the business case may not appear sound enough to justify moving in this direction. Additionally, when MNOs decide to move in this direction, the pace may not be aggressive.

Strict Regulation

Where regulators impose many and stringent regulations, MNOs are left with little option but to continue to work as silos i.e. each MNO would only wish to be responsible for what it can reasonably be sure to control. This means, in the case of content, an MNO would be more comfortable generating/sourcing, managing, pricing and distributing its own content as opposed to interfacing with developers and distributors (also known as aggregators). In the event that the MNO does not actually develop content in-house, it then negotiates strict legal agreements with a content development firm. With regard to opening up a network, this would be seen as risky because the open APIs can be used to propagate content that leads to the regulator holding the MNO to account.

Sensitivity of Telephony Services with regard to privacy

Telecommunication services, by their very nature, are quite sensitive to privacy and any avenue that may lead to breach of the privacy is thus avoided. Open APIs, if not well-managed, can lead to breach of privacy which could then lead to the previously discussed issue of regulatory difficulties becoming real. Matters of security thus assume higher priority.

No Customer Pressure for Opening APIs

Before the wide adoption of internet technologies, customers have not been particularly insistent on services that would demand and justify open APIs but the mass-adoption of Internet services is now leading to demands for open APIs as customers would wish to have an even more inter-connected mesh of services.

Lack of Common Standards and Procedures

In the absence of common standards and procedures, it is difficult to come up with open APIs as each MNO is focusing on rolling out what works for its network. There is thus no common reference and hence commonalities are not exploited. The situation leads to operators each developing their own localized interfaces that are highly customized to their own environment, sometimes reaching the extent of customizing interfaces to proprietary systems from the multitude of vendors who provide infrastructure to the operator. A GSM network operator will typically have dozens of vendors of infrastructure for managing OSS infrastructure like mobile switching centers, home location registers, short message centre servers, GPRS and WAP gateways and billing systems; it will also have vendors for BSS elements also known as downstream systems for example Business Intelligence (BI) and Management Information Systems (MIS).

2.8 Enabling Mobile Content by use of API

Even with the foregoing, it appears that several MNOs have already started making efforts to reduce the stringency of the controls applied on their operations in a shift from walled-garden to a programmable MNO or open telco. A review of trends in other markets will serve to show some of the trends that mobile operators would be keen to review as the developments may herald the industry direction. We examine some of the opened-up content platforms that have been rolled out by Vodafone Group, British Telecommunications (BT), O2 and Orange and also highlight the lessons drawn from these brief case-studies.

2.8.1 Vodafone's Betavine

This online resource is divided into various categories e.g. Techzone, Social Exchange, Resources and Beta Services. There is also a location where users can customize their preferred resources ("My Betavine"). Specifically under Techzone, the resources listed include APIs, widgets and applications. The APIs enable developers to create internet applications once, with the aim of reaching millions of Vodafone customers on any device while being able to charge for it directly through Vodafone's billing systems. According to Vodafone (2010), there are various benefits to the developers and internet companies which make use of these APIs.

- **A single point of access to millions of Vodafone customers across the globe**: This opens up various markets in different locations without having to invest efforts to customize content for various markets. Issues of relevance of content however need to be dealt with but in general, there are certain common market demographics which will be attracted to the same type of content regardless of location e.g. teenagers worldwide are known to have preference for music, fashion and cinema (genres may vary).
- **Faster time to market for new products and services across several operating systems and handsets**. By avoiding the lengthy and complex process of customization, developers are able to achieve faster rollout. It translates into better return on investment as well. (To simplify, one developer may create applications and content that can be deployed on multiple networks at one go whereas in a walled-

garden environment, it would require either more personnel or time to achieve the same target.)

- **Enhanced revenue stream opportunities**: There is a multiplier effect in developing content once and marketing it across different customer segments and across different locales.
- **Simplified micro-payments for services through the use of Vodafone's existing billing systems:** Developers need not grapple with the intricacies of mobile services billing, which is a complex field by itself. By leaving this to the MNO, they can concentrate on developing content and applications.

Likewise, customers would benefit from:

- **A greater selection of more compelling internet applications and services:** This diversity is critical for uses such as edutainment where variety is a strongpoint. Customers are not limited to what developers in their local market come up with. Rather, a customer may be consuming and benefiting from content that was originated by a developer on any part of the globe.
- **More convenience and greater flexibility in paying for new services:** A new payment method/model only needs to be rolled out once and will be available to all customers. Likewise, variations to that model can be centrally managed.
- **A simpler and more intuitive mobile internet experience:** By standardizing, we achieve easier experience for users because they are shielded from millions of similar applications which do the same thing in different ways. It is also easier to build, test and refine ways of providing service to the customer.
- **Consistent quality of service across the entire Vodafone footprint:** Barring specific network issues e.g. problems at the radio or core network, a Vodafone-UK customer would experience the quality of a widget the same way a Vodafone-Greece customer or a Vodafone-Ghana customer would experience it.

2.8.2 BT's Ribbit:

In July 2008, UK's BT acquired Ribbit Company, which is still based in Silicon Valley for $109 M. This was a departure from Vodafone's approach of setting up and running Betavine. Ribbit was already an established player, with a large focus on the developer community for its telephony software. Ribbit thus forms an already established conduit

for BT to connect with developers and offer them BT's large footprint spanning 5 continents. Again the benefits to developers and customers would be similar to the Vodafone case. However, arising from BT's contrasting approach, it is notable that there are two routes to market for a MNO to start engaging developers using APIs - one is to develop the open APIs from scratch while the second option is to acquire or partner with an existing player who is already running a stable of developers who use APIs to connect to MNOs.

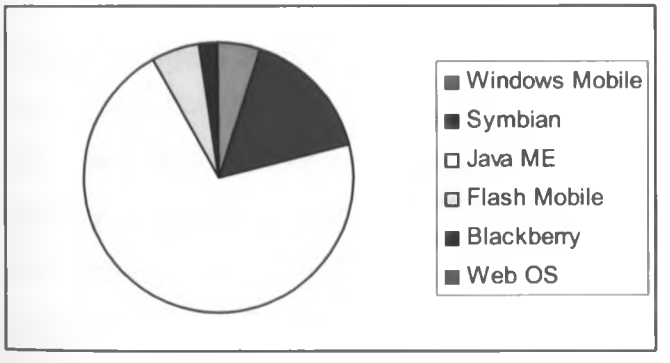
2.8.3 O2's Litmus

O2 states that Litmus aims to bring customers and developers together to create better applications. Customers get access to test new applications and can also chat directly with developers, letting them know exactly what they prefer to have in the applications. Litmus also has the option of paying customers who get involved in testing the applications. A member forum for discussing ideas is also available.

A review of the catalogue of applications on the Litmus site revealed certain trends:

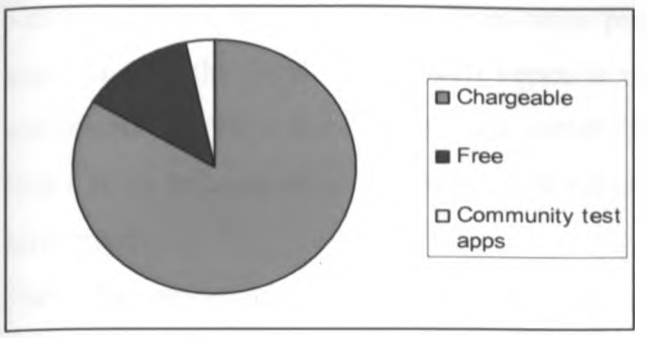
Platform:

Over 70% of the applications are java-based.



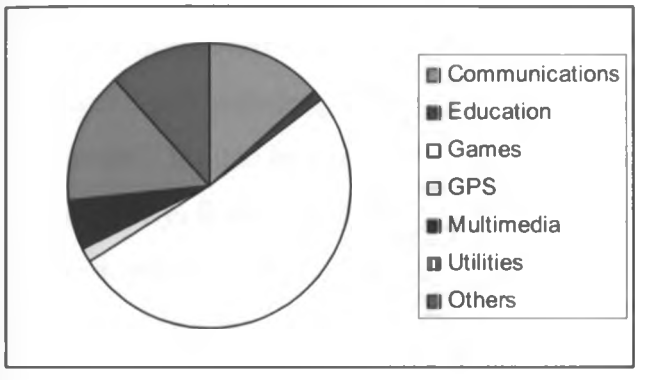
Type:

Over 80% of the applications are chargeable i.e. revenue generating



Category:

Games account for over 50% of the applications. The three highest categories are games, communications and utilities.



2.8.4 Orange's Partner

The Orange Partner APIs resource has clustered APIs into instant APIs, personal APIs and advanced APIs. Some of the APIs handle functions such as authentication, personal calendar, personal content, Payline (e-commerce), Contact Everyone API (broadcasts information via different media), SMS Internet API (broadcasts SMS to users), Click-to-call API (establishes phone calls), Location API (retrieve mobile location information) and Multimedia Conference API (creating web conference). These features indicate the wide array of possibilities presented by mobile content.

2.9 Constraints in Building Successful Developer Community

Opening up a network to become a versatile delivery channel for mobile content assumes that there will be sustainable sources of appropriate, relevant, quality-assured and reasonably priced mobile content. Otherwise, the network will be an un-used pipe on which the MNO has expended time and finances. The MNO can choose to develop this

content in-house or source for it from other parties. Whichever option is chosen, it is important that the developers be well-versed in content development in order to generate and sustain interest in the content to the extent that revenues are sufficient to cover costs. There is an industry-wide challenge in development of such content and this requires investment.

There are various challenges facing the developer community and Scott et al (2004) discussed some of them as:

- Weak networks and problems of access to key actors. Developers have been especially dependent on MNOs. This is perpetuated by MNOs operating as walled-gardens, a problem which we have discussed earlier in the literature review. In a sense, this results in a vicious cycle.
- Capital and knowledge constraints thus impeding financial opportunities.
- Severely limited business skills as well as the view that the African environment does not always foster a spirit of entrepreneurship.
- Poor access to technical systems and skills thus there are few software offerings relevant to content service delivery.
- Little collaboration between stakeholder groups resulting in fewer opportunities for sharing best practice and learning what has worked successfully as well as pitfalls to avoid.
- Lack of understanding of hybrid social/commercial models which perpetuate an outdated pigeon-hole thinking that creates problems for social ventures in investment, support and partnership building.

According to Kemibaro (2010), some of the individual mobile network operators have started pursuing initiatives that may result in better engagement of developers. Safaricom, for example, is championing the set-up of an Innovation Board. This board would oversee the process of engaging Kenya's technology community and general public in innovating. It would also vet business ideas and establish which opportunities are most viable and how to compensate innovators for those that get through. The nominees to the board are to be drawn from the developer community and the general public. Granted that innovation may not necessarily be limited to content but it would be expected that innovations around mobile content will feature.

By reviewing eMobilis (2010), on the education front, the eMobilis Mobile Technology Academy states that it is focused on providing locally relevant training to the students, with the aim of enabling them to gain practical skills and knowledge that enables them to work in the mobile cellular industry either as entrepreneurs or employees with the major network operators. It offers courses such as Certificate in Mobile Technology, Advanced Certificate in Mobile Technology, GSM for Customer Care Representatives and the Entrepreneurial Programming and Research on Mobiles (EPROM) Program. Some of the student projects indicate the varied use of mobile phone applications e.g. "Mobile Footah" is a football social network optimized for handheld devices where fans of local and foreign teams interact, an "M-traffic Application" which enables relaying of traffic information with the aim of decreasing congestion thus serving traffic marshals and ordinary persons in quest for real-time traffic information as well as an "M-Bus Booking Application."

The EPROM program is of relevance to mobile content. According to MIT (2010), this program was designed as an acknowledgement that today's mobile phones are designed to meet Western needs yet subscribers in developing countries, now represent the majority of mobile phone users worldwide. Africa, with Kenya at its forefront, is currently the fastest growing mobile phone market in the world. The continent's mobile phone use has increased at an annual rate of 65 percent - twice the global average. There is thus a business case for development of local applications and content.

MIT and Nokia jointly spearhead the EPROM initiative which covers areas such as Mobile Phone Programming for Entrepreneurs, An Introduction to Mobile Phone Application Development in Java and Mobile Web Application Development. This course is also offered in several Sub-Saharan African countries including the University of Nairobi (Kenya), Makerere University (Uganda), GSTIT (Ethiopia), Ashesi University (Ghana) and the Kigali Institute of Science and Technology (Rwanda). While such training may not be widespread, the advancement of training in areas of mobile content development would be critical in setting up a pipeline of skilled talent that can supply content.

In September 2010, according to infoDev (2010), two consortiums won the bid to become the hosts of the African Regional Mobile Application Laboratories and these

were *iHub_ consortium, comprising Nairobi's iHub, eMobilis, the World Wide Web Foundation and the University of Nairobi's School of Computing and Informatics, which would host the East Africa lab and in South Africa, the Meraka consortium, comprising the CSIR Meraka Institute, Innovation Hub, Innovation Lab and Ungana-Afrika, will host the Southern Africa lab. These mobile apps labs will be focal points run and used by Africans with the aim of increasing the competitiveness of innovative enterprises working in mobile content and applications. This initiative is spearheaded by Government of Finland and Nokia program, *Creating Sustainable Businesses in the Knowledge Economy.*

Whilst there are challenges in building a developer community, trends indicate that efforts are underway to generate a capable workforce that can develop mobile content. Positively, this is happening at both corporate and tertiary education level. Further improvement of synergies would be beneficial to the developer community. However, realization of benefits would require a framework of proper engagement between this fresh workforce and the MNOs.

2.10 Technological Trends in Kenya and Impact on Mobile Content

2.10.1 Content Delivery Platforms in Kenya

Safaricom Live is a WAP-portal that provides a platform to sell content under the categories of Music, Fun, News and Sports under the slogan of "Connect, Imagine, Discover". The music category contains popular recordings in audio and video and is organized according to genres e.g. Gospel, *Bongo,* Bollywood, *Genge,* Vernacular, and *Bamba Flava.* The content is audio-visual hence file formats such as MP3 are supported. The company also uses this platform to advertise services and existing promotions. Safaricom Live also contains links to popular sites like CNN, Facebook, Twitter, Yahoo! Mail, Gmail and Hotmail.

Subscribers access the Safaricom Live web-portal through data enabled mobile handsets. Subscribers who do not have capable handsets or dongles can request content through the traditional SMS channel but this works only for items such as ring tones and wall-papers. Review indicated that there is no direct interfacing to developers thus the WAP-portal is essentially a repository of content that is uploaded using Safaricom's internal processes.

Users of the platform do not have a forum to discuss content, rate the offerings or even offer suggestions for content improvement. There is no direct engagement between developers and consumers of the content.

Conscious segmentation of content did not appear to have been carried as one can expect that Safaricom's subscriber base comprises people in various stages of life, different income groups, varied professions hence different interests - yet browsing through the content, no specific categorization is in place. Content segmentations e.g. along the lines of health, farming, business and education would capture different population segments.

The chargeable content has a price tag and once the customer downloads the content, the charge is applied to the subscriber account. Billing is applied both on the item purchased e.g. a video clip costing Ksh. 25 (one-off charge) and the applicable GPRS charges (transport charges in a metered manner e.g. duration of connection or volume of IP packets delivered) - this is similar to De Reuver (2009) where billing fees were seen to include a charge for using the network resources and one for the content or service.

The Safaricom Live Portal does not have open APIs which a developer may use to interface with Safaricom network. However, in conjunction with Strathmore University, Safaricom set up the Safaricom Academy whose stated aims are to: promote local innovation in developing relevant applications in the Kenyan market; create an enabling environment for the development of relevant mobile applications and attract companies with applications to host them within the Safaricom Portal. The academy trains participants in such topics as Introduction to Telecommunication Technologies: GSM, GPRS, EDGE, 3G, HSDPA and WiMAX; Java Programming; Developing and Testing SMS and USSD applications as indicated by Safaricom Academy (2010).

The end-goal of the Safaricom Academy is to enable a talent pipeline of developers who can run content development firms and form a supply chain of content for Safaricom.

The other 3 operators: Airtel, Orange Telkom and Essar Telkom do not appear to have ventured into content portals but they deliver their content using SMS. However, Ouma (2010) reported that as Bharti Airtel, the new owners of Zain announced a group deal with IBM to manage the computing technology in 16 African operations; IBM would deploy a new content management system to offer rich media content such as music and video over mobile devices while stimulating the growth of the application developer

community. For instance, in the offing is a service named Spoken Web which is a voice-enabled Internet technology that enables users to access and share information by talking over an existing telephone – the service would be suitable for low-literacy populations who lack access to PCs or other devices.

2.10.2 Mobile Content using SMS

Currently in Kenya, network operators are principally delivering content using messaging and especially SMS. A full shift to using Web 2.0 technologies has not taken place and neither have open APIs been developed in order to take advantage of the Internet cloud.

The typical business arrangement is that the Premium Rate Service Provider (PRSP) connects to the mobile network operator's SMSC gateway using SMPP. End users subscribe to the service using 4-digit short-codes. Content can be charged on the mobile originating (MO) leg in which a subscriber is charged upon sending a request SMS or on the mobile terminating (MT), a scenario in which charging happens when content is pushed to the subscriber. The first mode of charging (MO, also known as pull) is preferable for user-initiated requests e.g. querying the weekend movies' schedule and the second one (MT, also known as push) would be practical for delivering items such as breaking news and scheduled morning broadcasts e.g. Bible/Quran verses. Some of the content contains breaking news, tips on life, romance, healthy living tips, stock prices, jokes and inspirational quotes. Mobile content delivery using SMS has its advantages but it also suffers from certain limitations.

In terms of pricing, it is much simpler and usually involves the network operator charging the subscriber a premium rate (i.e. a certain percentage mark-up on the on-net SMS rate) and then sharing the revenue thus realized with the PRSP. With regard to richness of content, it is limited. Services like navigational aid, instant messaging and chat, video on demand cannot practically be delivered on SMS channel.

2.10.3 The Shift to Delivering Mobile Content using open API

Whereas it is clear that Kenyan MNOs have not exploited open APIs concept, elsewhere in the world, there are emerging initiatives in mobile content delivery using open API such as BT's Ribbit, Vodafone's Betavine, O2's Litmus and Orange's Partner which have been reviewed previously. This lends credence to the assertion that faced with reductions in revenue from mainstream mobile services (voice and SMS), operators in the West have

already started to evaluate additional revenue sources and to take practical steps to realizing this revenue.

Aitken (2009) shows that GSMA's oneAPI project complements this mode of operation as the standards body has acknowledged that mobile application development often means using different APIs from different operators in order to provide access to their subscribers. At the same time many important network capabilities with regard to charging, messaging, location and user context are not accessible without a tight integration with operator systems. In consideration of this, the GSMA OneAPI Project aims to provide a set of commonly supported, lightweight, web-friendly APIs to overcome these problems in order to achieve effort and time savings in the creation of applications and content that is portable across MNOs. At the heart of it, OneAPI is a set of APIs which expose GSM network capabilities over HTTP. The oneAPI project is envisioned as an interface between web companies and other enterprises and the "programmable MNO" providing access to functions that manage Payments, Messaging, Bandwidth, Subscriber Information, Location and Presence.

Already, any MNO that is offering data services using GPRS or EDGE has the requisite infrastructure to at least deliver mobile content within its network to data enabled user User Equipment (UE) be it in the form of a mobile handset or modem/dongle/wireless router/terminal. The elements involved are the Base Transceiver Station (BTS) which communicates with the user equipment (UE) over the radio interface, the Base Station Controller (BSC) which controls a number of BTS elements and which contains a Packet Control Unit for handling requests from the BTS, the Authentication Center (AuC) and Home Location Register (HLR) which act in tandem to manage user profiles and authentication, the Serving GPRS Support Node (SGSN) principally responsible for mobility management and the Gateway GPRS Support Node which acts as a gateway to the Internet. The content repository acts as one of the elements serving packet requests channeled from the UE, through the intermediate elements (BTS, BSC, SGSN and GGSN). The restrictions have been on the diversity of the content repository as MNOs have not opened it up to interactions with developers using APIs.

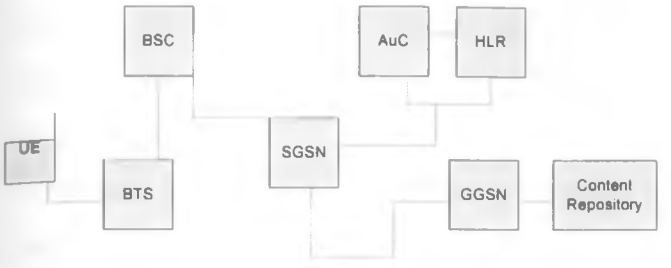


Figure 4 Mobile Content Delivery Using GPRS/EDGE

2.11 Review of Regulatory Environment

Just like in the traditional voice and SMS business, regulatory issues do arise with regard to mobile content. For instance, some content being proliferated on mobile networks may be indecent, inflammatory or unsuitable for consumption by individuals under certain age. Again taking the specific case of Kenya, the regulator, CCK recognizes the need to harness the emerging technological opportunities and also manage the various regulatory challenges. CCK proposes to adopt a market structure with three main segmentations which will form the broad segments of regulation:

- Network Facilities Provider (NFP)
- Applications Service Provider (ASP)
- Content Services Provider (CSP)

CCK has various key result areas as outlined in the CCK strategic plan covering 2008-2013 and these key result areas are relevant to content management:

• **An enabling regulatory framework:** Mobile content has various regulatory issues e.g. ensuring that the content is appropriate, decent and does not negatively target persons of specific race, gender, political or religious affiliation. Where such policies are flouted, then there needs to be in place a method of addressing shortcomings.

• **Facilitate universal access to ICT services:** Mobile content is one way of reaching the masses and can be used to educate, entertain and raise the standard of life in society. The growth of mobile content would be in furtherance of this CCK goal. CCK, for instance, is supposed to contribute to overall government objectives towards human, social and economic development. CCK recognizes that there are still marginalized areas which remain unattractive to commercial ventures by the private sector hence the pursuit of such initiatives as universal access funds. One of the strategies that CCK intends to

pursue involves supporting projects and initiatives aimed at developing relevant local content telecentres and ICT centres. These will be delivered through Public Private Partnerships (PPPs).

- **Efficient management of scarce resources:** the licensing of resources such as 3G spectrum falls under the remit of CCK. Delivery of certain types of content is dependent on the availability and fair allocation of the requisite spectrum.
- **Management of competition:** even if the market achieves open MNO model and progresses to collaborations in content generation, distribution and pricing, there will be various entities which are still in competition e.g. the MNOs, developers, aggregators, Intellectual Property (IP) owners e.g. artistes, brokers and advertisers. The role of the regulator in such a setting is to ensure that healthy competition exists and anti-competitive behavior and/or other unethical business practices are addressed in a fair, transparent and balanced manner. Because pricing is one of the frontiers where competitors engage, CCK aims to implement cost-based pricing mechanisms and periodically reviews interconnection arrangements that are in force.
- **Consumer education and protection:** Given that mobile content is still a relatively new frontier, consumers of mobile content need to be provided with proper channels of education. In addition, when their rights are violated, the regulator should step in and ensure that restitution is carried out. Tariff regulation also falls under this area. Subscribers also need avenues to report objectionable content, incorrect/unfair charging practices for redress by CCK and/or other statutory bodies.
- **Enhancing performance and accountability:** the various service providers need to be held to certain standards of performance and in this regard, independent review of Quality of Service (QoS) parameters by the regulator is important.

There are various challenges that CCK faces and they are recognized in the strategic plan. As an example, it must keep up with rapidly evolving technological trends, how to make sure that greater access to communication services and specifically content while at the same time making sure that consumer rights are safeguarded.

CHAPTER 3 MOBILE CONTENT FRAMEWORKS

We now review a select set of the current frameworks that would be applicable to the mobile content business.

3.1 STOF Framework

The starting framework chosen for this research is the STOF framework. In their work, which focused on evaluating the business potential of the open MNO, Luukkainen et al (2009) describe this framework as theoretical framework for the description and design of business model. At its core, it emphasizes a holistic approach using four domains namely **S**ervice, **T**echnology, **O**rganization and **F**inance.

Bouwman et al (2007), summarized the various domains as follows:

Service Domain: service concept and value proposition that organizations want to offer.

Technology Domain: technical functions and architecture needed to realize the value proposition.

Organizational Domain: agreements concerning the cooperation between organizations to deliver the value proposition.

Financial Domain: costs, investments, revenues and risks, and agreements on how to divide them among organizations.

The Four Domains of the STOF Framework

The four domains of STOF are discussed below.

Service Domain

The service domain examines the customer value of the service. This domain analyzes the value proposition of the service and also compares it to existing similar services or previous versions of the service. Under this domain, the following are examined: customer segmentation, pricing, ease of use, and the context of use. As such, the service domain is about the applications and use. Concepts such as intended value versus delivered value also fall under the service domain.

Technology Domain

There exists a direct relationship between the service domain and the technology domain since the latter is influenced by the requirements of the former thus leading to analysis of concepts such as technological architecture, applications, and devices. According to

Bouwman et al (2008), other important concepts under this domain include security, authentication and management of user profiles.

Organization Domain

The STOF framework recognizes that there is need to perform value-chain analysis in order to understand dependencies in the organizational setting and identify value addition processes during product definition. Various roles exist e.g. advertisers, API providers, MNOs and end-users (subscribers) just to mention but a few. In the case of mobile content, some actors might be: network operators, developers, advertisers, rights bodies e.g. MCSK, the regulator (CCK) and other statutory bodies. These actors have certain sets of requirements, resources and capabilities; they interact and perform certain activities in order to realize their goals and strategies.

De Reuver (2005) listed some of the potential organizations as Service provider (hosts the application that makes the service possible); Network operator (operates the mobile telecommunications network over which content is transmitted);Platform provider (provides the software that defines the general platform on which content is hosted);Application provider(develops the software that makes a service possible and that sits on the platform);Raw content supplier (supplies content in a format unusable for mobile service and terminal);Content developer (transforms raw content into content appropriate for delivery to mobile terminal);Content provider (provides appropriate/transformed content to the service provider);Content aggregator (serves as an intermediary between service provider and the content providers);Billing provider(provides billing services to collect revenues from end consumers);Marketing provider(markets the service - the customer would perceive that this party is the one delivering content) and Customer support provider(acts as point of contact for customer queries regarding the service and responds to customer queries).Since De Reuver(2005) was particularly focusing on Location Based Services, this study also evaluated the roles of user positioning provider (who would provide the x,y coordinates of the mobile device), GIS provider(who provides geographical information and GIS services and content geo-coding provider who is charged with the role of adding x,y coordinates to the content.

Finance Domain

The Finance domain shows the financial arrangements in the value network and illustrates how the actors aim to capture monetary value from the service. The main goal in the Finance domain is to create a win-win situation for all actors and to balance the division and sharing of benefits and costs. Bouwman et al (2008) noted that the key concepts in this domain include costs, revenues, capital, risks and their sources.

Bouwman et al (2007) stated that the STOF framework is apt in designing the business model for certain classes of services especially in the areas of e-commerce and mobile services. They further noted that the STOF framework can be viewed as a blueprint of how a network of collaborating entities targets to create and capture value from new, innovative services. As an illustration, Bouwman et al (2007) depicted the relationships in an IPTV offering as follows:

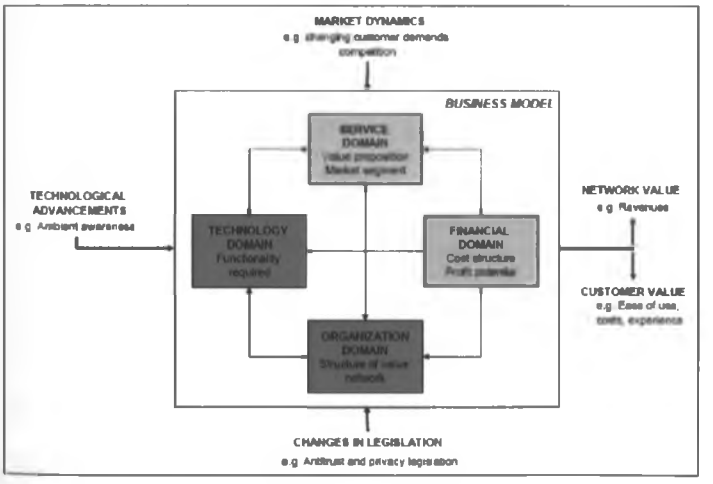


Figure 5 STOF Framework

In a simplified manner, under Service domain, value proposition and market segments are evaluated. The functional requirements are captured under the Technology domain while the Finance domain looks at cost structure and profit potential. The Organization domain contains the structure of the value network and the inter-relationships between the entities. This framework was principally developed for mobile services but is noted to be suitable for analyzing all kinds of digital services.

Previous work that has utilized the STOF framework:

Luukkainen et al (2009) used this framework in proposing an open MNO as one arrangement which would have new business potential for mobile operators by breaking down the silo method of operation. The open MNO, also referred to as programmable telco involves publication of standard APIs which allow content developers to inter-link with the MNO.

De Reuver (2005), in a study that examined the strategy that Orange Netherlands should pursue in offering wholesale mobile Location Based Services (LBS) also used the STOF framework. The study examined the different roles that the MNOs can assume, the technologies available for realizing the goals and the interactions that Orange should have with 3rd parties when offering the wholesale LBS product. For example, under the different roles, Orange could take on the part of being a network operator, a user positioning provider, a billing provider or a location privacy provider. The technology options available were to either use Cell ID information that is accessible from the serving BTS or to purely use GPS. It was recommended that Orange NL uses a combination of Cell ID and Assisted GPS (A-GPS). The charging models were proposed as revenue share, fixed access fee or fee per time unit.

Bouwman et al (2007) also used this framework in evaluating the robustness of IPTV Business Models. This study concluded that by choosing the right business model and paying due attention to the elements of Service, Technology, Organization and Finance, telecom operators (both fixed and mobile) can sustain the market competition and deliver customer value and economic benefit as they offer IPTV services. It was also noted that besides possible integration into content production and signing deals with multiple content providers, providing a platform for user-generated contents is also an effective way to create diverse content with low cost. With regard to collaboration, the analysis emphasized the synergy effect between the telecom operators' broadband and television service noting that telecom operators can leverage their advantage in the broadband market (e.g. brand, large customer base and sufficient cash flow) to the television market in order to increase the value for both.

In evaluating mobile service bundles using an example of navigation services, Bouwman et al (2007) applied the STOF framework and found that mobile service providers can use

service bundling to offer attractive services to customers. Further, customers may find bundles convenient compared to single services and there may be a price discount involved. The study reviewed what kind of service bundle may be attractive to users in the car navigation system market hypothesizing that customers are more likely to acquire enhanced services than supplementary services and that bundle price has a positive effect on the intent to purchase. Conjoint analysis was applied in order to critically assess which combination of services and price level is the most attractive to users. The conclusion was that that enhanced services, i.e. services that reinforce the functionality of the core navigation service, are more relevant than supplementary services.

Other work that has utilized the STOF framework includes balancing customer and network value of mobile payment services by Bouwman et al (2006), designing mobile remittance services in developing countries by Bouwman and Sandy(2008) and design of a standalone digital music vending service Bouwman et al(2008). Additionally, Haaker and Kijl (2008) assessed the business potential of new mobile services while Fielt et al (2008) worked on mobile services for patients with chronic lower back using the same framework. Notably, the common running thread of these studies is that they were in the mobile services sector and concerned emergent or new technologies and trends in this area.

The description of the open MNO model as set out by Luukkainen et al (2009) is especially relevant to this research owing to the premise that for network operators to profit from mobile content, they will ultimately need to pursue initiatives that enable content developers, aggregators and brokers to have some level of access to their subscriber bases i.e. open up as opposed to being walled-garden operations.

The case of an open MNO can be taken as a bazaar which brings together several actors and ultimately connects service providers to service users. Whereas the users get the service through the network infrastructure for the network operator and the brokers to realize revenue, pricing decisions come into play. Various business scenarios are realized. For example, in the case of basic mobile services provision, the MNO obtains revenue from the end-user who is mostly known as a subscriber. In an open MNO, end-users are not the only sources of revenue as Luukkainen et al (2009) note. Revenue can be

collected from different players some of whom perform a brokerage role. They go further to provide scenarios such as:

- Advertisers paying brokers based on user clicks
- Developers earning revenue based on content downloads
- Broker collecting revenue in the form of commission for both of the above cases
- End users paying a monthly fee for the service or paying per event e.g. upon downloading a wallpaper, a phone ring tone or using a navigation service
- Copyright holders levying fees for edutainment content

In summary, there is room for innovation. Luukkainen et al (2009) note up to six different revenue models including subscription, advertising, transaction, volume, licensing and sponsorship. Revenue share arrangements thus become an important factor to be considered. The flip side (costs) also needs to be actively managed but does not appear to have been considered in Luukkainen et al (2009).

Arising from the variations in billing, it would appear that operators need to customize their platforms to be able to offer various billing models. The question that arises is whether it is cost-effective to invest in modifications to billing systems, personnel to administer various tariffs and (remembering that generally, MNOs are running as walled-gardens, there would be need to interface to various content sources) or whether there would be real business value in pursuing a framework that manages content development, pricing, billing and subscriber access. This would borrow heavily from Adul (2008) in which the framework for inter-carrier billing system for interconnection was proposed. A highly simplified view would be as depicted below:

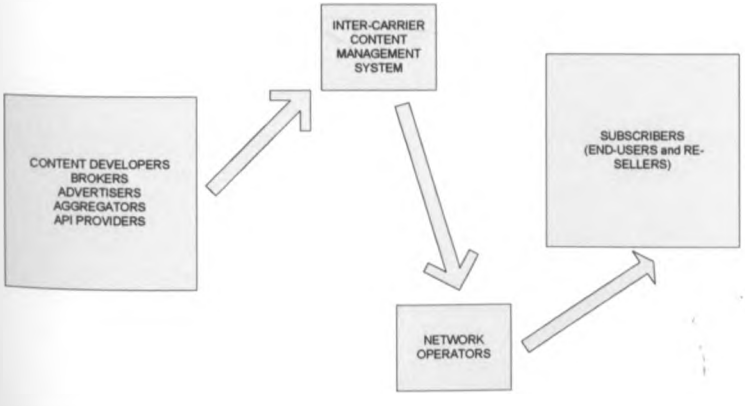


Figure 6 Expanded Value-Chain

Noting that the advent of multi-media services provides a new and evolving generator of revenue, Chakrabarti et al (1999) alluded to such a clearing house set-up but did not examine it in detail. Rather, this study concentrated on the development of a Charging, Accounting & Billing (CAB) system for each mobile operator. Arising from their assertion that in future, mobile terminals will be able to connect to different technologies and even connect to different mobile networks in the same country, it was noted that a more automated accounting system would be necessary. This particular study briefly noted that to reduce the number of interfacing CABs, a clearing house can be put in place and its role would be to collect accounting data from CABs and provide a single place for their clearing house. Consumers of content would also have expectations with regard to the having their requests serviced in an efficient and effective manner.

3.2 Framework for Mobile Governance - Government of India

The Government of India, in Jan 2012, released the Framework for Mobile Governance as shown in Government of India (2012). In summary, the Government of India will progressively adopt and deploy m-Governance in a time- bound manner to ensure inclusive delivery of public services to both the urban and rural populace in the country. The framework envisages that web sites of all Government Departments and Agencies shall be made mobile-compliant, using the "One Web" approach. Open standards shall be adopted for mobile applications in order to ensure the interoperability of applications across various operating systems and devices as per the Government Policy on Open Standards for e-Governance. In addition, uniform/ single pre-designated numbers (long and short codes) shall be used for mobile-based services to ensure convenience. All Government Departments and Agencies shall develop and deploy mobile applications for providing all their public services and availing content through mobile devices. They shall also specify the service levels for such services. (In this research, this framework will be referred to as Government of India Mobile Governance Framework and abbreviated as GOI).

There are 3 key components of this framework namely, Mobile Services Delivery Gateway (MDSG), Mobile Governance Innovation Fund and Knowledge Portal on Mobile Governance. The 3 components respectively map to technology/infrastructure, funding and awareness.

MDSG

The MSDG will be rolled out with the aim of providing functionalities such as end-user interface, content for Mobile Services, Mobile Applications (Apps) Store, APIs for Value-Added Services Providers, Mobile-Based Electronic Authentication of Users and Payment Gateway.

Mobile Governance Innovation Fund

The Department of Information Technology (DIT) shall create a Mobile Governance Innovation Fund to support the development of suitable applications by Government Departments and Agencies and also by third-party developers including start-ups. DIT would manage this fund for a minimum period of 3 years.

Knowledge Portal on Mobile Governance

DIT will also develop and deploy a knowledge portal to facilitate knowledge management – this will act as a platform for awareness generation and dissemination medium for various Central Government Ministries and the State Governments. It is envisaged that this will enhance the absorptive as well as the service provisioning capabilities of various stakeholders in m-Governance.

3.3 Telemanagement Forum (TMF) Frameworx®

The Telemanagement Forum, also known as TM Forum, describes itself as is a global, non-profit industry association focused on simplifying the complexity of running a service provider's business through sharing of knowledge, driving industry collaboration and setting of standards (TM Forum 2012). Its membership roll spans 195 countries and includes 900 companies in the fixed and wireless business as well as manufacturers of software that runs on telecoms equipment. It is thus one of the largest industry collaboration associations in the telecoms sector. TM Forum has developed a framework named Frameworx® and this was previously referred to as NGOSS or "New Generation Operations Systems and Software". The purpose of the framework is to provide ways to help Communication Service Providers (CSPs) to manage their business by availing a set of principles and technical deliverables. Frameworx® is thus applicable to mobile content as well since MNOs are also CSPs.

The 5 fundamental principles in Frameworx® are Separation of Business Process from Component Implementation, Loosely-Coupled Distributed System, Shared Information Model, Common Communications Infrastructure and Contract-defined interfaces.

Separation of Business Process from Component Implementation: This principle is important because when Operations Support Systems (OSSs) are linked together, the business processes they support are increasingly distributed across the various platforms. Effectively, it becomes difficult to tell which system is driving the process at any one time. To deal with this, Frameworx® requires that the process is managed as part of the centralized infrastructure, using a workflow engine that is responsible for controlling the flow of the business process between the applications. At any one time, the centralized workflow engine would be able to pinpoint the flow of the process and identify bottlenecks and failure points, if any.

Loosely-Coupled Distributed System: By adhering to a loosely-coupled implementation, each application is fairly independent of the other applications in the overall system. As a result, it becomes possible to safely make alterations on one application without adverse effects on other applications. In a sense, this is a call towards

breaking away from monolithic implementations that characterized the telecoms landscape in the past.

Shared Information Model: Since data must be shared between the applications, it is only prudent to ensure that applications exchange this data using a common model so that in a sense, they can "speak the same language" regardless of implementation details. A single information model for data that is shared between applications is thus a key enabler.

Common Communications Infrastructure: The CCI is important because previously, in the 1980s, the telecoms world was awash with standalone applications and as the ecosystem of the telecoms value-chain evolved, this mesh was proving to be a challenge in terms of service management and system operations. To interconnect various systems, it was thus imperative to create many interfaces in the form of many-to-many. In Frameworx®, systems interface with the CCI rather than directly with each other. This reduces complexity because each application only requires one interface (to the CCI) rather than many (to other applications). Thus, the complexity is therefore reduced to one of order n, rather than n2.

Contract-defined interfaces: Arising from the interactions in the 4 previously described domains; there is a need to document those interfaces, both in terms of the technology employed and the functionality of the application and the data. The Frameworx® contract specification provides a means to document these interfaces, and these are therefore contract defined interfaces. The contracts are analogical to extensions of Application Programming Interface (API) specifications.

Previous work that has utilized Frameworx®

Frameworx®, then known as NGOSS was used by Chou and Lee (2008) in defining a framework for Telecommunication Electronic Commerce. Miyazawa and Nishimura (2011) also referenced this framework in defining, for telecoms, a scalable algorithm for root-cause analysis assisted by alarm information model. In this work, they proposed a

Root Cause Analysis (RCA) mechanism which classifies alarms based on their types of failures, such as resource, performance and service failures, and then promptly identifies the root cause by using a hierarchical alarm information model as defined in Frameworx®.

3.4 The Open Group Architecture Framework (TOGAF®)

According to its website, the Open Group is a global consortium that enables the achievement of business objectives through IT standards (TOGAF 2012). With more than 400 member organizations, it has a diverse membership that spans all sectors of the IT community — customers, systems and solutions suppliers, tool vendors, integrators and consultants, as well as academics and researchers. The key objectives of the Open Group are: Capture, understand and address current and emerging requirements, establish policies and share best practices; facilitate interoperability, develop consensus, and evolve and integrate specifications and open source technologies; offer a comprehensive set of services to enhance the operational efficiency of consortia; operate the certification services. TOGAF® was first developed in 1985 and was based on the US Department of Defense Technical Architecture Framework for Information Management (TAFIM). The Open Group Architecture Forum has developed successive versions of TOGAF at regular intervals and published them on The Open Group public web site.

TOGAF covers four domains i.e. Business, Application, Data and Technology. It aims to provide information architects with a highly summarized starting point which can then be built upon and also relies heavily on modularization and standardization.

Business architecture: This essentially defines the business strategy, governance, organization, and key business processes of the organization.

Applications architecture: provides a blueprint for the individual application systems to be deployed, the interactions between the application systems, and their relationships to the core business processes of the organization with the frameworks for services to be exposed as business functions for integration.

Data architecture: the structure of an organization's logical and physical data assets and the associated data management resources

Technical architecture or technology architecture: This looks at the "nuts and bolts" hence it describes the hardware, software and network infrastructure needed to support the deployment of core, mission-critical applications.

3.5 The Zachman Framework

John Zachman developed the Zachman framework during his period at IBM, according to Zachman (1987). Initially published under the title "A framework for Information Systems", the framework made its first appearance in the IBM Systems Journal in 1987 and later updates in subsequent revisions formalized it as the Zachman framework.

At its core, the framework is a descriptive analogy that borrows from a discipline which even Zachman himself acknowledged is quite unrelated to information systems – classical architecture. Zachman held that it was however only logical to look into the field of classical architecture and learn from the thousand or so years of experience that have been accumulated therein. While doing that, by analogy, we can apply the comparison to the field of information systems when developing information systems architecture. He thus proposed that in the same way that classical architecture has formalized different plans at different levels and for different perspectives (owner, designer, builder), the same can be done for information systems. The plans in classical architecture e.g. architect's drawings, architect's plans, contractor's (structural, mechanical, electrical, wood, plumbing) plans, shop plans can be likewise adduced in the information systems arena.

Zachman framework holds that it is possible to apply the same in the development of just about any complex engineering product.

Generic	**Buildings (Classical Architecture)**	**Airplanes**	**Information Systems**
Ballpark	Bubble Charts	Concepts	Scope/objectives
Owner's representation	Architect's drawings	Work breakdown structure	Model of the busines (or busines description)
Designer's representation	Architect's plans	Engineering design/bill of materials	Model of informatio system (o information systen description)
Builder's representation	Contractor's plans	Manufacturing engineering	Technology model (o technology-

		design/bill of materials	constrained description)
Machine language representation	-	Numerical code programs	Machine language description (or object code)
Product	Building	Airplane	Information System

The structure of the Zachman framework is represented below:

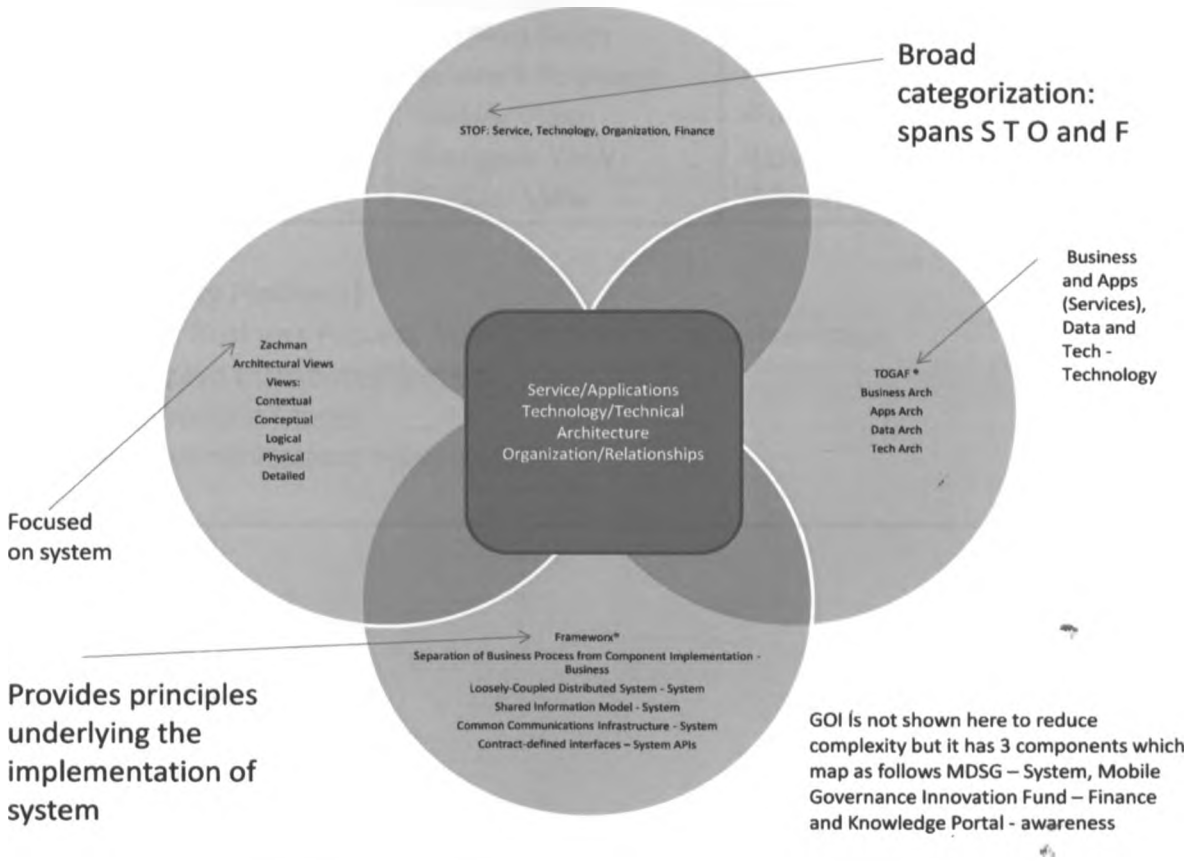
	Why	**How**	**What**	**Who**	**Where**	**When**
Contextual	Goal list	Process List	Material List	Organizational Unit & Role list	Geographical Locations List	Event List
Conceptual	Goal relationship	Process Model	Entity Relationship Model	Organizational Unit & Role Relationship Model	Locations Model	Event Model
Logical	Rules Diagram	Process Diagram	Data Model Diagram	Role Relationship Diagram	Locations Diagram	Event Diagram
Physical	Rules Specification	Process function specification	Data Entity Specification	Role specification	Location specification	Event Specification
Detailed	Rules Details	Process Details	Data Details	Role Details	Location Details	Event Details

3.6 Revised Framework

Using the foregoing summary of frameworks, we have analyzed the key feature of each framework looking at broad parameters as below

	STOF	**Frameworx®**	**TOGAF®**	**Government of India (GOI)**	**Zachman**
Originator	Bouwman et al	Telemanagement Forum (TMF)	The Open Group	Government of India	John Zachman
Currency	Developed in 2007	Developed initially as NGOSS in 2000	Developed in 1985	Initial version developed 2012	Initial version developed 1987
Genesis	Academic Research	Industry Collaboration	Industry Collaboration	Government	Academic Research in Industrial setting
Use	Has been used in development of business models for content, mobile business and IPTV	In use by 900 companies spanning 195 companies which are in CSP Business as well as software and hardware development for telecoms		Government of India	First used in IBM before making its way into academia and industry
Major Components	Services, Technology, Organization, Finance	Business Process, Distributed System, Shared Information Model, Common Communications Infrastructure, Contract-defined interfaces	Business, Application, Data, Technical/technology architecture	Mobile Services Delivery Gateway, Mobile Governance Innovation Fund, Knowledge Portal	Owner, Designer, Builder View Contextual, Conceptual, Logical, Physical, Detailed. Apply 6 questions: Why, How, What, Who, Where, When

According to Krishnaswamy (2004), Venn Diagrams are appropriate in identifying linkages and overlaps in ideas or perceptions. These commonalties are then used to develop a shared understanding of an issue, problem or situation. The Venn diagram comprises two or more overlapping circles. They are used to describe and compare elements and characteristics of a situation. In analysis, we have applied Venn diagram to compare the frameworks previously discussed. It was not possible to take all the detailed text that describes the components of each framework and apply the Venn diagram. As a first step, summarization of the components was carried out.



By re-ordering the related components and using STOF as the base framework (in consideration of its merits as having been developed through academic research, has been adopted by business and government, is one of the most current of the frameworks and contains the broadest categorization), we proposed the following extended STOF framework for managing mobile content. The Technology domain has been

incrementally extended by bringing in elements of Frameworx® arising from the fact that the Frameworx® framework was designed specifically to tackle the challenges of system implementation in the telecoms environment and is quite detailed, the Service domain has been updated with elements from GOI and TOGAF®, the Finance Domain has been extended by incorporating GOI aspect of funding, the costs and settlement whilst the Service domain has been updated with TOGAF® element of Applications and GOI element of Awareness. The Organization domain has incorporated the Owner, Designer and Builder Views as identified in the Zachman framework which draws upon lessons from classical architecture.

<table>
<tr>
<td><u>Service:</u>
(Value Proposition/Target Group)
•Applications and content
•Awareness</td>
<td><u>Organization</u>
(Division Roles Network Strategy)
•Owner View
•Designer View
•Builder View</td>
<td><u>Finance</u>
(Revenue Model)
•Budget and Resource allocation
•Funding
•Costs & Settlements
•Monetization</td>
</tr>
<tr>
<td colspan="3"><u>Technology</u>
(Service Delivery Platform)
•Separation of Business Process from Component Implementation
•Loosely-Coupled Distributed System
•Shared Information Model
•Common Communications Infrastructure
•APIs</td>
</tr>
</table>

CHAPTER 4 TESTING THE FRAMEWORK

4.1RESEARCH DESIGN

From the analysis above, the key features of the hybrid framework were extracted and designed into a list of interview questions (see Appendix 1) that was used in interviewing staff at Airtel Africa Headquarters. This is a telecoms company whose Africa operations are headquartered in Kenya, operating in 17 African countries and with parentage in India. Within the India and related regions, the company operates in India and South East Asia. Approximately a third of the company is owned by Singapore Telecoms (SingTel) by way of shares. Responses were also sought from three Kenyan MNOs – Safaricom, Orange and Yu.

The basic questionnaire served as first step in gauging the importance of the key features of the framework and to identify improvements that need to be factored into a revised version of the framework, if needed. Implicit in this was also the possibility that we may arrive at a conclusion that there is no requirement to update the framework in case it was identified to be sufficient for business purposes in 2012 and going forward.

Selection of interviewees was done bearing in mind seniority of staff member, the role and the business function which the interviewee works for. The mobile content business in Airtel is driven by the following key functions: New Products & Services (NPS) which is a team within the Marketing Division, Information Technology (IT) and Networks (NW). The three functions identified above hold principal role in mobile content. Specifically, the Group Head of Products & Innovation Revenue Management drives this line of business function, reporting into the Group Products & Innovation Director who in turn reports to the Chief Marketing Officer. In addition, we also sought responses from the following individuals drawn from IT, Networks and Audit teams. IT and Networks teams are responsible for actualizing the implementation of the technology that drives mobile content, while audit is responsible for review of process and system controls that ensure business objectives are actually met and that compliance is maintained (whether it is compliance to internal policies, procedures and guidelines or to external bodies such as regulatory institutions like CCK). In consideration of the above,, we thus selected the following roles as appropriate to assess the framework.

Role	Company
1. Head of Core Network & Value Added Services (VAS)	Airtel Africa
2. Head of Infotainment Content & Portals	Airtel Africa
3. Head of IT Operations	Airtel Africa
4. Chief Information Officer	Airtel Africa
5. Chief Technical Officer	Airtel Africa
6. Head of Products & Innovation Rev	Airtel Africa
7. Group Internal Audit Manager (IT)	Airtel Africa
8. VAS- Airtel Burkina Faso	Burkina Faso
9. VAS- Airtel Congo B	Congo B
10. VAS-Airtel DRC	DRC
11. VAS-Airtel Gabon	Gabon
12. VAS-Airtel Ghana	Ghana
13. VAS - Airtel Kenya	Kenya
14. Head of Online Safaricom	Kenya
15. VAS - Airtel Malawi	Malawi
16. VAS- Airtel Niger	Niger
17. VAS-Airtel Nigeria	Nigeria
18. VAS-Airtel Tanzania	Tanzania
19. VAS- Airtel Uganda	Uganda
20. Yu - Head of VAS	Yu
21. Head of Marketing	Orange

Other functions such as Customer Service, Finance, Supply Chain Management and Legal & Regulatory are in support roles and their processes usually,fit into the functional

priorities defined by the critical functions that are responsible for revenue, services and technology

The questionnaire used had several elements and was organized in the structure of the extended STOF framework. We requested the interviewees to provide responses indicating the importance attached to the following on a scale of 1 to 5 where 1 is least important and 5 is most important.

Service

- Product Proposition: Applications and Content
- Customer Awareness
- Organization awareness (internal)
- Monetization of product

Technology

- Implementation of Service Delivery Platform (SDP)
- Separation of business process from system details
- Distributed implementation
- Shared information model across the business units
- Common Communications Infrastructure i.e. standardized implementation
- APIs to enable extension of systems handling mobile content

Organization

- Scope and objectives definition
- Roadmap and plans for implementation
- Design details and documentation

Finance

- Budget & Resource allocation
- Settlement processes

A number of open-ended questions were also included e.g. what are the key metrics of success that you are using to evaluate progress with regard to mobile content business,

from the proposed framework, what are some of the items that in your view should be removed, added, amended; In the your setting, how suitable would this framework be in managing mobile content, specifically what are some of the key challenges that may be encountered. These open-ended questions were to facilitate discussion and allow interviewees to provide additional information and a qualitative assessment of the proposed framework.

CHAPTER 5 RESULTS & DISCUSSION

5.1 Summary of Results

To interpret the results, we applied the Mean Opinion Score (MOS) that has been used for decades in telephony networks to obtain the human user's view of the quality of the network entity. This test is governed by ITU-T recommendation P.800 and evaluates each criterion on 5 point scale as follows:

- 5 Excellent
- 4 Good
- 3 Fair
- 2 Poor
- 1 Bad

When the ratings are aggregated and the average calculated, it is the possible to apply percentage judgment on the results. When the results are calibrated on a percent scale, it means a score of 20% and below would be bad, 20% to 40% would be poor, 40% to 60% would be fair, 60% to 80% would be good and a score of 80% to 100% would be excellent.

This form of analysis is appropriate when expert opinion is required and also when number of respondents is not voluminous. On the other hand, MOS requires expert opinion and is not suitable for mass surveys. It was thus appropriate for the analysis that we were carrying out because information was sought from respondents who are experts in the area of telecoms and specifically have a hands-on exposure to mobile content business. Secondly, we were seeking a subjective assessment of a proposed framework.

Tabulation of the scores indicated the framework scored 76%. In summary, the scores were as follows:

- Finance 91%
- Technology 81%
- Service 71%
- Organization 66%

Results revealed that the Finance component was rated to be the most important. Out of a possible maximum score of 100%, respondents scored it 91%.Budget allocation for

mobile content projects was at 91% and business settlement processes for managing content providers were at 90% bringing in an aggregate score of 90.5% hence rounded up to 91%.

The second most important component was Technology, being rated at 81%. Under Technology, factors that were rated to be most important include separation of business process from system details (during implementation), deployment of service delivery platforms and standardized implementation of systems across operations (business units).

The 3rd most important component was services and this was driven mostly by product propositions i.e. the actual applications and content, followed by the monetization strategy i.e. how does the MNO plan to turn the actual content into revenue.

From analysis, there is logical reason for the Finance component to be prominent – the implementation of the mobile content hinges on the availability and deployment of funds to cater for CapEx and OpEx. Simply put, with no money allocated, no project kicks off. Secondly when all the functions of the framework have been put into motion and revenue is being realized, elements of revenue reporting as well as cost management become quite important. Likewise, settlement procedures between the MNO and the partners (e.g. developers) are rated high because failure to arrive at a mutually beneficial position may render the business relationship unsustainable and thus bring the value-chain for mobile content down.

5.2 Refinements to the framework

Whilst the overall score of the framework is indicative that the framework is largely suitable, a look at some of the feedback gathered from the open-ended questions is warranted. Thus, in addition to the analysis of the questionnaire responses, we have summarized below the key points arising from the discussion (open-ended) questions.

5.2.1 Identification of Maturity Level

According to respondents, there is need to build in parameters that evaluate the maturity of the market with regard to mobile content. The market life cycle and product life cycle are thus important. The handshake between Product Development, IT and Networks on the one hand and Customer Care teams is critical

5.2.2 Key Metrics

A quality assurance program is important. Thus, a content audit framework is important. It should minimally evaluate relevance (in the case of Airtel, localization for each of the markets is important), newness/freshness of content, variety across all genres in order to be able to address wide audience. Some of the Key Performance Indicators that should be tracked include output KPIs, Average Revenue per User (ARPU), Penetration (% of subscribers accessing mobile content) and finally, actual Revenue. An additional metric, margin, was also proposed. Some KPIs proposed are essentially marketing KPIs and we may not evaluate them further in this study e.g. through customer surveys, the Marketing functions seeks to establish traction and thus evaluates such parameters as Intention to Recommend (ITR), Intention to Purchase (ITP) and Top of Mind Awareness (TOMA) in addition to the solid indicators of progress e.g. Share of Gross Activations (SOGA), Customer Market Share (CMS) and Revenue Market Share (RMS).

5.2.3 Regulatory Compliance

The regulatory angle is also important. Content publishing rights should be borne in mind. Some of the content obtained from aggregators has been collected from other parties and the legal agreements need to be considered. For companies operating across many countries, the content development and distribution process should be cognizant of the diversity in market needs. The product development processes should thus be well aligned and properly localized.

5.2.4 Reporting

Reporting was identified as one key item that needs to be considered in this framework. We have thus added this component and included it as an over-arching principle across the four domains. This would include reporting on service availability, finance metrics and daily business KPIs.

5.2.5 Revenue Assurance & Fraud Management

Revenue Assurance, which is a formalized discipline in telecoms, is defined as the use of data quality and process improvement methods that improve profits, revenues and cash flows without influencing demand. According to TMF Guidebook, TM Forum (2009), Revenue assurance is a practical response to perceived or actual issues with operational underperformance, most commonly relating to billing and collection of revenue. Some of

the procedures associated with identifying, remedying or preventing errors may be undertaken by a dedicated Revenue Assurance department, though responsibility for revenue assurance is often diffuse and varies greatly with the organizational structure of the provider. Specialized tools for revenue assurance management are being marketed and MNOs are advised to assess the need and applicability of the same.

Related to revenue assurance is the discipline of fraud management. Feedback from respondents indicated that the gains made by generating a new revenue stream can be reversed by fraud, either subscriber initiated or employee initiated. A case in point may involve MNO employee colluding with content aggregator to inflate invoices. In the absence of proper management review, this affects margins that the MNO is realizing.

Compliance to revenue recognition processes, revenue assurance and settlement were identified as important. Settlement was singled out as one of the critical success factors in ensuring a sustainable business partnership. This draws our attention to the importance of safe-guarding revenues from the new business line, despite the expectation that in the beginning phase, revenues from mobile content may only constitute a minor part of the revenue pie. The feedback received points to the need for proper risk management being in-built into the framework.

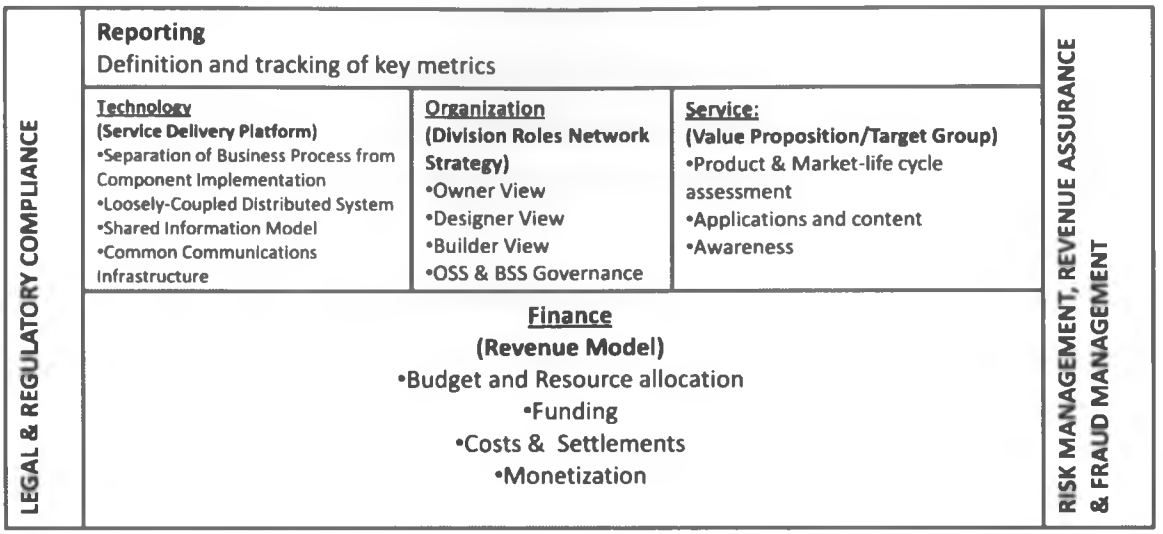
5.2.6 OSS and BSS Vendor Governance

Traditional OSS and BSS vendor governance has been done in certain ways which may not be applicable to mobile content. For example, the vendor who supplies MNO with switches may have been paid an initial fee to install the switches and later is paid annual support fees and licensing based on number of subscribers. Mobile content does not follow such linear scheme. For example, the vendor contract may include such conditions as number of hits successfully served, quality of service delivered, number of retries to access content, media clarity etc. Therefore, respondents suggested the need to factor in the revised agreements and the mechanisms for vendor engagement. Tied in to this point is the need to ensure proper Business Continuity Planning (BCP) to ensure that customer-facing systems are available and proper Recovery Time Objective and Recovery Point Objective targets are set and adhered to. Root cause analysis for system problems encountered in mobile content is also important in order to ensure continual improvement. The case of Airtel is perhaps specific as Airtel works on a heavily

outsourced model hence there are contracts with Network and IT Vendors and these apply to Managed Services/Managed Capacity (MC/MS) – a situation in which the vendor is compensated not for the "physical box" i.e. installation but only for the amount of traffic /revenue generated through the system.

CHAPTER 6 VALIDATED FRAMEWORK

Based on the analysis in the preceding chapter, the updated framework below was derived. It incorporates results of the questionnaire in terms of prioritization of the components of the framework and also factors in the responses received via open-ended questions.



6.1 Components of the framework.

Below we discuss the components of the framework.

6.1.1 Legal & Regulatory Compliance

Legal and regulatory compliance spans the entire value chain of mobile content. The consideration of legal contracts and adherence to the stipulated rules and regulations from national and international bodies will need to be considered by each party in the ecosystem.

6.1.2 Finance

Financing provides the investment base to provide enable rollout and maintenance of systems and processes that are used in managing mobile content.

6.1.3 Reporting

The reporting aspect is important because it enables the formalization process of obtaining health-check from the ecosystem. Reporting could cover elements in all the other domains e.g. reporting on regulatory compliance, reporting on finance-related

issues, reporting on service availability/disruptions as well reporting on key risk indicators.

6.1.4 Technology

This is the core of the system and is delivered using concepts that have been discussed elsewhere in this work e.g. APIs and SDPs.

6.1.5 Organization

The organization is about arrangement of the various interfacing parties, processes and systems. Each of the component should be clearly defined as to who is the owner, the builder, the designers as well as the governance process that manages it.

6.1.7 Service

Service is about the core propositions that are to be delivered to the customer. The processes of preparation, deployment, marketing, change management would dictate the reliability and quality of service provided.

6.1.8 Risk Management, Revenue Assurance & Fraud Management

Proper risk management enables the rollout and sustenance of the ecosystem. This comprises the assessment and mitigation of key risks in order to ensure that the operations of the ecosystem are well protected.

6.2 Applying the framework

Having established that the framework proposed is looked upon favorably by MNOs and with the knowledge that the business case for walled-garden style MNOs is progressively weakening as Internet technologies and content assume even greater importance, it would then appear that there is room for flexibility in delivery of content. As revenues from the traditional channels continue the downward trend, MNOs have little choice but to consider getting into arrangements that provide flexible and sustainable sources of revenue. This calls upon them to liaise with other stakeholders in a framework that formalizes relationships, gives unto each stakeholder their due revenues and ensures that costs and risks are well managed.

Because there is currently no conscious user segmentation, the content being offered through mobile technologies in Kenya is dominated by news, music, jokes, phone ring-

tones and wall-papers marketed as a mass-offering as established in the literature review. MNOs are limited in satisfying the subscribers for several reasons. While it would be difficult to predict what subscribers will want in future, an Inter-Carrier Content Management Platform (ICCMP) should not arrogate upon itself the role of determining the content what subscribers desire. The ICCMP should simply provide a dynamic avenue for subscribers to communicate what they want (and are willing to pay for) and for developers to avail that content (if it is practical and cost-effective) in order for the network operators to avail the content (and levy charges for this). This "open-market" approach then provides avenues for other stakeholders such as advertisers to ride on it and likewise achieve their needs.

The technology set-ups being used at the moment are specific to each operator. Despite the fact that radio and core network vendors supply standardized equipment the lack of collaboration means that each operator would need to roll out their own service delivery platform and manage its own stable of operators. It is likely that if proper capacity planning is not carried out, some MNOs could end up with excess capacity. Conversely, under-estimated capacity requirements carry the risk of inadequate capacity which can adversely affect quality of service.

The emergent NGN technologies provide avenues for managing this disparate state of affairs. For example, rollout of a shared IP Multi-media System (IMS) to act as a shared core gives each MNO access to an extensible, flexible resource. Subscriber access to this core should be granted after validation against the MNO's Home Subscriber Server. The IMS then interfaces with a content repository to which content providers upload content. The source of the content can be content developers, content aggregators or even subscribers who wish to get into content-resale arrangement.

Various protocol standardization bodies have, over the decades, standardized a number of protocols which lend themselves to the task at hand in order to link up two or more switched networks to each other through standard inter-working functions. The challenge of inter-linking GSM networks thus appears not to be one of restrictions arising from technology. Whichever approach chosen, ICCMP should support industry standards in order to achieve inter-operability.

Previous work by Luukkainen et al (2009) proposed a set-up based on Service-Oriented Architecture (SOA). It essentially involves putting in place a service delivery platform between MNO and the cloud of internet services and developers. Developers connect to the SDP by use of secure, standardized APIs whereas the MNO connects to the SDP by use of an adaptation layer. Some of the APIs and their functions that were described include call control(call routing and triggering) , messaging(message routing and triggering), location(advertising), payment(micropayments), network presence(roaming state, free/busy), profile and SLA(quality of service, security, content caching and delivery).The heart of the SDP is a core collection of support functions which are used for background support actions such as security, identity management, privacy protection, community management, business processes and device management.

This appears to be a fully-fledged approach, which may not be attractive to green-field operators who are keen to recoup their costs or even established MNOs faced with a new business model. We propose a stepped evolution to this final state in consideration of the possible costs and logistical challenges in setting up such a platform in Kenya. The stages would be initially a basic shared content repository that takes advantage of existing industry protocols to interconnect core-networks of the operators and this would then be developed into a shared IP Multimedia Subsystem (IMS). Alternatively, depending on market readiness, MNOs can opt to skip the first step and roll out a shared IP Multimedia Subsystem.

6.2.1 Shared Content Repository

The first suggested option is using existing GSM network and fetching content from a shared content management platform. This calls for little or no changes to each MNO's core network and billing platforms. Rather, the benefit would be that such a shared content management platform becomes a recipient of more content sources as opposed to each MNO having an in-house content management platform. Given that in a walled-garden setting the MNO would have the content management platform within its network perimeter, use of VPN, firewalls and tunneling would be necessary to achieve security. A highly abstracted representation of two MNO's inter-linking their infrastructure is shown below.

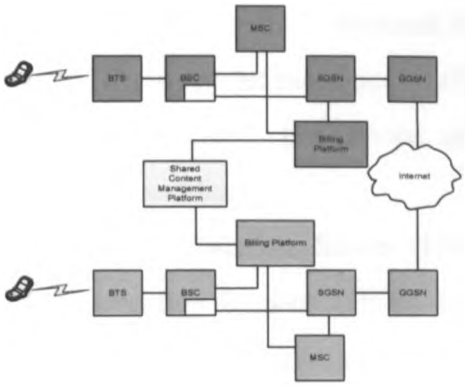


Figure 7 Shared Content Repository

To manage security, the content management system may be placed in a shared demilitarized zone (DMZ) and the various MNOs then have to pull content and replicate it to a server that is within their perimeter networks.

6.2.2 Shared IP Multimedia Subsystem

The second option involves taking advantage of NGN technology to deploy a shared IP Multimedia Subsystem (IMS) core that opens up the platform not just to MNOs but also to Fixed Operators and Mobile Virtual Network Operators (MVNOs) who are a type of a service provider who enlist subscribers but have not invested in network infrastructure hence they ride on existing MNOs infrastructure. According to 3GPP (2010), the 3rd Generation Partnership Project (3GPP) which unites telecommunications standards bodies as organizational partners, states that the objective of IMS is to efficiently support applications involving multiple media components as video, audio, and tools like shared online whiteboards, with the possibility to add and drop component(s) during the session and thus it lends itself to delivery of mobile content in an IP-oriented manner.

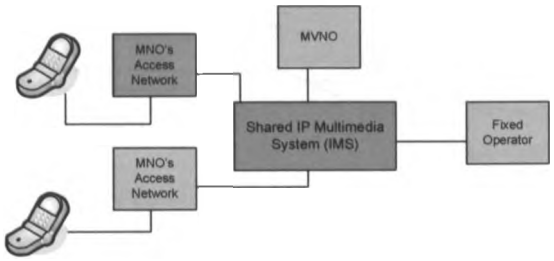


Figure 8 Shared IMS

Grégoire and Islam (2009) alluded to extending the IMS in this manner although the focus of this particular study was not on content management. IP Multimedia Subsystem focuses on the transparent delivery of multimedia and communication applications with

SIP. It has successfully attracted the operators' attention due to its foundation on two widely deployed technological building blocks: IP and SIP. IMS breaks the traditional isolated, dedicated, per-service architecture, and introduces the application-oriented horizontal solution.

The Home Subscriber Server (HSS) is essentially the successor of traditional GSM's Home Location Register (HLR) database and contains not only location-related data (to enable mobility management) but also subscription-related data, like the list of services the user is able to get and the associated parameters. The Proxy-Call State Control Function (P-CSCF) acts as the "first contact point" of IMS. Its main task is to select the I-CSCF of the Home Network of the user. It also performs some local analysis e.g. number translation and QoS policing. The third component is the Interrogating-CSCF (I-CSCF) which serves as the key entry point of the home network and chooses, in collaboration with the HSS, the appropriate S-CSCF. The Serving-CSCF (S-CSCF) has the role of performing the actual session control by handling the SIP requests and performing the appropriate actions like requesting the home and visited networks to establish the bearers. It also forwards the requests to the S-CSCF /external IP network of other end user as applicable. It will also link with the Application servers, which in the case of this work, would be holding mobile content and interfacing to the billing platform. Specialized S-CSCF elements may be deployed to handle different services. Several S-CSCF units are also advisable to enable load balancing as well achieving redundancy to avoid service disruptions.

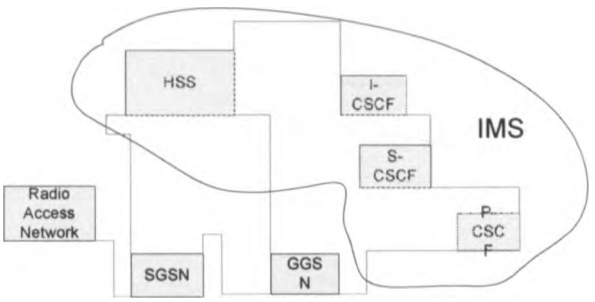


Figure 9 Components of the IMS

The shared IMS approach may not be suitable in an environment where most MNOs are still running non-IP core networks as it would call for investment in replacing a number of elements in their core networks. However, ITNewsAfrica (2010) reported that while

announcing the deployment of Huawei's mobile soft-switch that would enable Safaricom to reduce transmission costs, improve service quality and upgrade its network to allow for better convergence, real-time monitoring, fault location and automatic recovery functions, Safaricom also announced that it is currently aiming to develop an all-IP network, enabling the construction of a high-performance and cost-efficient mobile core network. In 2009, Ratio (2010) announced that Orange Telkom had launched an IP/MPLS core to manage its business services segment. This core combines IP technology and Multi-Protocol Label Switching (MPLS) which enables integrated communications. Quality of service can also be applied on the data streams passing through the queue. The core provides corporate uses with VPN connectivity, inter-branch connectivity as well as specialized voice services like flat fee billing for mobile and fixed telephony and closed-user group services (where calling within a subset of defined numbers is charged preferential rates). It would appear that IMS has not taken root among Kenyan MNOs. However, as more MNOs deploy IP core networks, inter-linking of the IMS implementations may prove an intuitive progression, guided by frameworks such as the one that we have proposed in this work.

CHAPTER 7 CONCLUSIONS & RECOMMENDATIONS

To recap, market trends indicate that the business case for walled-garden MNOs is gradually but increasingly becoming weak. MNOs have to adapt to the fact that traditional revenue channels (voice and SMS) are on a decline and the margins from these traffic types need to be supplemented. This shift has already started in the West.

The rising rate of mobile penetration and the increase in use of Internet technologies indicates the potential for mobile content. Before taking advantage of this business opportunity, MNOs need to ensure that they put in place solid frameworks that are informed by proper research and have been validated through business knowledge.

7.1 Achievements

This work has shown that by leveraging on the STOF framework as base and applying components from other frameworks, it is possible to arrive at a framework that key business leaders in MNOs can utilize in driving the business of mobile content forward.

With regard to the objectives of this research:

a) This study has examined the current frameworks that are related to mobile content business. A comparison of TMF Frameworx®, Government of India Mobile Governance Framework (GOI), The Open Group Architecture Framework - TOGAF®, The Services Technology Organization Finance (STOF) Framework and Zachman Framework has been conducted.
b) A revised framework has been developed, using the STOF framework as the base. This framework has been presented to business leaders in an MNO for validation. The insights taken from the business leaders have been used to further improve the framework.
c) Finally, the revised framework has been documented and recommendations for putting it into place have been made. A proposal on how the framework can be put to use has also been presented.

7.2 Limitations

Upon updating the framework with the feedback received from the respondents, we have not iterated the testing process to confirm if the updated framework would indeed have been scored more favorably - this was however part of the research design. The premise made is that by accurately capturing the key feedback points received and fitting them into the framework, the resultant framework is an improved version. The risk in this is however not significant as the first version circulated to the respondents was rated well as per the Mean Opinion Score percentages.

7.3 Recommendations for future work

As this work has not focused on upstream sources of content e.g. the transformative phase of content from raw source into a format usable for mobile consumption, further work in evaluating how well this framework would fit with such players is recommended.

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APPENDIX: 1 QUESTIONNAIRE

My name is Joseph Nderitu, MSc Information Systems at the University Of Nairobi, Kenya. For my research project I am seeking evaluation of a proposed framework for managing mobile content from a Mobile Operator Perspective.
All information received will be used for academic purposes only. Thank you.

Evaluating the relative importance of the components in the proposed eSTOF(extended Service-Technology-Organization-Finance) framework for managing mobile content business:

Name
(optional)_____Department_____
Role:_____

With regard to mobile content business please rate the importance of the following, where 1 is least important and 5 is most important.

Domain		1	2	3	4	5
SERVICE	Product propositions-applications and content					
	Monetization strategy					
	Customer Awareness with regard to service available					
	Organizational Awareness (internal)					
Others:						
TECHNOLOGY	Implementation of Service Delivery Platforms (SDPs)					
	Separation of business process from system details					
	Flexibility in system implementation					
	Shared information across operating units/business functions					
	Standardized implementation of systems across operations, business units					
	APIs to enable extension/interfacing of systems e.g. with external developer community					
Others:						
ORGANIZATION	Planning: Scoping and objectives of each project					
	Roadmap and plans for implementation of mobile content					
	Design details and documentation regarding mobile content					
Others:						

FINANCE	Budget & resource allocation for mobile content projects					
	Business settlement processes e.g. for content providers, partners					
Others:						

If applicable to your role, what are the key metrics of success that you are using to evaluate progress with regard to mobile content business?

From the proposed framework (see below diagram), what are some of the items that in your view should be removed/added/ amended?

If this framework is employed in your operation, what are some of the top challenges that may be encountered?

Service: **(Value Proposition/Target Group)** •Applications and content •Awareness	**Organization** **(Division Roles Network Strategy)** •Owner View •Designer View •Builder View	**Finance** **(Revenue Model)** •Budget and Resource allocation •Funding •Costs & Settlements •Monetization
Technology **(Service Delivery Platform)** •Separation of Business Process from Component Implementation •Loosely-Coupled Distributed System •Shared Information Model •Common Communications Infrastructure •APIs		