Foreword

Sustainability scored two huge global wins last year. First, it was the successful renewal of commitments towards sustainable global growth through the Sustainable Development Goals. Second was the Paris Agreement where governments finally came to an agreement and brokered a deal that is accepted by all nations, to recognise and combat the real threats of climate change. On both wins, the business community played a pivotal role in enabling the negotiations through the sharing of their technology, economic case and community influence in countries they operate in.

In Singapore, the two international efforts also led to significant milestones with sustainability as the national agenda. At the governmental level, we saw the revised version of the Sustainable Singapore Blueprint and the launch of Singapore’s Climate Action Plan by our President. In the private sector, we witnessed the implementation of the “Comply or Explain” sustainability-reporting requirement by the Singapore Exchange, the regulatory body of Singapore listed companies.

With the global and local sustainability agenda taking centre stage, early business adopters are already benefitting from this shift complementing the increasing demand by the informed consumers to vote with their dollars for sustainable businesses. As this trend is set to grow, the businesses community will have to adapt or risk being eliminated. Companies must look into sustainability beyond just ticking the box, but truly integrate it into their business modus operandi.

However, the road to achieving sustainability is not a simple or straightforward one. It differs from company to company depending on the nature of their business. Therefore, this annual book of case studies becomes increasingly important for businesses, both big and small, to find out more what has been done and adapt it for themselves as part of their sustainability journey.

We would like to express our sincere thanks to the Nanyang Business School, Nanyang Technological University for its continual support for the Case Studies Handbook project. We are grateful to them for the time and effort put into documenting these sustainability best practices, in hope that other businesses can be both inspired and learn from our winner’s respective stories.

At the same time, we would like to acknowledge the winners of Singapore Business Federation’s Singapore Sustainability Awards 2015 that have kindly contributed their stories to this publication. Their willingness to share their experience with the business community will greatly benefit the readers and for that, we would like to express our sincere and heartfelt gratitude towards them.

As we enter into a new decade of the sustainability movement in Singapore, Global Compact Network Singapore (GCNS) is committed to serve the business community in Singapore towards achieving sustainability. The integration of SBF’s Sustainable Development Business Group and GCNS will provide the resources needed to better serve companies by equipping them the necessary competitive advantage needed in the face of the new global agenda.

Mr Wilson Ang
Executive Director
Global Compact Network Singapore
Foreword

By The Dean, Nanyang Business School, Nanyang Technological University (NTU).

The Nanyang Business School is delighted to partner with the Global Compact Network Singapore (GCNS) to jointly publish this handbook featuring case studies of business organizations that won the Singapore Sustainability Awards in 2015.

Sustainable Earth is one of the peaks of excellence and key research areas at NTU. Since 2005, NTU has secured grants to the tune of $1.3 billion for research related to sustainability. Two of our flagship research centres are the Energy Research Institute @ NTU (ERI@N) and the Nanyang Environment & Water Research Institute (NEWRI). ERI@N focuses on research related to renewable energies and sustainable urban mobility solutions. NEWRI focuses on research related to sustainable water technologies both for developed and developing countries. NTU organizes the Singapore Sustainability Symposium annually which focuses on thought leadership and policies for Sustainable Cities. NTU also has many corporate laboratories setup in collaboration with global corporations, that focuses on research related to sustainability. For example, the corporate lab setup with BMW focuses on e-mobility.

At the Nanyang Business School, we host the Centre for Business Sustainability. This centre is a platform for exchange of interdisciplinary research ideas. The centre hosts interdisciplinary research seminars that focus on business sustainability by leading global scholars and academics, as well as industry leaders. The centre also initiates interdisciplinary research focused on business aspects of sustainability with the Engineering Schools and research centres within NTU.

We are pleased to see a varied line up of award winners from both Sustainable Business and Green Technology category that include multinational corporations, an SME as well as a government statutory board. These organizations displayed great enthusiasm throughout the process of award evaluation, selection and case writing, where they eagerly shared their sustainability stories with our research team about their practices and efforts.

The case studies featured in this handbook look at specific sustainability topics that are unique to each company and/or industry. The cases will appeal to a wide audience – both sustainability practitioners and academics. Here are some of the highlights of the case studies:

- **Ardentec** is a leader in providing chip and wafer testing services for integrated manufacturing devices (IMDs) and showcases its cutting-edge technology to provide top solutions for their customers.

- **Buckman Laboratories** has developed innovative chemical solutions for their target markets that help customers with resource optimization and environmental impact reduction.

- **Maritime and Port Authority of Singapore (MPA)** has used sustainability as an industry growth strategy and leadership culture to promote green shipping practices to the maritime business community.

- **Canon Singapore**: This case focuses on Canon’s advanced green technology products that are unique in providing the least environmental impact with durable energy-efficient office network machines.

- **Elmich Pte Ltd** is a case that demonstrates how the green building industry has the potential to be a game-changer in reducing emissions and heat from buildings by using products from natural sources and recycled plastics.

We hope that you will find this Case Study handbook, produced jointly by GCNS and Nanyang Business School, with its varied sustainability themes, both enlightening as well as inspiring and help start (or further continue) your own sustainability journeys.

Dr. Neo Boon Siong  
Canon Professor of Business and Dean  
Nanyang Business School  
Nanyang Technological University
Today in Singapore, the electronics industry, including the semiconductor sector is a major contributor to the local economy. Of the S$11.8 billion in fixed asset investments EDB secured in 2014, electronics accounted for 14% of the total investments. Due to Singapore's pro-business environment, the country is home to nine of the world's top 15 fabless semiconductor companies. The semiconductor sector can be further divided into specific functions: design, manufacturing, packaging and testing. Each function makes for an important part of the semiconductor value chain (i.e. electronic products). Testing, in particular, provides the final quality assurance by checking their functional and electrical characteristics, and performance defects. The testing data is also collected and analysed for the manufacturing and assembly processes to improve their products.

There are 15 such semiconductor assembly and testing companies in Singapore, one of them being Ardentec Singapore Pte Ltd.

**COMPANY PROFILE**

Ardentec Corporation was founded in Hsinchu, Taiwan in 1991. It focuses on providing testing solutions in memory, logic, mixed-signal integrated circuits (IC) and semiconductors for integrated device manufacturers (IDMs), pure play wafer foundry and fabless design companies. With its exceptional capabilities in testing, product engineering and information technology (IT) complemented by a team centric management philosophy, Ardentec Corporation is one of the top wafer test service providers in Taiwan.

*Served by Ardentec, Globally Admired* is their corporate slogan and commitment to their customers. Many of their customers are either among the world top ten fabless design companies or in the world top ten IDMs, covering East Asian countries such as China and Taiwan and extending to North America and Europe. It has also expanded its operations to other countries, including Singapore.

Ardentec Singapore, a wholly owned subsidiary of Ardentec Corporation was founded in June 2006 to provide professional semiconductor testing services while the advancement of semiconductor testing technology was booming and the semiconductor industry was growing. Due to Singapore's strategic location and mature business environment, Ardentec Singapore is able to better cater to their regional customers through a shorter cycle time.

Through technical innovations, encompassed by engineering capabilities, and supported by passionate staff members, the company is devoted to this life-long journey of becoming a sustainable business.
COrPOrAtE SuStAInABILIty COMMItMEnt

Ardentec Singapore believes that profitability and sustainability are not mutually exclusive. While delivering profitable growth, they are also devoted to contributing positive change and to make an impact on people and the planet. In turn, these people and the planet will continue to sustain them in their operations. As such, it has adopted a strong environmental management, employee engagement and community involvement framework that are supported by a good governance structure.

The company’s belief in sustainability was inherited from its headquarter in Taiwan, which was awarded the Corporate Social Responsibility (CSR) award in 2013. It is also guided by a sustainable business framework, with a focus on corporate governance, environmental protection, employee engagement, supplier management and community involvement. Evidently, Ardentec Singapore emulates similar principles and incorporates them into their business framework as well. There is regular communication on the sustainability direction between the headquarter and Ardentec Singapore to ensure they are aligned in principle. While the general direction is provided, Ardentec Singapore is given free rein to develop its own corporate sustainability goals, as it is understood that the most effective sustainability efforts consider its unique operating context.

Ardentec Singapore’s key guiding principle – the 10 core values as shown on Figure 1 is in fact defined by its people as a ground up initiative. The employees chose these 10 values they wish to imbue in all aspects of their work and communicated them to the management. These 10 values serve to cultivate their business attitude and broaden their aptitude across the entire organization.

CORPORATE SUSTAINABILITY COMMITMENT

Ardentec Singapore has formulated their corporate governance framework in accordance with domestic laws, regulations and guidelines e.g. the Companies Act of Singapore. International standards are also referenced to ensure their framework is accepted globally.

Sustainability Steering Committee

With regard to managing sustainability matters, Ardentec Singapore has a designated Sustainability Steering Committee. The committee is chaired by the General Manager, who is able to make decisions and assign duties swiftly. The committee members are involved in designing and planning initiatives, while the Operations Director executes them. The structure and functions of each member are reviewed bi-annually. The direct involvement of the top management makes for an effective sustainability committee as resources can be engaged efficiently. Sustainability efforts can also be well aligned with the company’s overall corporate strategy.

The Sustainability Steering Committee is responsible for all sustainability related activities and communicates frequently with their stakeholders. Some of these activities and messages...
include environmental, safety and health (ESH) risks, information security risks, annual business continuity plans, corporate social responsibility (CSR) initiatives and workforce development.

**Risk Assessments**

Risks and opportunities are assessed through risk assessments. Proper risk assessment procedures on ESH, business continuity and information security are in place. These risk assessments occur annually on a departmental level.

**Environmental, Safety and Health Risk Assessment**

At Ardentec Singapore, ESH aspects are taken seriously. As seen on Figure 2, each department is required to conduct their own individual ESH risk assessments. After which, Ardentec Singapore’s ESH department has to consolidate and review these results. The ESH management committee then finally defines the goals, strategies and policies to be implemented in each of these departments. In recognition of these robust procedures, Ardentec Singapore is certified for ISO 14001 Environmental Management System and AS0007 for Environmental Aspect/Hazard Identification and Risk Assessment Procedure.

**Business Risk Assessment and Continuity**

Ardentec Singapore prides on building trust with their stakeholders i.e. clients and suppliers. When disruptive incidents occur, Ardentec Singapore is well prepared to continue providing their services to their business partners. Drills are conducted annually as part of the ISO 22301 for Business Risk Assessment and Continuity requirements.

**Financial Risk Assessments**

As a business, a healthy bottom line and revenue is naturally one of the priorities. Monthly quality audits are carried out to assure that the systems and processes are efficient and reliable. Ardentec adopts a stringent approach to cost management and looks out for opportunities to reduce operational costs and optimize its resources.

**Key Performance Indicators**

In addition to setting the sustainability direction and activities, the Sustainability Steering Committee identifies key performance indicators (KPI) to promote sustainability success. These include both financial and non-financial indicators to track their economic, environmental and social success. Some of the KPIs include energy consumption, employee turnover rate and Return on Investment (ROI). ROI is an important indicator of whether the sustainability initiatives create financial value for the company.

**Stakeholder Engagement**

To meet the expectations of their stakeholders, Ardentec Singapore communicates with their customers, business partners, suppliers, the government and the community in a timely manner. Corporate disclosures on important issues are conducted to ensure information transparency.

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**Responsible Dept**

<table>
<thead>
<tr>
<th>Every Dept</th>
<th>ESH</th>
<th>ESH Management Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>List each dept. operation list</td>
<td>Collect related regulation &amp; major occupational disaster record</td>
<td></td>
</tr>
<tr>
<td>Environment aspect/hazard identification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify critical environment aspect and intolerable risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan management method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have management methods register in critical environment aspect/intolerable risk control chart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dept head verifies and signs for approval</td>
<td>Integrate every dept. environment aspect/hazard identification and management method</td>
<td></td>
</tr>
<tr>
<td>Execute according to management method</td>
<td>Decide management method</td>
<td></td>
</tr>
<tr>
<td>Explain in committee meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Ardentec Singapore's EHS Risk Assessment Procedure.
WORKING TOWARDS AN ENVIRONMENTALLY SUSTAINABLE BUSINESS

Ardentec Singapore’s environmental sustainability policy states that their development must follow a low carbon emission, energy saving and environmentally conscious direction. This policy complies with Singapore government’s business environmental regulations and ensures their license to operate. Beyond compliance, Ardentec Singapore sees that being environmentally sustainable makes complete business sense in that it secures one’s business, and also differentiates them from their competitors.

Reducing carbon emissions

Increasingly, global warming is felt in many parts of the world. In response, many governments have identified reduction in greenhouse gas (GHG) emissions as one of the strategies to mitigate global warming. Ardentec Singapore foresees that moving forward, consumers and business partners will prefer purchasing green products and engaging in green services. Hence, the company has made a prudent decision to manage their GHG emissions in various areas of operations.

There are three different scopes of GHG emissions that could arise in companies engaged in wafer and semiconductor testing. Ardentec Singapore is committed to managing GHG emissions arising from scopes 1 and 2 as these can be directly controlled by modifying their operations (see Figure 3).

Ardentec Singapore has achieved the ISO 14064 certification for GHG emissions quantification and reporting every year since 2012. It is also the first company in the local semiconductor industry to accomplish this achievement.

Energy saving through process redesign

Based on the assessments conducted by each department and reviewed by the Sustainability Steering Committee, energy consumption is identified as one of the main opportunities to manage GHG emissions. As a testing facility, not many materials are used since no physical product is delivered. A large amount of electricity however is required to run its machinery, equipment and support its basic operations.

From the year 2011 – 2012, the company’s dedicated Energy Saving Team engaged in an “Improvement of Facilities Equipment Efficiency and Quality Project” in a bid to raise productivity, lower GHG emissions and lower operating costs. This project enabled them to save 701,162 KWh of electricity, reduced 2,013 m3 in water consumption, and reduced 432 tons of CO2 emissions. Building on the success, the team continued with another project titled “Improve Energy Saving Efficiency and Quality” in the following two years. This project helped reduce electricity use by 73,420 KWh, 2347 m3 in water consumption and 44 tons of CO2 emissions. The team was able to apply their knowledge of plant processes and equipment to identify opportunities for energy savings. They purchased a variable-speed drive air compressor that was able to reduce compressor frequency and exhaust loss of the adsorption dryer. They also found that by shortening the cycle of the cooling tower washing, its heat dissipation performance was improved, that subsequently led to energy saving from operating the chiller unit. These two projects won Ardentec awards in the Quality Control Circle (QCC) competition.

In year 2014, Ardentec Singapore installed the Smart Release System to replace their existing conventional Chemical Water Treatment System for their cooling tower. This system has enabled them to automatically control the chemical composition of the cooling water. It has resulted in reduced bacteria growth and higher quality cooling water. In turn, the cooling tower and water-cooling chiller have also achieved higher efficiencies, reducing electricity consumption by 55,179.9 KWh per year. It is estimated that a total of 168,539.7 KWh of electricity will be saved over the next three years.

Figure 3: Scope of GHG emissions at Ardentec Corporation

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Energy saving through managing overheads
In addition to adjusting plant processes, Ardentec Singapore also hopes to reduce energy consumption in running of its offices. The use of air conditioning and lighting is staggered into different time segments at different locations of the offices. Light sensitive switches are also installed in glass-walled hallways. Since year 2014, normal lighting has also been replaced with LED lights. Their first phase of light conversion is estimated to save 112,874.25 KWh of electricity per year.

The Information Management Department also installs automatic computer processes to shut down hard disc drives and computer equipment for monitoring the wafer test systems when they are not in use. These may seem like minor modifications, but can accumulate significant savings.

Environmental consciousness
While building a new plant site or planning operational activities, Ardentec Singapore first considers the location’s proximity to nature. They make it a priority to stay away from any habitats and sanctuaries that are rich in biodiversity so as to avoid habitat destruction and fragmentation. They also locate themselves close to their customers to limit transportation-linked environmental costs.

EMPOWERING THE WORKFORCE
Ardentec Singapore views its workforce as the most important asset. It is committed to establishing a work culture that could attract and retain the best talents. It showcases its dedication to fair labour practices and human rights through its employee welfare policies and competency development plans.

Employee engagement
Ardentec Singapore believes that employees have to feel a sense of belonging for them to give their all to the company. They design various activities to provide opportunities for the staff to interact and bond with one another. A new employees’ lunch is organized for new employees to get oriented with each other as well as with the management team. This is also a chance for them to have an idea of the working and management style within the company. Bi-annual off-site team building sessions are also promoted to facilitate understanding and cooperation of the team members in a casual setting.

Quarterly communication sessions are organized to provide a feedback channel for employees. During these sessions, staff can state their concerns and suggestions about the company. Most importantly, these sessions promote two-way communication where the management also responds to the feedback provided. Another communication channel is the Employee Satisfaction Survey that is administered anonymously. A successful case of feedback sharing was where the management approved of employees’ suggestion to have flexi-work arrangements. Currently, Ardentec Singapore is in the midst of piloting the flexi-work arrangement with the assistance of National Trades Union Congress (NTUC).

Employees at Ardentec Singapore work with each other to better understand and improve the operational processes. This team-centric philosophy is guided by the QCC concept, a management technique that involves using groups of employees to solve issues that are relevant to their own area of work. One example is the Energy Saving Team, which consists of employees from the Plant Facilitation Department and is responsible for optimization of infrastructure and reduction in energy consumption. Members of the team are able to apply their direct expertise to re-design the processes and achieve significant improvements in their respective tasks.

Employee welfare
Employees are well taken care of in terms of work health and safety, fair remuneration and human rights. ESH procedures are in place and recognized by International Standards to provide a safe working environment. Overtime (OT) work hours are regulated to ensure employees have adequate rest. Their OT benefits surpass the Employment Act requirements. Dormitories for foreign workers are also properly furnished to ensure pleasant living conditions.

Employee training and development
Talent training to support an individual’s growth and the company’s business has become one of Ardentec Singapore’s key focuses. When an employee begins their employment with Ardentec Singapore, they are tasked to set individual personal goals. The company then assists the employee to achieve these goals through a customized series of training and development programmes. In order for the employees to keep updated with technical knowledge and learn soft skills, they are required to complete a minimum number of 40 hours of training per year. In
addition to courses assigned by Ardentec Singapore, employees are encouraged to select courses they are interested in to facilitate better learning. Training records are also kept for each employee. A well-structured job rotation system is also in place to encourage employees to expand their knowledge and skillsets. Through a performance review termed the Development Discussion Guide (DDG), employees’ training needs are identified. This information helps Ardentec Singapore conduct possible matches for job rotations within the company. Through these efforts, the company supports their employees’ development and charts their direction and career path.

One successful case of job transition at Ardentec Singapore is that of a receptionist who is now a recruiter. While she was employed as a receptionist, her supervisors found that she had great potential for the human resource field just half a year into her job. She was then encouraged to enroll in the Certificate in Human Resource Management programme conducted by the Singapore Human Resources Institute (SHRI) Academy. There, she acquired knowledge in general management, employee relations, and human resource management. With this qualification and her experience, she was reassigned as a recruiter at Ardentec Singapore.

**Employee participation**

Ardentec Singapore is unique in that it does not have a dedicated research and development (R&D) department. It believes that having a single department discourages creativity, as employees would rely on that R&D team to generate new ideas. Hence, all departments are strongly encouraged to predict upcoming business trends in the semiconductor industry, and come up with new thoughts about their business model and processes. This greatly engages the employees as they too are allowed to voice their opinions about strategic issues within the company, beyond their daily duties.

**Impact of employee empowerment and engagement**

To measure the effectiveness of these employee policies, each department has its turnover rate as one of the KPIs. An analysis by Ardentec Singapore has shown that more than 17% of their staff has been with the company for more than 5 years, and 15% are the pioneers who have been with

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**Today in Singapore, the electronics industry, including the semiconductor sector is a major contributor to the local economy. Of the S$11.8 billion in fixed asset investments EDB secured in 2014, electronics accounted for 14% of the total investments. Due to Singapore’s pro-business environment, the country is home to nine of the world’s top 15 fabless semiconductor companies.**
them since their incorporation. Ardentec Singapore continues to review their internal policies to improve their current employee compensation and benefits package.

COMMUNITY INVOLVEMENT
Ardentec Singapore shares a sense of social responsibility towards the local community and the future generation. They make regular contributions to the community through their ongoing voluntary community investment activities. They have a long-term relationship with the Singapore Children Society beginning in the year 2011. Employees have visited the children's home, and also organised carnivals and donation drives for the society. Ardentec also participates in international coastal cleanups to do their part for the environment, and raise environmental awareness amongst its employees.

CHALLENGES AND TARGETS FOR IMPROVEMENT
Going forward, one of the key challenges related to sustainability that Ardentec Singapore has identified is the green buy-in from their employees. The success of any corporate sustainability initiative hinges heavily on employee participation. A mindset shift is necessary for the employees to support these initiatives, and Ardentec Singapore will continue to influence them positively through constant communication.

While sustainability is very much embedded in Ardentec Singapore’s operations, it aims to eventually also promote sustainability throughout its supply chain. Currently, the company provides a Supplier’s Agreement and Ethic Policy that suppliers have to abide by before they are approved. The Agreement requires suppliers to operate based on standards that are equivalent to those put forth by the Electronic Industry Citizenship coalition (EICC). Paper audits are also conducted periodically to review their suppliers. However, it is limited in terms of environmental and social sustainability. Ardentec Singapore is aware of this and aims to make their supply chain more transparent with regard to environment, social and governance matters. It is in the company’s interest to not only further sustainability in its own company, but expand that externally as well.

The absence of a semiconductor testing industry association poses challenges for Ardentec Singapore in trying to benchmark itself against industry standards. While there is the Singapore Semiconductor Industry Association, a semiconductor testing facility is vastly different and has unique business concerns.

Finally, Ardentec Singapore aims to develop a sustainability report to communicate its sustainability direction and progress in the near future. It would provide a clear picture to its stakeholders. In the process of developing a report, Ardentec Singapore would also discover more opportunities to leverage.

CONCLUSION
Ardentec Singapore has demonstrated their commitment to sustainability in a number of ways. The company’s 10 core values highlight its approach towards practicing sustainable business. The Sustainability Steering Committee has ensured that they adhere to international standards and are certified for environmental, health and safety, and GHG emissions standards. Leveraging the QCC, Ardentec Singapore achieved reductions in energy and water consumption and stayed true to its focus of low carbon growth.

As sustainability is increasingly understood and embraced globally, businesses that have already embarked on the sustainability journey will stand to gain a competitive advantage. Ardentec Singapore strongly advocates sustainability in all aspects of their business operation. This has the strong support of the top management. As one of the sustainability pioneers in the local semiconductor testing community, it certainly is one of the exemplary businesses for others to follow.

*All data and information about the company has been obtained from 1) publicly available resources, 2) company websites and reports, and 3) company representatives.


3 Fabless manufacturing is the design and sale of hardware devices and semicon chips while outsourcing the fabrication of those devices to a specialized semicon manufacturer called semicon foundry.


Acknowledgements

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