Russian Semiconductor Market Status and Prospects for Growth

Russian Path from Semiconductor Science to Critical Mass in Manufacturing

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Global Semiconductor Market – Breakdown of Consumption by Region

The global semiconductor market was worth US$ 300.4 billion in 2010

**AMERICAS**
- Sales of semiconductors are concentrated in the North America, particularly in the US
- In 2010, North American semiconductor market grew by 40.7%, the highest regional growth, reaching US$ 54.2 billion

**EUROPE**
- After a brief slowdown, in 2010 the European semiconductor market expanded by 27%, totalling US$ 38.6 billion

**ASIA PACIFIC**
- The semiconductor market has risen by 35% amounting US$ 169.3 billion
- China’s demand for industrial and automotive ICs was among the key growth drivers

**RUSSIA**
- In 2010 the Russian semiconductor market was valued at US$ 1.2 billion
- In its optimistic scenario, F&S forecast that by 2015 the market could total US $9.9 billion

**JAPAN**
- Following a difficult 2009, the Japanese semiconductor market amounted to US$ 49.0 billion in 2010, 21.1% year-on year growth

Source: World Semiconductor Trade Statistics, IC Insights, F&S analysis
**World Map of Manufacturing Hubs**

**EUROPE**
- Semiconductor clusters around Grenoble (France), and Dresden (Germany)
- Wafer fabs, R&D and design centres from STMicroelectronics, NXP, Infineon, etc.
- Trend towards decreasing the number of fabs due to high upgrade costs and foundry outsourcing instead

**US**
- Wafer fabrication and R&D centres concentrated in Texas and California
- Intel, Texas Instruments, Samsung and Freescale continue to expand in the US due to established industry ecosystem in place.

**CHINA**
- Agglomeration of assembly and test facilities due to economies of scale and cost-advantages
- Growing foundry business to serve booming domestic demand – ICs for consumer electronics, industrial and automotive sectors

**SOUTH KOREA**
- Place of origin for two of the world’s largest semiconductor companies – Samsung and Hynix, both with further plans for expansion

**ASIA PACIFIC**
- A number of major Western and Japanese semiconductor companies located their test and assembly facilities in Malaysia and Philippines
- Singapore - wafer fabrication facilities from STM, NXP and Micron

**JAPAN**
- Home base for several semiconductor majors – Sony, Toshiba, Renesas, Elpida (both wafer fabrication as well as assembly and testing facilities)
- The industry faces ever-increasing competition from South Korean and Taiwanese rivals.

**TAIWAN**
- A foundry service centre of the world – Taiwan Semiconductor Manufacturing Company (TSMC) and United Microelectronics Corporation (UMC).

Source: F&S analysis
Russian Semiconductor Market: Growth Scenarios

The Russian semiconductor market is to triple by 2015

- **Optimistic scenario (CAGR – 39%)**: legislative “enticement” to drive localization of manufacturing in key industries (automotive, telecom, etc.)

- **Moderate scenario (CAGR – 19%)**: based on a largely status quo view of the Russian market.

- **Very optimistic scenario (CAGR – 53%)**: positive changes in the Russian business environment and human capital development.

  The scenario envisages positive effects from manufacturing localization by the foreign investors and large-scale investment projects (LED lighting, smart grid, smart cards, etc.)

  Very optimistic scenario can kick-off only from 2014

Source: F&S estimates, 2010
Russian Semiconductor Market: Growth by End-markets

- **Automotive** is expected to be among the fastest growing due to governmental support of Russian-OEM partnerships and expanding Russian automotive market. Applications: Wireless solutions, power management, hybrid electric vehicles, tyre-pressure monitoring systems, LED lighting, etc.

- **Energy and Lighting**: state-supported energy conservation initiatives in the public housing & utility sector, are forecast to drive demand for electronic energy efficiency solutions. Potentially large-scale domestic market; attractive export opportunities. Existing domestic manufacturing. Applications: Smart meters, LED lighting.

- **Telecom** sector will be fuelled by infrastructure upgrades – 3G/4G development.

- **Smart cards IC** forecast is largely conservative, excluding government e-ID projects like “universal electronic card” (prospects unclear at the time of research) but it has high potential in the domestic and CEE/CIS markets. Large scale market. Existing strong domestic manufacturing, e.g. fire security. Applications: National e-ID projects. Near-field communication, high-capacity SIM, RFID (brand protection and object identification), video content analytics.

*Compound Annual Growth Rate*


Source: F&S Research & Analysis, estimates
Russian Semiconductor Market: Export opportunities

Western Europe
- **Smart meters** deployment and roll-out of smart grids, as well as **LED lighting** promotion are some of the cornerstones of the European energy-efficiency policy.
- Russia could penetrate the market in partnership with, for example, Energomera - leading manufacturer of metering equipment; as well as supply other key players – Elster, Echelon, Iskraemeco.

Middle East
- One of the most attractive **electronic security market** in the world: critical infrastructure (oil and gas), border control and citizen security are demanding large shipments of CCTV cameras, intrusion detection systems, etc.
- Russia could explore export opportunities in partnership with Russian manufacturers of relevant equipment or approach foreign players active in the market.

Eastern Europe / CIS
- **Electronic security** equipment will be in high demand for critical infrastructure surveillance (power plants, air- and sea-ports) in the new EU member states; several **smart cards** projects are in discussion (e.g. e-Passport in Ukraine, e-ID and e-Health in Poland). Large number of **automotive components suppliers** in the region will require ever-growing number of IC supplies.
- Russia should explore cultural/political/economic proximity with the region and engage in pro-active dialogues with end-users as well as respective Governments.

APAC
- Asia-Pacific is to remain the largest consumer of microelectronics worldwide, with major OEMs across all industries moving their production into the region.
- Opportunities, as well as tough competition, will exist in all key areas – **automotive, energy, smart cards and security**.

Source: F&S Research & Analysis
Russian Semiconductor Industry Growth Prospects

Frost and Sullivan believes that there is an opportunity for Russia to establish a competitive presence on the global microelectronics stage.

However, numerous strategic and operational challenges need to be addressed for the semiconductor industry in Russia to take off.

- The Right Timing of Market Entry
- Deciding which Business Model to Follow
- Creating an Attractive Holistic Ecosystem
- Attracting the Right Partner
The Right Timing of Market Entry

The industry has typically involved 3-4 year cycles – the next upturn can be expected in 2013/14

Approximate cycles:
- Year 1-2: high growth
- Year 3: slow growth
- Year 4: flat growth/decline

Annual Semiconductor Shipments (volumes)

The lead-time for Russia is likely to be circa 2 years

High-level roadmap for Russia – from planning to producing

- Growth is expected in industrial and automotive semiconductor markets
- The most important drivers for growth:
  - Wireless handsets
  - Consumer electronics

Long-term CAGR:
- Optimistic: 15%
- Realistic: 8-10%

The right timing is of critical importance!

Source: Semiconductor Industry Association, 2010
### Key Trend

- Semiconductor industry is increasingly moving away from vertical integration towards asset-light (asset-smart) business models
- This is leading to minimization of in-house resources and maximization of outsourcing opportunities

### Choosing the Business Model

<table>
<thead>
<tr>
<th>IDM (Integrated device manufacturer)</th>
<th>Fab-Lite</th>
<th>Fab-Less</th>
<th>Foundry</th>
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<tbody>
<tr>
<td>Marketing/ Sales</td>
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<td>Semiconductor production (fabs)</td>
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<td>Design/ IP</td>
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<tr>
<td>In-house manufacturing</td>
<td>In-house manufacturing</td>
<td>Foundry partners</td>
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<tr>
<td>Vertically integrated enterprise with complete product life-cycle in-house (Intel, Samsung, STMicroelectronics)</td>
<td>A company retains fab(-s) but shifts focus towards R&amp;D and increasingly outsources to foundries (Texas Instruments, Renesas Electronics, IBM, Infineon)</td>
<td>Pure-play R&amp;D firm, manufacturing outsourced to foundries (Qualcomm, Marvell, Broadcom, nVidia, Xilinx)</td>
<td>Contract manufacturing on a large scale (TSMC, UMC, GlobalFoundries, SMIC)</td>
</tr>
</tbody>
</table>
Creating an Ecosystem

**Capital and Land**

- Russia boasts no shortage of land for manufacturing expansion as opposed to, for example, Taiwan or South Korea – both countries also prone to earthquake impacts as a stability concern for the industry.
- Government's support of microelectronics development, we believe, also signifies readiness to provide capital funding.

**Technical and Managerial Competence**

- Russian has good technical education, with proper training in microelectronics its graduates could become a potent driving force behind the industry growth.
- More is to be done in terms of developing managerial competencies.

**Robust Public-Private Framework**

- Semiconductor industry has evolved due to successful cooperation between public and private institutions – governmental bodies, R&D institutes, business investors.
- Russia must encourage and facilitate commercialization of innovations by large number of start-ups and R&D centres in the country.

**Effective Transportation/Logistics**

- Both semiconductor and electronics manufacturing rely heavily on effective logistics system – Russia is advantageous on the cost side, however a lot yet to be done in terms of efficiency.
- On a flip side, advances in microelectronics can help solving some of the pressing issues in transportation (RFID tagging, satellite navigation, stolen vehicles tracking).

**Tax and Tariffs**

- Semiconductor industry remains sensitive about various policy issues. The Government must create the right incentives for investment by revisiting its policy for tax and import/export duties,
- Creation of economic zones with preferential treatment as Zelenograd or Skolkovo is a welcoming step forward.

Success in microelectronics requires 5 main types of capabilities; Russia has work to be done across all the areas
Case-study: Semiconductor Ecosystem in India

**Key Insight**

- India boasts established semiconductor R&D services industry but failed (thus far) to build a semiconductor manufacturing capacities.
- Lack of supporting industry ecosystem is among the key reasons which prevent global semiconductor companies from investing into fab construction in India.

### IC Research and Design

- Well-established IC design industry with Intel, Texas Instruments, AMD, STM, Infineon, Renesas having presence in the country.
- Established IP protection laws.
- Growing domestic demand for electronics – consumer products, industrial electronics, aerospace and defence, IT, automotive.

### Semiconductor Manufacturing

- **SemIndia**'s fab construction was put on hold after its 3-year technology transfer deal with AMD expired in 2008 – the latter pursuing fab-lite strategy.
- In 2007 Hindustan Semiconductor signed a Memorandum of Understanding with Infineon (130nm) but talks stalled and never materialized.
- In 2006 India and Taiwan semiconductor industry associations signed a MoU to explore partnership in chip industry, however it did not go beyond IC research and design.

### What Russia could learn

- Start with developing IC research and design capabilities as the first necessary step towards semiconductor manufacturing.
- For global companies willing to invest in semiconductor manufacturing – relevant ecosystem must be present in the first place.
- Explore the possibility of cooperation with India in microelectronics industry given strong intergovernmental relations between the two countries.

Creating an ecosystem means:

- Pool of qualified human resources (both technical and managerial qualifications);
- Established transport infrastructure (roads, ports, railway);
- Efficient water and energy supply;
- Supply chain management – availability of IC test and assembly, packaging, IP creation industries
- Proximity to end-user, i.e. electronics manufacturing.

**Frost & Sullivan**
Attracting the Right Partner

✔ **Current exposure in Russia**
Company’s presence in Russia, including non-microelectronics businesses, in particular – availability of manufacturing capacities or R&D centres

✔ **Political and economic relations**
Major semiconductor corporations are the beacons of their homeland’s technological and economic prowess; cooperation with such firms usually involves senior government officials and evolves within a framework of wider intergovernmental relations.

✔ **Product focus**
Relevance of the company’s product portfolio to the domestic microelectronics demand in Russia is crucial.

✔ **Investment outlook**
Company’s on-going, large-scale investment projects elsewhere would make commitment to a significant project in Russia less likely

✔ **Business model and strategy**
Foundries are less attractive for knowledge sharing and technology transfer agreements

✔ **Other**
Collaboration history, experience/willingness to operate in the emerging markets’, past technology transfer agreements, cooperation with government bodies

Partner evaluation criteria could vary from product portfolio attractiveness to political links with Russia
Attracting the Right Partner (2)

Customer partnership

- STMicroelectronics strategic alliances with customers: Magnetti Marelli (Italian producer of automotive electronics), LifeNexus (US, personal eHealth-card), Arad (Israeli smart water meters manufacturer), consumer electronics and telecoms – Alcatel-Lucent, Bosch, HP, Nokia, Pioneer, etc.

Joint Development Agreement (JDA)

- Crolles2 (2002-2007, France): STM, NXP, Freescale, Toshiba and others – joint collaboration to develop CMOS logic chips at 45nm and 300mm wafers.
- IBM Alliance (ongoing, US): IBM, Samsung, GlobalFoundries, STM, etc. – R&D at <28nm process nodes.

Human capital transfer

- Advanced Technology Investment Company (Mubadala Group, GlobalFoundries) signed a deal with Singapore Polytechnic to train wafer fabrication technicians for a planned 300mm fab in Abu-Dhabi.
- Brazil IC Project: 20 Brazilian semiconductor engineers will receive training at Toshiba’s facilities in Kawasaki.

Inter-state rivalry

- Facing tough challenge from the South Korea (i.e. Samsung and Hynix), leading Japanese memory producer – Elpida, reached an agreement with Taiwan’s Powerchip Technology in a deal which was immediately dubbed as “Taiwan and Japan vs. South Korea”.
- Experts also voice opinion for India and China to join forces for them to succeed in semiconductor industry: the former has excelled in IC design while the latter is a major manufacturing hub.

Finding a technology partner is only part of the challenge; Russia needs to develop partnerships at various levels
### Case-study: Brazil and Toshiba

**Key Insight**

- The talks with Brazil's technology partner – Toshiba, started at the government level between Brazil and Japan.
- Toshiba concluded that financially and business-wise, Brazil should focus on building its human resources and IC design capabilities in the first place, instead of building fabs.

#### Drivers

- Government support – the National Microelectronics Policy (2001), Brazil IC Programme - $ 290 investment (since 2006).
- Technology partner – Toshiba: personnel training, JV for IC design house.
- Japan-Brazil roadmap for “cultivation of microelectronics”.
- High internal demand for microelectronics which domestic IC industry is to address in the first place – RFID solutions, digital TV, industrial applications.

#### Restraints

- Lack of qualified technical and managerial staff, absence of microelectronics experience.
- Unwillingness of global vendors to commit to IC manufacturing in Brazil – high CAPEX, lack of infrastructure.
- Lax intellectual property laws.

#### What Russia could learn

- Proactively engage with leading global semiconductor companies, possibly on inter-governmental level.
- Adopt fab-lite business model: concentrate on IC design and development, outsource manufacturing.
- Develop microelectronics products according to internal demand primarily.

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**“The ox chip”:**

- RFID tag developed at 60nm, planned – 35nm;
- Large internal market – 200m head of cattle, to be replaced every 3-4 years;
- “Beyond cow” – stolen cars’ and biomedical products’ tracking.

**Digital TV:**

- 2006 – memorandum of understanding with Japan to adopt its ISDB-T standard in Brazil;
- 2010 – JV with Toshiba for the latter to open its IC design house in Brazil.

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To summarize...

We believe that the Russian semiconductor market is set for growth and there is an opportunity for Russia to be established as a semiconductor hub in the global micro-electronics industry, HOWEVER:

1. Given the industry’s demand cycles and the necessary lead-time to move from planning to execution, timing is of crucial importance.

2. There is a tendency for specialisation (fabless/ fab-lite vs. foundry), rather than implementation of an end-to-end (IDM) business model.

3. Irrespective of the business model, a powerful value proposition based on an holistic ecosystem is vital.

4. For the strategy to be successful, partnerships at several levels are required.
Thank you!

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