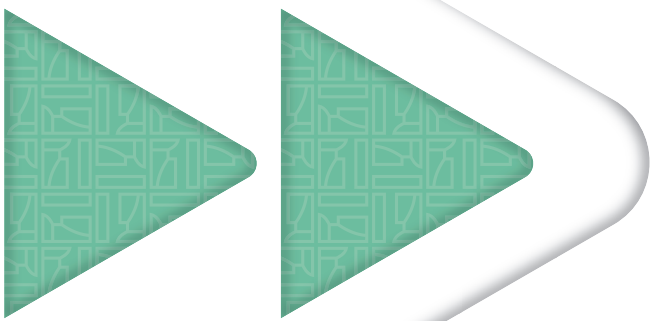
الهيئة الاتحادية
للتنافسية والإحصاء
FEDERAL COMPETITIVENESS
AND STATISTICS AUTHORITY

United Arab Emirates

Policy in Action

RAK Ceramics: Paving the Way to the UAE's Competitiveness



Fast-Forwarding the Nation

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Policy in Action Series

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LETTER FROM THE SECRETARY GENERAL

I am pleased to present the 7th edition of our Policy in Action series, *RAK Ceramics: Paving the Way to UAE's Competitiveness*. In this issue we explore the case of *RAK Ceramics* and its rise to prominence as a world leading company in the intensely competitive global ceramic market.

The northern UAE emirate of Ras Al Khaimah plays a vital role in the shared prosperity of the UAE. Its success has been accomplished without significant oil or gas reserves. Rather, it has been policy-driven growth, developed primarily through a focused economic diversification strategy including significant investments to nurture indigenous industry.

Today, *RAK Ceramics*, an inspiring global icon, is a prime example of the emirate's native industry. Its rise has been enabled through a supportive policy environment and a business model focused on global expansion, customer focus and on-going innovation. One of our goals is to highlight some key elements of this success story including the business model that have given ascendency to this corporation that has brought the "made in the UAE" brand to over 160 countries around the world.

RAK Ceramics follows in a long and rich tradition of ceramics materials synthesis and processing innovation in the Arab region. For centuries ceramics production and processing has been driven by innovation, and to this day is a vibrant and fertile area for research and development (R&D). Indeed, innovation has fueled the growth of *RAK Ceramics* in the face of an increasingly competitive global market.

Through this issue we look forward to sharing insights from a UAE national champion that is a major contender in the global arena, and one that has made valuable contributions to UAE's national competitiveness.

We gratefully acknowledge the support of *RAK Ceramics*, the RAK Chamber of Commerce and Industry, the Sharjah Museum of Islamic Civilization and the US Council on Competitiveness for their time, expertise and contributions to this case study.

We look forward to sharing our work and our findings.

Abdullah Lootah
Secretary General
Emirates Competitiveness Council

PREFACE

Trained as an archeologist, I have been fascinated with the role of technological innovation in the continuum of human progress. Practicing one of the world's oldest crafts, humans have made clay pottery and figures for more than 20,000 years as far back as the Ice Age, when China and Japan were still connected by a land bridge, and before recorded history making ceramics a key for unlocking the secrets of ancient civilizations.

Ceramics have long served as a medium for conveying a civilization's history, culture, and myths. For example, the red figure and black figure kraters of Classical Greece (5th-4th century BC) were large water vessels used to serve guests at Greek symposia. They were decorated with scenes of Greek life, such as a music competition or men training for the Olympics, and depictions of heroic narratives such as Hercules locked in combat with the giant Antaeus or Greek soldiers battling Amazon warriors. Ceramic relics have provided much of what we know about Greek mythology, which had significant influence on Western art and literature.

In addition to providing a record of human civilization, the history of ceramics is a story of global technology development, transfer, and commercialization with all the hallmarks of innovation and competitiveness we know today.

Intangible assets such as intellectual property and value created by knowledge are key sources of competitive advantage. In the ancient world, intangibles technical knowledge, and elegant design and artistry transformed cheap and abundant silicon and clay into valuable objects such as cups, jars, and luxury items driving global supply chains, the expansion of trade, and wealth creation in the producing regions. For example, in the 6th century BC, Athens and Corinth competed against each other for the wealth generated by ceramic exports to foreign markets across the Mediterranean.

For thousands of years, the quest for better and cheaper ceramics fueled technological innovation all over the world including in the Middle East. Egyptian Blue the world's first synthetic pigment, and milestone in chemistry and human progress was created about 5,000 years ago as a low cost alternative to crushing the gem Lapis Lazuli to get blue pigment. Surprisingly, researchers have discovered that Egyptian Blue exhibits properties of nanomaterials. The near-infrared luminescence of its monolayer nano-sheets, created when the pigment is decomposed in mere hot water, could lead to new advancements in biomedical imaging, infrared devices, and security inks. Other ceramic inventions from the Middle East include Egyptian faience more than 5,000 years ago, tin glazing in the 8th century, and stoneware in the 9th century. Innovative lusterware tiles used in mosques and palaces became a signature of architecture from the region.

Timeline of Selected Ceramic and Glass Developments

Today, a plethora of ceramic materials are now used in domestic, industrial and building products. Though ceramics products have widely differing functions, all are durable, heat resistant, waterproof making them valuable for a variety of uses. They have thus become ubiquitous in a range of industrial and building products (including various different tiles, flooring and sanitaryware), kitchenware (pottery, dinnerware), and a host of technical applications including medical uses, thermal insulation and tiles for space crafts and in aerospace.

For regional innovations, see pages 14 – 16.

24,000 BCE

Ceramic figurines used for ceremonial purposes

14,000 BCE

First tiles made in Mesopotamia and India

9000-10,000 BCE

Pottery making begins

5000-8000 BCE

Glazes discovered in Egypt

1500 BCE

Glass objects first made

1550 CE

Synthetic refractories for furnaces used to make ceramics etc.

Mid 1800's

Porcelain electrical insulation Incandescent light bulb

Source: *American Society of Ceramics*

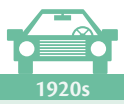
The history of ceramic innovation is also a record of technology transfer through the interactions between people and different cultures. When innovating, it is easy to imitate what one can see. For example, the Turkish Iznik pottery and tiles used extensively in buildings of the Ottoman Empire were adapted from the highly prized blue and white porcelain imported from China. However, the transfer of ceramic formulations and production techniques required closer contact. The Egyptians shared the manufacturing process for Egyptian blue with the Greeks and Romans, transferring the technology across the Mediterranean. During Japan's 16th century invasion of the Korean peninsula in the Imjin War, Korean potters were captured and taken to Japan. The Korean potters' skills and their discovery of kaolin clay were the foundation for Japan's world-class porcelain industry and ceramic innovations such as the white glazed stoneware still popular in tea ceremony sets.

The fusion of creativity and ceramic technology has been a driving force in industrial cluster development. In 18th century Europe, Chinese ceramics were in high demand, short supply, and expensive. Efforts to imitate Chinese porcelain led to the development and mass production of bone china in England, making very fine ceramic wares once available only to the tea-drinking aristocracy affordable for the middle class. The invention of bone china sparked the Stoke-on-Trent cer amics cluster home to companies such as Wedgewood, Royal Doulton, Spode, and Minton. Abundant supplies of clay and coal, canal transportation enabling the supply chain for materials, and innovations such as advancements in transfer printing fueled the cluster's growth.

Continued advancements have made ceramics one of the most important high tech materials used across numerous industries in products ranging from turbine blades and biomedical implants, to ballistics armor and semiconductors. Looking to the future, a profound revolution in materials science and technology is unfolding. Materials development has relied on trial and error experiments, and materials application on choosing from the stock of available materials. But, powerful computational tools, simulation, and modeling, as well as new tools for materials synthesis, processing, characterization, and testing will enable the development of materials for specific applications with less physical experimentation and without building prototypes. These tools will also provide platforms for different materials fields metal, ceramics, plastics, and biomaterials to collaborate on new materials design and development. Nanotechnology and biotechnology will provide game-changing possibilities and materials with unimaginable properties.

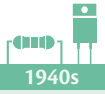
The tradition of Islamic ceramic innovation is alive and well in the UAE today. UAE companies have harnessed art, design, and high technology to establish one of the world's foremost centers of ceramics design and manufacturing excellence, exporting products worldwide, and integrating these innovative materials to enhance the world-renowned, groundbreaking architecture of the Emirates.

Deborah Wince-Smith
President & CEO
The US Council on Competitiveness



1920s

High-strength quartz-enriched porcelain for insulators, spark plugs and glass windows for automobiles



1940s

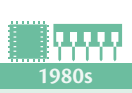
Capacitors and magnetic ferrites

1960s

for voltages over 220 kV application of carbides and nitrides

1970s

Introduction of high-performance cellular ceramic substrates for catalytic converters and particulate filters



1980s

High temperature semi-conductors

1980s to present

Advanced applications take advantage of specific mechanical and chemical properties of glass or ceramic materials

RAK Ceramics: Paving the Way to the UAE's Competitiveness

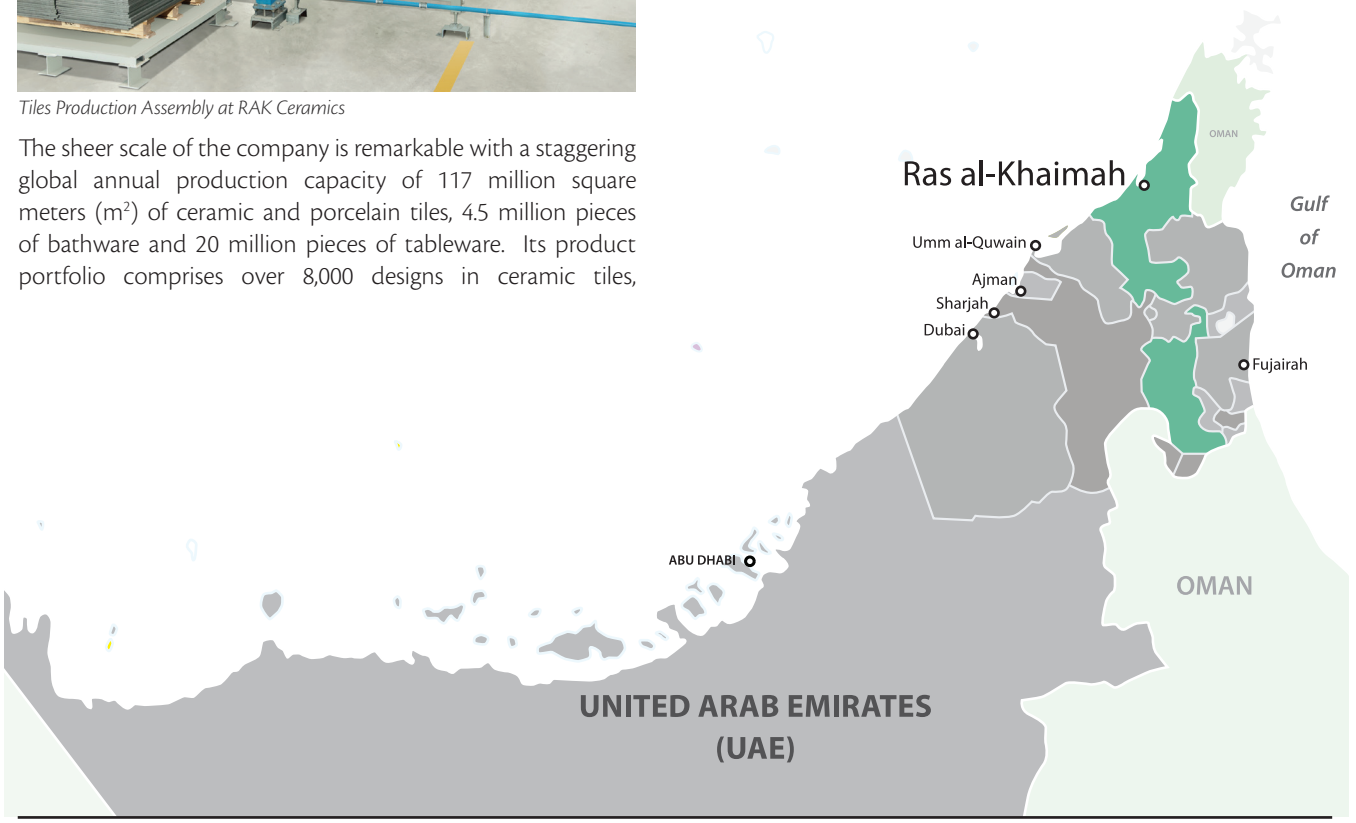
INTRODUCTION

The Burj Khalifa, London's Wembley Stadium, Heathrow Airport and the Grand Hyatt in Washington share an unlikely common denominator tiles that grace their floors and walls, come from an ostensibly surprising manufacturing plant, *RAK Ceramics*.[1] Nestled in Ras al-Khaimah (RAK), a northern Emirate of the United Arab Emirates (UAE), *RAK Ceramics* is a world-leading ceramics manufacturer and innovator with annual sales turnover in excess of AED 3.5 billion (US$1 billion) and sales to 160 countries.[2]

Tiles Production Assembly at RAK Ceramics

The sheer scale of the company is remarkable with a staggering global annual production capacity of 117 million square meters (m^2) of ceramic and porcelain tiles, 4.5 million pieces of bathware and 20 million pieces of tableware. Its product portfolio comprises over 8,000 designs in ceramic tiles, manufactured within 10 production facilities in the UAE, and additional plants in Bangladesh, Sudan, China, India and Iran. Eighty five percent of *RAK Ceramics*' output production is exported to its customers in 160 countries.The company has a staff of over 8,500 employees in the UAE and 15,000 worldwide.[3]

RAK Ceramics: Paving the Way to UAE's Competitiveness explores how *RAK Ceramics* has emerged to become one the world's largest manufacturers in an intensely competitive global ceramics market. The case study highlights the success factors that enabled *RAK Ceramics*, within the span of two decades, to become a world-leading company, with a vision "To maintain its status as world's leading innovator in the ceramics field."[4] Key elements included: 1.) Early stage support from the emirate, 2.) an export-oriented strategy imprinted on the DNA of the company from the outset, reinforced by well aligned business model; and 3.) a well-integrated processes and culture of on-going innovation at the firm level.



[1] *Duncan, The National (12 July, 2013)*
[2] *RAK Ceramics statistics (2014)*
[3] *Ibid*
[4] *RAK Ceramics website*

Support for an Industry

The Launch

In 1989 His Highness Sheikh Saud Bin Saqr Al Qassimi, ruler of Ras al-Khaimah was in quest of a successful, large-scale company to unleash the potential of the emirate to reach the next level of growth and competitiveness. He believed that the abundance of high grade sand and silica in the emirate could, given the right conditions, be converted to quality ceramics. If successful, it could give birth to a lucrative sector and diversify the emirate's economy. His vision was to create a world-class producer of ceramics in Ras Al Khaimah.

To investigate the feasibility of his idea, he reached out to Dr. Khater Massaad, a geophysicist from Lausanne, who was conducting research on water resources in the emirate of Fujairah, at the time. He commissioned him to carry out a feasibility study for ceramics production in Ras Al Khaimah. Following an extensive survey of the various types of sand and silicate materials available in abundance in Ras al-Khaimah, Dr. Massaad confirmed that the land offered valuable raw materials for a potential ceramics industry in the emirate.

The ceramics industry is extremely capital intensive, and the geological resources were only part of the story. To create an industry would require was significant energy resources, financial investment, infrastructure, technical capacity, and human capital. A production facility would necessitate land, high-tech equipment, kilns, additional raw materials, and a workforce most of which would have to be imported. Post-production costs would also be high, and would include transportation and distribution all of which would augment the price of the product, in an extremely price sensitive market.

Cognizant of the immense cost and challenges involved, the Sheikh nonetheless decided to provide the investment necessary to create a world-class ceramics industry that he believed would take the emirate to the next level of competitiveness. Pursuing this agenda required courage and vision both hallmarks that he carried, characteristic of UAE's leadership. Start-up finance and a land grant were provided for the production facility, and construction of a manufacturing plant was begun.

In 1991 *RAK Ceramics* opened its doors at the Al Jazirah Al Hamrah site, with Dr. Massaad as the first CEO. The plant boasted state-of-the-art ceramics machinery secured from Italy, and know-how of leading ceramists from around the world, was brought to the emirate. With a production yield of 5,000 m^2 of tiles per day, this was the first large-scale ceramic manufacturing facility in the emirate, and indeed in the UAE.

Breaking into a Mature Market

When *RAK Ceramics* was launched in 1991, the UAE's building boom had not yet begun. And with few orders at home to sustain the company's ambitious expansion plans, *RAK Ceramics*, began to scour international markets. However, the industry dynamics were not favorable to a new entrant. The global market was mature and growing at a moderate pace, with the industry driven by distribution channels and product price. *RAK Ceramics*, to break into this market, needed to compete for market share among long-standing market leaders, foremost of which were the Italian and Spanish companies, together accounting for over 40% of global exports and more than 11% of the global consumption.

The company recognized formidable hurdles that it would face in breaking into a mature market with long-standing incumbents, made more challenging by China beginning to gain a strong presence. It nonetheless began to carve out an export-oriented strategy.

RAK Ceramics Campus (2012), Jazeerat Al Hamrah

Business Model for Success

Growth in International Markets

By 2005 the global ceramics market was increasingly fueled by the growth in construction as a result of the rising population. The construction industry is the biggest end-use industry of ceramic tiles. Within the construction industry, with the construction of residential buildings being the main application of ceramic tiles accounting for more than half of the total market share of ceramic tiles.[5] The global tile market consumption was estimated at 6.75 billion m^2 per year with an annual growth of 7.3% per year recorded during 2000 to 2005. China was gaining ascendency, manufacturing over a third of the worldwide production. The remaining one third was manufactured collectively by Spain (8.6%), Italy (8.1%), Brazil (8%) and India (4.2%). The balance was accounted for by numerous indigenous, small-scale ceramics production in national markets.[6]

Antimicrobial tiles used in hospitals

Following careful analyses of different country markets, *RAK Ceramics* began to diversify from serving the UAE and the GCC to creating products that filled market gaps in foreign markets for modest margins. As it began serving customers in new country markets, the company began to to gain market share. As the orders began to flow in *RAK Ceramics* ramped up its production and international sales. It expanded its production facilities and its factories were meeting a significant 0.9% of global production.[7] In 2005 *RAK Ceramics* became the 10th largest exporter, accounting for 23 million m^2 of ceramics.[8] By 2005, *RAK Ceramics* had grown at a compounded rate of growth of approximately 30% per year since its establishment.[9]

The period between 2008 to 2010 saw an international contraction of the construction industry. Yet during this period *RAK Ceramics* experienced significant growth by virtue of its diversified market base and ability to deliver economies of scale as well. By 2010 *RAK Ceramics* had added 10 production plants and expanded its footprint to 160 countries, and was ranked the world's largest manufacturer of ceramic tiles, by Ceramics World Review.[10] The company's annual sales turnover hit an excess of AED 3.5 billion (US$1 billion) with a global annual production in excess of 117 million m^2 of tiles, 4.5 million pieces of bath ware and 20 million pieces of tableware. Since 2010 *RAK Ceramics* has maintained its distinction of being the world's largest greenfield ceramics manufacturer, spotlighting the UAE's competitiveness in the sector.

Growth Informed by Industry Dynamics

Over the course of its two-decade existence *RAK Ceramics* carefully analyzed and managed industry dynamics leading to its competitive edge. It crafted a strategy underpinned by understanding the market structure and local industry practices. It also identified key pillars of its approach customer preferences, service expectations, price sensitivity and on-going innovation in each of the countries it marketed to. While the company began increasing its capacity in the UAE, it quickly realized that to be competitive it would need to set up production units in key growth markets. Consequently, it opened its first foreign production facilities in Bangladesh, followed by China and then India, Sudan and Iran. This allowed the company to be nimble, reduce transportation costs and perhaps most importantly, enhance responsiveness to customer needs in those markets.

RAK Ceramics' investments in technology and market development at an early stage of company's growth, the establishment of overseas manufacturing leading to competitive cost structure and a broad market base, assisted the company in quickly generating resources to fund its growth. Its overseas expansions were made according to a stringent set of criteria which included: Large and growing populations; relatively low

[5] *Research and Markets, (2014)*
[6] *RAK Ceramics statistics*
[7] *Ibid*
[8] *According to the International Trade Center, in terms of imports, in 2013 the United States led the list of top ceramic importing countries with 160 million m^2 of ceramic tiles which account for 6.0 % of world imports. Saudi Arabia (150 million m^2) and Iraq (121 million m^2) come second and third place as importers of ceramic tiles. The UAE imported 53 million square meters and exported 51 million m^2.*

product penetration (with opportunities for higher growth potential), relatively high product import tariffs (yielding economic benefits of having a local manufacturing facility); a clear gap between the supply and the demand at the product quality end (facilitating distinct premium product positioning) and policy environments in which government encouraged investment in technology.

Table 1 below illustrates milestones in *RAK Ceramics* growth over two decades. The company now boasts production facilities in Bangladesh, China India, Sudan and Iran.

Ceramic tiles being manufactured at RAK Ceramics

Table 1: Milestones of the Development of RAK Ceramics

1991	*RAK Ceramics* is founded with the a tile plant of an operating capacity of 5000 m^2/daycapacity
1993	A first sanitary ware plant is commenced with production of 3000 pieces/day
1995	A second tile production plant started with a production capacity of 14,500 m^2 per day capacity
1997	*RAK Ceramics* obtained an ISO-9001certification accreditation from the Ceramic Industry Certification Scheme, UK A third tile production plant with an operating capacity of 14,500 m^2/day is constructed
1998	A fourth tile plant with a production capacity of 20,000 m^2/ day is constructed
1999	A fifth ceramic plant with a production capacity of 20,000 m^2 / day is constructed
2000	Bangladesh—*RAK Ceramics* first overseas tile plant commences production of 10,000 m^2/day A sixth tile production plant with a capacity of 20,000 m^2/ day is opened with state-of-the art technology to manufacture large format slabs (120cm x 180cm) A second sanitary ware plant in RAK commences production with a capacity of 2000 pieces per day
2002	A seventh ceramics plant with production capacity of 20,000 m^2/dayis commenced An eighth plant in RAK with 30,000 m^2/day ISO 9001 certification is received from BVQI
2003	China—*RAK Ceramics* starts its second overseas tiles pant in China where it produces a capacity of 15,000 sq.mt per day
2004	Sudan—*RAK Ceramics* starts third overseas tiles plant in Sudan with a production capacity of 10K m^2/day Bangladesh—a new sanitary ware plant in with a capacity of 1000 pieces per day furthermore Laticerete RAK, a Joint venture starts production to make the adhesives and grouts
2005	Iran—*RAK Ceramics* starts forth overseas tiles plant in Iran with a production capacity 10,000 m^2/day Ninth ceramic plant in RAK with 30,000 m^2/day capacity is launched
2006	Tenth tile production plant in RAK with a production capacity of 45,000 m^2/day *RAK Ceramics* starts fifth overseas tiles plant in India with Capacity of 20K sqmt per day RAK Porcelain a high end table ware for hospitality is launched
2007	Created a joint venture with Kludi RAK to manufacture kitchen and bathroom fittings along with other accessories for bath ware products
2008	Expansion of eighth plant in RAK to increase capacity to 36,000 m^2/day
2009	Expansion of seventh and tenth plants to add additional tile production capacity of 3000 m^2/day and 15,000 m^2/day
2010	Officially recognized by Ceramics World Review as the world's largest ceramic tiles manufacturer *RAK Ceramics* is a AED 3.5 billion (US$1 billion) conglomerate and exports to over 160 countries
2011	RAK maintained its super brand status for the third consecutive year World largest Ceramics tiles manufacturer for second year in a row with a 117million m^2 of global output (Ceramics World Review)
2012	*RAK Ceramics* achieved milestone of selling 1 billion m^2 of tiles world wide Retained a super brand status for forth consecutive year *RAK Ceramics* is ranked the world's largest manufacturer with a global annual output of 117 million m^2 tiles 4.5 million pieces of bathware and 20 million pieces of tableware

Business Model for Success *continued*

The company's astute management and ability to understand the international ceramics market dynamics led to robust financial growth and significantly increased its net worth. *RAK Ceramics*' revenues grew at a compounded average growth rate of 17% compared to 6% yearly growth rate of the global industry during the period of 2001-2012.[11]

Its revenues grew from AED 678 million in 2001 to over 3.1 billion in 2013. Its assets grew from AED 1.1 billion in 2001 to 5.6 billion in 2013; with a concomitant rise in its worth from AED 718 million to 2.5 million[12] as illustrated in **Annex 1.** Along with diversification of products, markets and supplier base, *RAK Ceramics* also diversified its financial resource base in its emerging market expansions into Bangladesh, India, China and Iran, with support from the International Financial Corporation (The World Bank Group).

Today *RAK Ceramics* has an estimated market share of over 60% of ceramic tiles and sanitary ware business in the UAE. The company exports 85% of its local production positively contributing to country's trade balance.[13]

To achieve its success the company had to craft a business model that allowed it meet its export strategy to provide value to its international customers. A closer look at *RAK Ceramics*' business model shows the following key integrated aspects:

1. A strong customer orientation focused on meeting their needs through portfolio variety
2. On-going innovation an in-house process designed to nurture creativity and ensure that innovative designs make it to commercialization
3. State-of-the art technology to create the innovations
4. Strong collaboration in the value chain in 160 countries with suppliers and distributers

See Diagram 1

Customer Orientation

Customer orientation is a vital aspect of national competitiveness. International competitiveness reports such as the World Economic Forum's, Global Competitiveness Report (GCR) evaluate the extent to which firms in a country respond to customer needs. In the 2014-2015 GCR report, the UAE ranked 3rd globally (144 countries) in the "Goods Market Efficiency" pillar which includes Customer Orientation.

RAK Ceramics constantly innovates to address expressed or unarticulated customer needs, introducing a range of new products into each of its markets every year. Such initiatives include product designs developed in response to local tastes. By working closely with customer segments that are trend-setters in each of the markets it serves, including architects, project developers and retail clientele, *RAK Ceramics* identifies dynamics of popular items and patterns enabling it to anticipate and create products specific to customers' demands in each of its markets. This trend mapping has allowed it to create tiles that are thicker than standard tiles, more durable for high traffic areas, anti-microbial tiles in demand by the hospitality and hospitals industry and glow-in-the-dark tiles for architectural special effects. For instance, in India, the company was the first mover to provide large format tiles. In Germany, it introduced 'Lounge Series' tiles with darker hues and unpolished finishes for a market that was oriented towards this aesthetic.

RAK Ceramics dishware is used at discerning hotels around the world

State-of-the Art Production Facilities

Technology is an essential pillar to national competitiveness as it improves the efficiency with which a country utilizes its resources. The GCR assesses level of technological readiness of economies as a pillar of competitiveness. In the 2014-2015 report UAE ranks 24th in the pillar and is among the top 10 in the world for indicators within this pillar: Availability of latest technologies 8th/144 and Firm level technology absorption 7th/144.

At *RAK Ceramics*, top drawer technology was a priority from inception. Today, much of the firm's success lies in its unparalleled production facilities that dedicate specialized space and equipment to enable the creation of a host of innovations. The company's facilities extend over an area of 1,500,000 m^2. On this vast area of land are 10 state-of-the-art tiles factories, two sanitary ware plants, raw material warehouses, workstations, showrooms, office buildings, showrooms, R&D laboratories, and a silkscreen and digital printing facility. The manufacturing plants are equipped with some of the longest kilns in the world. The company also boasts the largest press in the ceramic industry – the PH 7200 (tons) produces Gres Porcellanato slabs, which are large format slabs of up to 125 x 185 cm – with *RAK Ceramics* producing the largest such tiles the industry.

Other best-in-class equipment, which allows it to create products with a high degree of customization and respond to stringent specifications include water jet cutting machines for design effects, rotomatrix color decoration machines that give tiles unique naturally-simulated prints, Nanopix digital printing technology for flooring effects, high-pressure casting moulds for sanitary ware and diamond cutting equipment.

Culture of Innovation

Collaborating Across the Value Chain

Competitiveness reports assess the level of business sophistication in countries, evaluating elements such as local supplier quantity, nature of competitive advantage, state of cluster development, value chain breadth, international distribution, process sophistication, and extent of marketing. In the 2014-2015 GCR, the UAE ranked 14th globally in the Business Sophistication pillar, with a ranking of 13th/144 in value chain breadth; 3rd/144 in control of international distribution; and 27th/144 in production process sophistication.

Since its inception, *RAK Ceramics* sought to work very closely with suppliers, numbering over 2,000 today, as a way to gain entry into a number of markets rapidly. Such a strategy means that *RAK Ceramics* has been able to focus on its core competencies, manufacturing and innovation, and through these collaborations with other businesses in the value chain, unlock competitiveness advantages. The company's collaborations in the inbound value chain included developing relationships with leading machinery suppliers from Italy, fritz and glaze suppliers from Spain and Italy, raw material suppliers from Europe and Asia and developing a local supply chain for packaging and operations support. An important aspect of the supply chain development was proactive promotion of company's track record in absorbing technologies with continuous scale expansion which developed company's positioning with technology as well as material suppliers.

Besides the inbound value chain development, the company proactively created an outbound logistics thriving ecosystem of SME's specializing in distribution and warehousing as well as other supporting activities. It nurtured and developed these relationships over time to enhance the company's economic, technological and commercial development, and its overall competitiveness.

Innovation

Competitiveness reports are unanimous on the inextricable link between a nation's competitiveness and the innovation of its firms. In the 2014-2015 GCR, the UAE ranked 21st globally in the Innovation pillar. It ranked as follows in indicators of the pillar: Capacity for innovation 25th/144; Company spending on R&D 22nd/144; Availability of scientists and engineers 7th/144.

Early on, *RAK Ceramics* sought to be an innovator in the industry. The company was among the first in the industry to use digital printing to produce ceramic tiles, which mimic other surfaces including marble and stone. Given the global shift towards replacing paints, metal slabs, marble floors, and other home decorative products with ceramic tiles,[14] this is a strategy that propelled the growth of its markets. By constantly innovating, identifying and catering to niche markets in its diverse international markets, the company began to experience significant growth. *RAK Ceramics* has continued its emphasis on continuous innovation with R&D being well integrated in core supply chain, production and sales management of the company.

This focus on innovation has empowered teams at *RAK Ceramics* to identify niche areas and create a host of innovative new tiles including designs and technological specialties. This includes the larger format tile creating the world's largest slab measuring 125cm x 185 cm a popular item in construction industry, Luminous, a glow-in-the-dark tile and Antimicrobial, an antibacterial finish specialized for the hospitality industry, and a range of innovative eco-friendly products such as the stone and wood art collections, and increasingly popular tiles, simulating true to nature type prints, created using the latest Nanopix technology.[15]

Diagram 1: A Business Model for Success

[9] *RAK Ceramics statistics*
[10] *Ceramic World Review (2010)*
[11] *RAK Ceramics statistics*
[12] *Ibid*
[13] *Ibid*
[14] *Research and Markets (2014)*

Culture of Innovation *continued*

RAK Ceramics integration of R&D activities into operational activities has resulted in reducing the time between studying a product innovation and launching a new product. Primarily the R&D scope of activities hinges around five key areas:

- Product development–through a continuous exploration of market trends across product categories and customer needs the product development team identifies new products/innovation ideas that can be commercialized.
- Raw materials and formulation development–there is on-going exploration at *RAK Ceramics* of new sources of raw materials to improve its formulations and to deliver improved quality and price performance of its products.
- Production technology development–the company's operations team interacts closely with the machinery manufacturers providing them with inputs for design of process components that enhance efficiency. In addition this close interaction allows *RAK Ceramics* to adopt latest development in production technology.
- Energy consumption optimization–as ceramics is highly energy consumptive, teams work on generating ideas that assist for optimizing the usage of energy.
- On-going R&D at the company seeks innovative uses of ceramics that would result in enhancing and broadening the scope of uses of ceramics.

Ceramic tile manufacturing machine

RAK Ceramics' Luminous tiles - the first in the industry

[15] *In 2012 RAK Ceramics was recognized as the 'Most Innovative Company' by as the Asian Quality Leadership Award.*

Diagram 2: Product Innovation Process at RAK Ceramics

Innovation at *RAK Ceramics* follow a process from R&D to concept generation and ultimately to commercialization and price competitiveness. Innovations at the company are able to overcome the two major hurdles generally faced in bring innovations to market, or 'Valleys of Death' typically faced by innovations ***(See Diagram 2)***. The first 'Technological Valley of Death' occurs early in the development of a technology, as breakthrough research and technological concepts aim to achieve commercial proof-of-concept (between stages 1 and 2); At this stage, innovators conducting research need further capital to undergo a process of developing, testing, and refining their technologies in order to prove that these innovations will be viable in markets beyond initial success in the laboratory. *RAK Ceramics*, overcomes this hurdle by having state-of-the art labs and prototyping facilities in-house where ideas can be translated into tangible samples. The second persistent market gap (between stages 4 and 5), named the 'Commercialization Valley of Death', which appears between the pilot/demonstration and commercialization phases of the development cycle. By being close to its customer base and being responsive to the markets it serves, *RAK Ceramics* has been able to overcome this second impediment. In overcoming these two hurdles *RAK Ceramics* is able to bring innovations swiftly to the market, beating out competitors and creating new markets.

Source: *Adapted from Breakthrough Institute, Bridging the Clean Energy Valleys of Death, Jesse Jenkins and Sara Mansur, November 2011.*

The company's approach to R&D is unique in the industry as it undertakes both product and process innovations engaging the operations teams. Each manufacturing unit of the company is staffed with laboratory facilities with teams that engage with external as well as internal resources and compete for innovative ideas that have potential to deliver enhanced value to customers and shareholders. Management evaluates the innovative ideas and encourages dissemination of these across other units to spread such innovations. These teams also pursue application or process innovations to improve upon the delivery of technology or process, such as for example improving energy efficiency of production.

With this tightly integrated business model, it has increased its flexibility, lowered costs, market reach and skilled labor all advantages in fueling continuous innovation and sustainable competitive advantage.

Ceramic tile polishing stage

Conclusion

Ras Al Khaimah sand dunes

RAK Ceramics is a rare global example of successful government interventions to create an industry. The intervention had the foresight to exploit overlooked natural resources of sand and silica, which would take the emirate to the next level of competitiveness, effectively making a major mark for the UAE on the global stage. Key elements of the success of this intervention were the ability of government to identify the abundant sand as a valuable resource, one that may potentially have been overlooked. Another feature of its successes was the leadership of the His Highness Sheikh Saud Bin Saqr Al Qassimi, who jump started the process by providing early financial support, and a land grant, as well as guidance to the company. Additionally, it was set up and managed as a private company from inception, meaning that *RAK Ceramics* had to be competitive in order to survive and was able to accomplish this in an exemplary way. Its governance was further strengthened by the company going public after which it had to abide by the Abu Dhabi Securities Exchange (ADX).

Significantly, *RAK Ceramics* proved that a small domestic market does not necessarily hinder the emergence of a national champion. On the contrary, cognizant of that fact, the company oriented itself, from the outset, towards international markets and developed an international expansion plan. Another determining factor was the degree of customer sophistication in the UAE market. Satisfying demanding customers locally helped the company develop methods and approaches to serve wider segments of customer abroad and better cater to their needs.

With these firm foundations in place *RAK Ceramics* established itself as an innovator of ceramics, a key factor in its ongoing success. The company's ability to continually create product-lines that meet the needs of the world market, based not solely on price competitiveness, but on innovation and R&D, are increasingly important as the world becomes more driven by value-added design. Today, the ceramics industry faces a number of competitiveness challenges, fuelled by globalization. International players are emerging in several ceramics subsectors, particularly in wall and floor tile manufacturing. Additionally, comparatively low-cost ceramics products from emerging economies are making it increasingly difficult to compete on the basis of cost.[16] In this regard the higher value-add innovation that *RAK Ceramics* is engaged in is pivotal. These innovations not only enable the company to maintain an edge in an increasingly competitive environment, but the advances contribute to the diversification of UAE's economy.

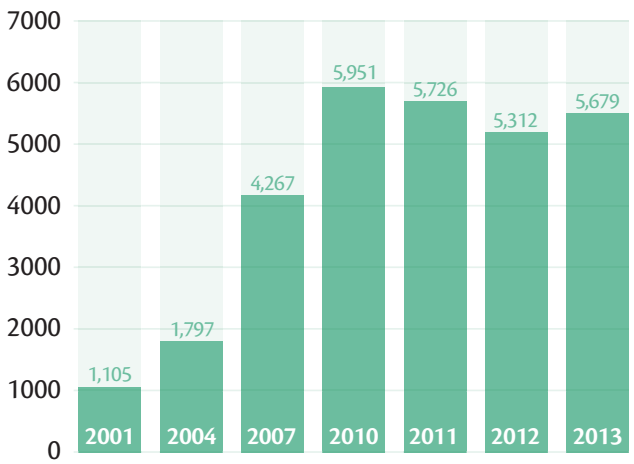
The nation's competitive advantage in a global marketplace is underpinned by the ability to effectively manage and utilize its resources in efficient and sustainable ways. As underscored by the case of *RAK Ceramics*, that done correctly, economic policies can support the development of global firms. In turn, firms must innovate continuously to upgrade productivity, creating a virtuous cycle of productivity and prosperity. As more and more firms in the country embrace innovation, creativity with greater value-added production and wider reach into global markets, the UAE fortifies its position as a leading innovation-driven economy of the 21st century–as called for in the UAE's Vision 2021.

RAK Ceramics Headquarters, Ras Al Khaimah

[16] *Research and Markets (2014)*

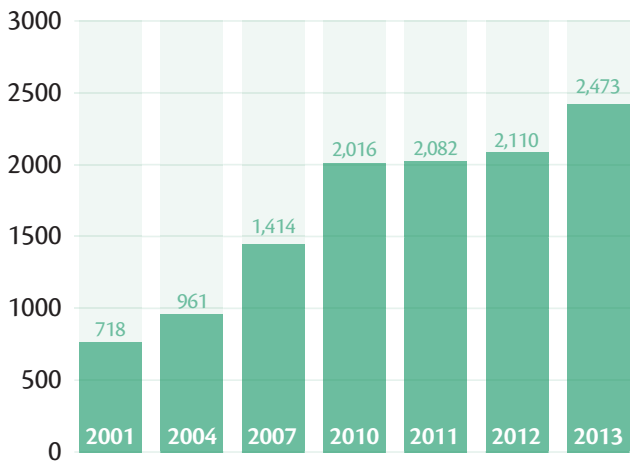
Annex 1: Financial Performance of RAK Ceramics

RAK Ceramics Assets Growth Trend



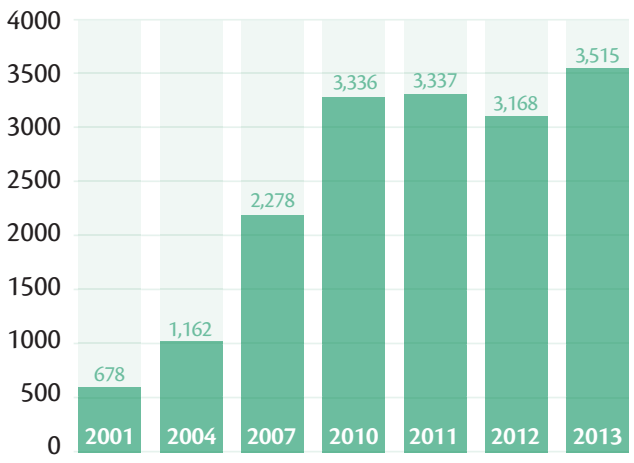
Assets (in Millions of AED)

RAK Ceramics Net Worth



Net Worth (in Millions of AED)

RAK Ceramics Revenue Growth

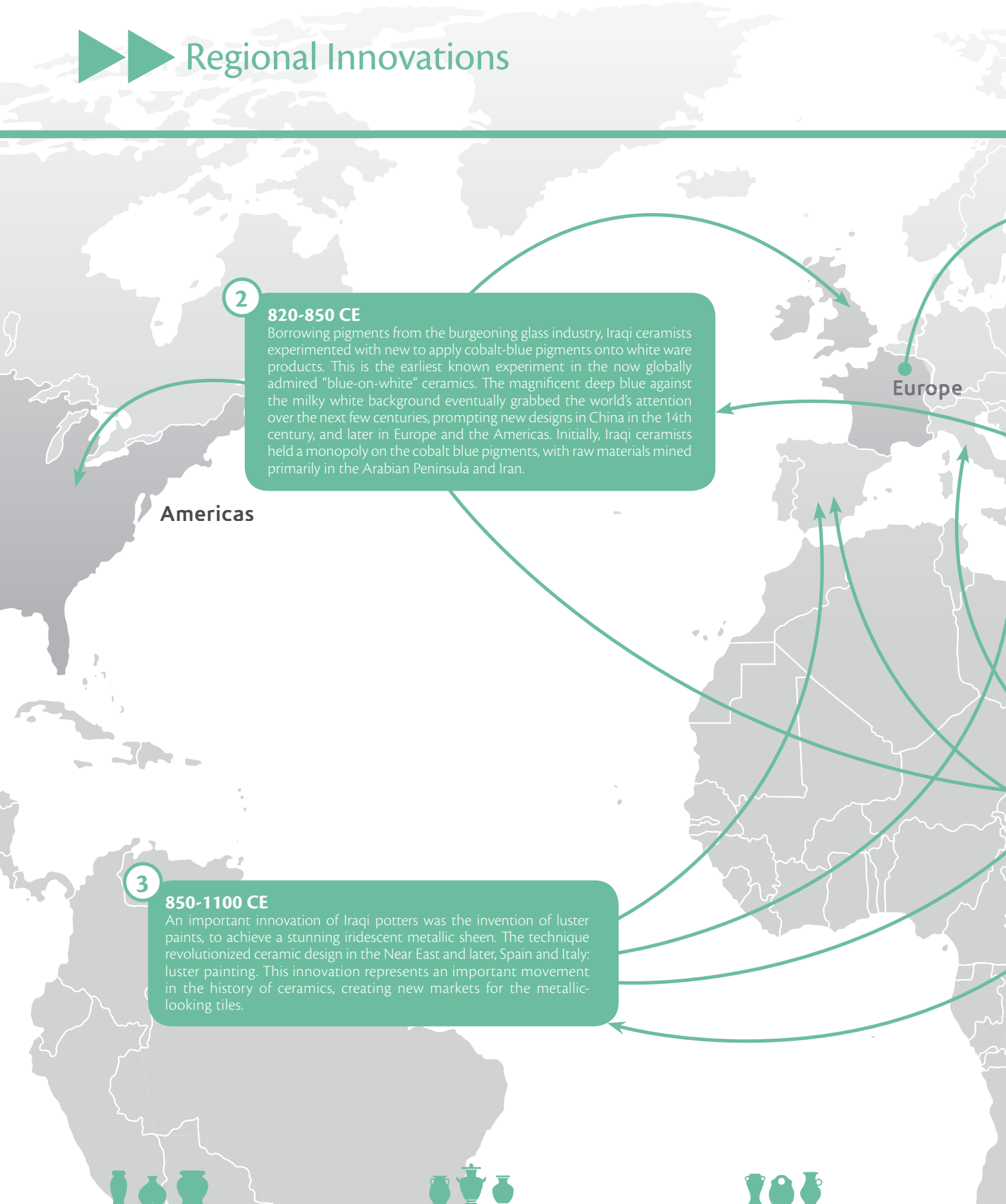


Revenue Growth (in Millions of AED)

RAK Ceramics Net Income Trend

Net Income (in Millions of AED)

Regional Innovations



800-820 CE

Iraqi ceramists experimented to match the quality of Chinese ceramics and improved ceramics in the Middle East region.

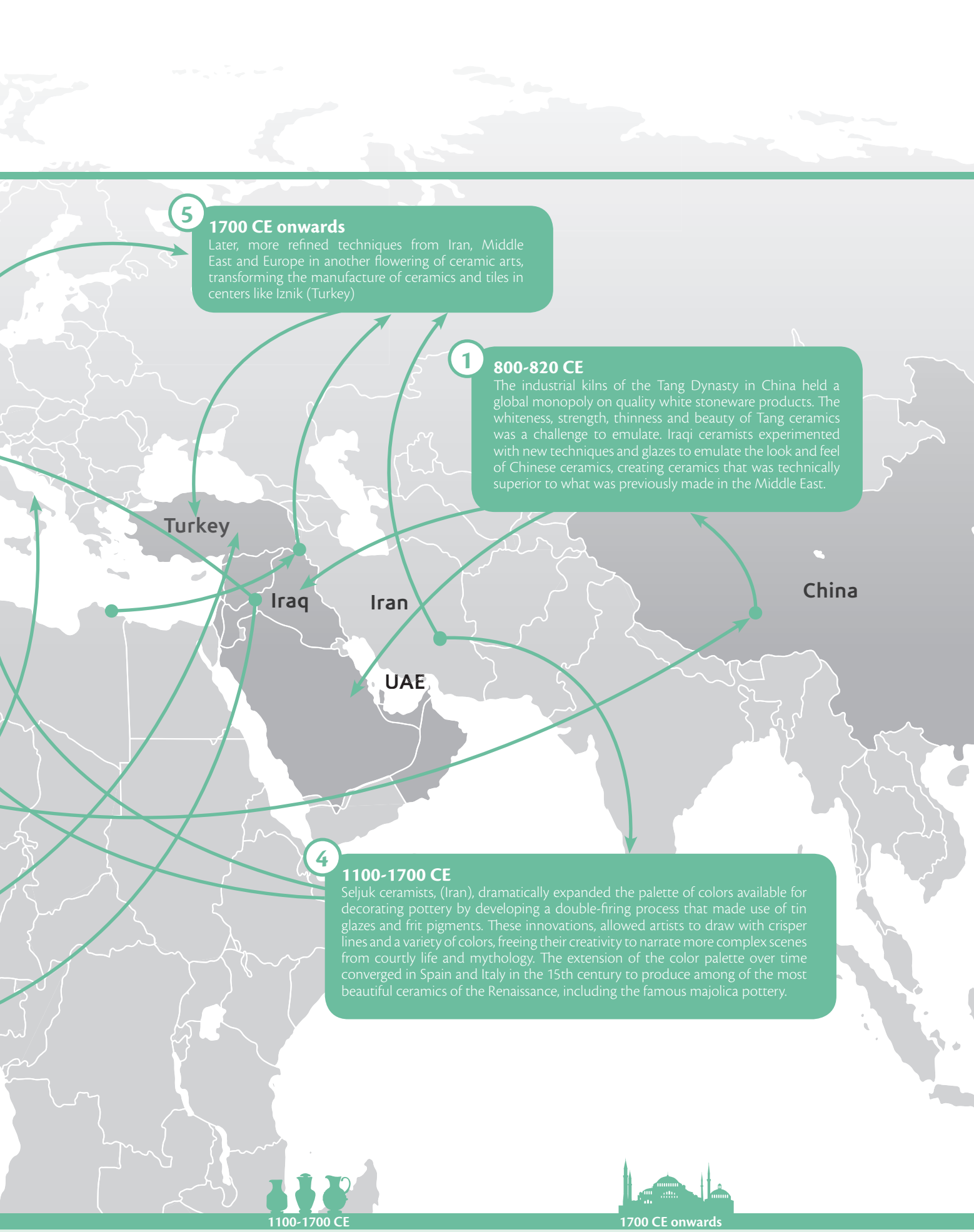
820-850 CE

Iraqi ceramists created the earliest known "blue-on-white" ceramics, prompting new designs in China, Europe and the Americas.

850-1100 CE

Iraqi potters invented luster paints, revolutionising ceramic design, and representing an important movement in history, creating new markets for the metallic-looking tiles.

Sources: *Adapted from Grube, The Art of Islamic Pottery, Metropolitan Museum of Art, NY, Art of the Islamic World, the Smithsonian's Museum of Asian Art, Freer Sackler Gallery and Science Creates*



1100-1700 CE

Ceramists in Iran dramatically expanded the palette of colours for decorating pottery. Artists could draw with crisper lines which allowed more creativity.

1700 CE onwards

Techniques from Iran, Middle East and Europe in another flowering of ceramic arts transformed the manufacture of ceramics and Iznik tiles (in Turkey).

Regional Innovations *continued*

Glazed jug, 6th century AH/ 12th century AD, Syria

Pottery ewer with underglaze black decoration and clear green glaze, 7th century AH/ 13th century AD, Syria

Lusterware bottle with abstract designs and inscriptions, late 6th-early 7th century AH/ late 12th -early 13th century AD, Kashan

Lusterware tile with inscription, flowers and birds, 7th century AH/ 13th century AD, Kashan

Pottery bowl with horse rider, 6th century AH/ 12th century AD, Syria

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CERAMICS AND MODERN LIFE

Ceramic material is prized for its excellent wear, resistance to corrosion and high temperature; high stiffness; high melting point; high compressive strength and hardness; and wide range of electrical, magnetic, and optical properties.
Engineers and ceramicists are therefore constantly pioneering solutions to make life better using ceramics in a range of every day materials as well as high-performance applications.

Ceramic components are critical in nearly everything that makes modern life possible-from power supply and energy use, modern communications, construction of homes and business, large and small appliances, safe water supplies, space and air travel, engines, and hip replacements.

SANITARY WARE
Another significant part of the ceramics industry includes sanitary ware (toilets, sinks, bathtubs, etc.)

CARS
Ceramics are integral to cars and are included in engine sensors, catalytic converters, spark plugs, windows and engine components

TABLEWARE
Tableware or dinnerware refers to dishes used for setting a table, serving food and dining, including plates, bowls, cups and serving dishes

AIRPLANES
Ceramics are embedded into the windshield glass of airplanes to create anti-fogging/freezing glass windows and jet engine components

DRINKING WATER
Water treatment systems use ceramic membranes and filters to create safe water supplies

COMPUTERS
The nearly $2-trillion global electronics industry would not exist without ceramics. Ceramics' wide range of electrical properties--insulating, semi-conducting, superconducting, piezoelectric and magnetic are critical to cell phones, computers and televisions

ELECTRONICS AND ELECTRIFICATION
The global market for electronic ceramics is estimated at around US$9 billion. Modern electronics would not exist without ceramics used in insulators for power lines, power conducting systems including substrates and IC packages, piezoelectrics, magnets and superconductors

THE INTERNET
Ceramics are used in glass optical fibers, fiber amplifiers, and laser materials, without which the internet and modern communication technologies would not be possible

HOUSEHOLD APPLIENCES
Ceramics are found in porcelain enamel coatings for major appliances, glass fiber insulation for stoves and refrigerators, and glass-ceramic stove tops

SPACE EXPLORATION
Space engineered ceramics are used in space shuttles, including shuttle tiles, thermal protection systems in rocket exhaust cones, engine components, electromagnetic and transparent windows

IMAGING: X-RAYS TO FILM
Medical diagnostic ceramic applications include use in transducers for ultrasound diagnostics, scintillators for X-ray CT scans, piezoceramic transducers for ultrasound diagnostics and sonar detection systems

DENTISTRY
Dentists use ceramics to create veneers, implants and braces

CONSTRUCTION
Ceramic floor, wall and roofing tile, countertops, brick, gypsum, sewer pipe, and glass constitute a major part of the multi-billion dollar construction industry

HEALTH TECHNOLOGIES
Biomedical applications of ceramics include bone implants, replacement joints, hearing aids, pacemakers, heart valves and biomedical pumps. Future applications are expected in gene therapy and tissue engineering

Sources: Silnes, American Ceramic Society, History of Ceramics, (May 2014) and Wray, American Ceramic Society, History of Ceramics, (May 2014)