THE SUBMARINE CABLE INDUSTRY AT A CROSSROADS: A MACROECONOMIC EVALUATION OF THE INDUSTRY'S FUTURE

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Abstract: Has the submarine cable industry finally future-proofed itself? As of 2010, opportunities for growth seem few and far between. There are no more "green-field" markets for cable developers, as the handful of unconnected population hubs (those of Eastern and Central Africa) finally gained fiber connectivity in 2009. Meanwhile, almost every international route features multiple cables peddling commoditized bandwidth. The newest generation of systems promise terabits of design capacity, and suppliers specializing in upgrade technologies promise to extract even more gigabits from the previous generation of cables than ever thought possible. Where exactly does the industry stand now, and how long will it take for the existing undersea infrastructure to fill?

1. THE STATE OF THE INDUSTRY IN 2010: $50 BILLION AND 1.1 MILLION KILOMETERS LATER

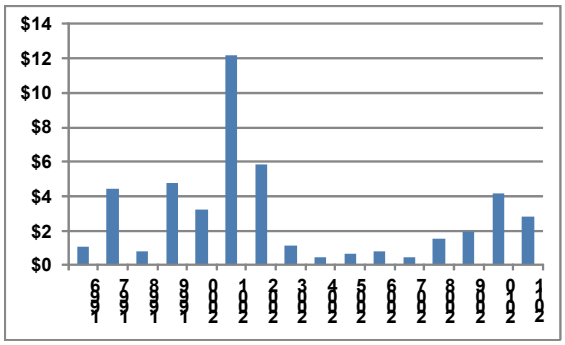
As of February, 2010, $50.5 billion worth of submarine fiber optic systems had been successfully put into service, spanning a total of 1,104,844 kilometers. More money has been invested in fiber optic systems than the entire annual gross domestic product of Luxembourg or Bulgaria, and enough cable has been laid to circle the globe 27 times.

In the late-1980s and early-1990s, when the first long-haul commercial fiber optic systems were installed, few could have predicted the tumultuous path that the industry would travel to achieve these milestones.

In terms of investment, the industry saw its greatest heights during a speculative, Internet-fueled frenzy that resulted in a wave of deployment between 1999 and 2002. That four-year period accounted for $26 billion, or over half of all fiber optic investment to date.

Unfortunately, the crash began before the final systems were even lit. Between mid-2001 and mid-2002, 360networks, Global Crossing, FLAG Telecom, and Worldcom each declared bankruptcy. Plans for billion-dollar projects were shelved, existing networks were sold for pennies on the dollar, and the industry went into a five-year trough that saw an average of less than $700 million worth of systems enter service each year.

Submarine Cable Investment, by RFS Date, 1996-2011 (Includes Highly-Probable Systems)



Source: Terabit Consulting

By 2006, however, signs of a recovery started to appear, encouraged by the newly-advantageous terms offered by the industry's suppliers, who were desperate to compensate for the terabits of overbuilt capacity on their traditional bread-and-butter transoceanic routes. Suddenly, routes that had been underserved or even completely neglected by fiber became the focus of attention and, arguably, the targets of a new wave of speculation.

2. THE ECONOMIC GEOGRAPHY OF SUBMARINE CABLES

In 1990, as the fiber optic cable industry started to come into its own, its largest investors – AT&T, BT, C&W, Deutsche Telekom, France Telecom, KDD, and Telecom Italia – as well as its cable manufacturers and ship operators – remained concentrated in the world's six largest economies. Twenty years later, the submarine cable industry, like the global economy, has become infinitely more complex, but at the same time, the industry's evolution has mirrored that of the global economy.

World's Largest Economies, 1990 and 2010 (Purchasing Power Parity Terms)

	1990	2010
1	United States	*European Union*
2	Japan	United States
3	Germany	China
4	France	Japan
5	Italy	India
6	United Kingdom	Germany

Source: IMF, World Bank

Specifically, as the economies of China and India have grown, so too has their influence in the submarine cable industry. Since acquiring the Tyco Global Network in 2005, the Indian operator Tata Communications has emerged as the largest owner of terabit-capable submarine cable systems in the world. Eastward across Mumbai's Thane Creek, Tata's competitor Reliance Communications is also (as of February, 2010) one of the world's largest submarine network operators, having built upon its acquisition of FLAG Telecom in 2004. Even farther east, China Telecom, China Unicom, and China Netcom have each taken major stakes in submarine cable projects, and Huawei Marine Networks is steadily building its record as a turnkey supplier of submarine systems.

If the concentration of "cable capital" has become more regionally diverse in the last few years, the actual deployment of submarine cable systems has, by comparison become virtually universal. The first of the two figures below shows the geographic distribution of investment during the speculative frenzy that resulted in the wave of deployment entering service between 1999 and 2002. For the most part, this investment was concentrated along historically-proven submarine cable routes between developed economies in Europe, North America, and East Asia, although there were signs of an increased effort to provide connectivity to China and emerging markets in Latin America. The second figure depicts investment by region for systems entering service in 2008 or later, including projects considered to be highly-probable.

Investment by Region or Route during 1999-2002 Speculative Frenzy (Based on RFS Date)

Region / Route	Investment ($Bil)	% World
East Asia	$6.0	23%
Transatlantic	$5.9	23%
Latin America	$4.4	17%
Transpacific	$4.1	16%
Australia	$1.6	6%
S. Asia / Mid. East	$1.6	6%
Europe	$1.4	5%
Africa	$0.6	2%
North America	$0.3	1%

Source: Terabit Consulting

Investment by Region or Route, 2008-2011 (Based on RFS Date) (Includes Highly-Probable Systems)

Region / Route	Investment ($Bil)	% World
Africa	$2.8	27%
S. Asia / Mid. East	$2.1	20%
Transpacific	$1.7	16%
East Asia	$1.5	14%
Europe	$0.8	8%
Pacific Islands	$0.6	6%
Australia	$0.4	4%
Latin America	$0.3	3%
North America	$0.3	2%

Source: Terabit Consulting

Because of a late-mover technological advantage, the latest wave of deployment has led to a sustained shift in the regional distribution of next-generation submarine systems. Africa, India, and China are now on a par with, if not ahead of, the international bandwidth capabilities of many developed markets.

Geographic Distribution of Terabit-Capable, Interregional Systems, as of YE 2011 (Includes Highly-Probable Systems)

Region / Route	Terabit-capable systems
South Asia and Middle East	8
Africa	7
East Asia	7
Transatlantic	7
Transpacific	6
Latin America	5
Oceania	4

Source: Terabit Consulting

From this analysis, important questions emerge: can Africa and South Asia sustain the vast resources of international bandwidth that have been constructed to their shores? And what will be the bandwidth requirements of the Chinese Internet market? In order to address these issues, a fundamental examination of each region's macroeconomic environment, as proposed later in this paper, must be undertaken.

3. WHO WILL CONTROL THE INFRASTRUCTURE?

Although many observers reported the death of the consortium model in the late-1990s, in fact consortia remain the most popular entity for financing submarine cables. Notably, however, carriers have tended to align themselves in groups of consortia that compete against each other, a phenomenon that was virtually unheard of in the 1990s. This has sometimes resulted in micro-consortia of a half dozen or fewer carriers. Although this has increased project risk, the internal bandwidth requirements of consortium participants has generally assured favorable outcomes in most carrier-led endeavors.

Pro-Rata Share of Terabit-Capable, Interregional Systems, as of YE 2011 (Includes Highly-Probable Systems) (Depicts Extra-Consortium Investment of Individual Investors)

	Route Km	% World
Consortia	208,553	37%
Tata Communications	41,185	7%
Pacnet	40,500	7%
Global Crossing	35,480	6%
Southern Cross Cables	28,847	5%
Reliance Comm.	27,425	5%
Brasil Telecom	22,000	4%
Telefonica	22,000	4%
NTT	21,000	4%
Telstra	18,525	3%
Columbia Ventures	11,700	2%

Source: Terabit Consulting

The pure "carriers' carrier" model, which was employed by the majority of transoceanic network developers during the speculative bubble of 1999 to 2002, has been pursued by only a handful of

investors lacking bandwidth requirements of their own, with limited success.

As the deployment of submarine cable networks has shifted toward the developing world, non-traditional sources of funding, such as those of international financial institutions and regional development agencies, have become increasingly popular.

4. TOWARD A NEW DEMAND MODELING FRAMEWORK

Traditionally, feasibility studies and demand models for submarine networks have comprised either a top-down, interview-based analysis of carrier demand or a bottoms-up model of end-user demand. Although these models are well-suited for developed markets, markets in South Asia, the Middle East, Africa, China, and Latin America require thoughtful region-specific considerations of macroeconomic issues, including:

- poverty rates,
- poverty reduction strategies,
- national development plans,
- education and literacy,
- linguistic considerations,
- cultural preferences,
- deployment of electrical networks and other utilities,
- availability of IT infrastructure, and/or
- governmental control of Internet usage.

Oftentimes, surprising phenomena can affect capacity demand in developing markets. While performing a feasibility study in Central Africa, for example, analysts from the author's organization noticed a marked decline in the total number of mobile minutes on Sundays compared to the rest of the week. Sources soon revealed that many mobile subscribers lacked electricity in their homes and charged their handsets at their employers during the week. The battery's charge from Friday afternoon would normally last through Saturday night, but by Sunday the battery would often be depleted. Although engineers at each of the mobile operators were working to deploy public charging stations in order to address this problem, analysts nevertheless developed a modeling framework that drew heavily from the city-by-city deployment plans of the national utilities, and more specifically, a day-by-day model of peak-hour demand identified lopsided usage patterns by users who were attempting to compensate for infrastructural weaknesses.

5. CASE STUDY: SEYCHELLES

In 2009 the author's organization performed a traffic and market analysis on behalf of the Government of Seychelles in order to forecast demand for a proposed submarine cable linking Seychelles to the mainland. Because Seychelles is a well-developed but geographically isolated economy with a wealth of statistical information, the project offered a unique opportunity to develop a next-generation model of demand.

As a result of Seychelles' relatively small population (85,000) and geographic isolation (1,300 kilometers from the coast of Somalia), the country has never been able to take advantage of the Internet capacity available to most developed nations. The country had not always suffered from bandwidth isolation; in the late-1800s Seychelles was linked by one of the most technologically-advanced cables of the era, a £265,000 telegraph cable connecting to Zanzibar and Mauritius. Later, a high-frequency radio connection to Nairobi was established. However, throughout the Internet era the country had been limited to expensive, low-bandwidth satellite connections which, in spite of the best efforts of the operators and the government, had stunted the growth of the islands' ICT sector.

A submarine cable had been under consideration by the Seychellois government since the 1990s, and a grant in 2009 from the Middle Income Country Fund of the African Development Bank made possible a study of the project's feasibility.

Analysts traveled to Seychelles to meet with the country's regulator, operators, and other stakeholders in the project. The responsiveness of the government and the country's telecommunications operators and Internet service providers, as well as a wealth of extremely granular statistical information covering Seychellois demographic and economic issues, allowed the analysts to expand upon a micro- and macro-economic framework by examining residents' disposable income and the proposed pricing of operators and Internet service providers. Ultimately, a reliable model of demand elasticity was formulated and integrated into a larger model of overall demand and market conditions.

6. CONCLUSIONS

If the cycle of deployment between 1999 and 2002 was characterized by its speculative nature, then the deployment cycle between 2008 and 2011 could be characterized by a rush to connect to three regions: India (and nearby markets in the Middle East); Africa; and China. These developing markets pose unique challenges and suffer from a wide variety of obstacles to growth. A full understanding of the opportunities for the submarine cable industry in these markets can only be derived from an understanding of each region's underlying macroeconomic characteristics and a pragmatic consideration of local bandwidth distribution, and resulting demand, in such a framework.

