

PREFACE

In 1965, the Intel co-founder Gordon Moore, in publishing his paper “Cramming more components onto integrated circuits” in *Electronics Magazine* (19 April, 1965), made the observation that in the history of computing hardware the number of transistors on integrated circuits doubles approximately every two years. This law is now used in the semiconductor industry to guide long-term planning, and to set targets for research and development.

The capabilities (processing speed, memory capacity, sensors) of many digital electronic devices have been improving at roughly exponential rates, and are thereby strongly linked to Moore's law. This exponential technological improvement in the electronic devices has dramatically enhanced the impact of digital electronics in nearly every segment of the world economy. Indeed, Moore's Law has characterized a driving force of technological advancements and socio-economic developments in the late 20th and early 21st centuries.

Moore's Law has had an amazing run for past several decades, with unmeasured economic impacts on US Microelectronics industry. The progress of Moore's Law has even transformed the business model of US semiconductor industry and still continues to do so. However, now the immense problems of youth unemployment, huge capital investments, unsustainable trade and budget deficits as well as manufacturing complexities constitute measures of bankruptcy of economic wisdom, which are making it difficult to sustain Moore's Law and its economic impact on US Semiconductor industry. There is hence an urgent need for new ideas to constructively deal with these business and economic issues affecting the survival of the U.S. Microelectronics industry. In this book, I have provided a solution for carving out a brilliant future of the US Microelectronics and Semiconductor industry. The suggested solutions are resilient enough to solve the economic and business problems facing this industry.

The suggested recommendations call for a radical change in the economic thinking of semiconductor industry professionals and business leaders. These recommendations are (i) challenging the stereotyped economic views, questioning the sustainability of existing modes of conducting microelectronics business, and (ii) introducing new Research & Development (R&D) promoting ideas, business models, and economic policies for revival of the U.S. semiconductor industry. Together, they constitute novel socio-technological and business-economic reforms towards a sustainable future of the microelectronics industry and its professionals.

In this process of exposing the reader to an economic heresy, this book has also introduced a new business model for the U.S. Semiconductor industry based on what is known as Progressive Utilization Theory (PROUT). But let us remember that John Maynard Keynes was also a heretic and so was the father of modern economics, Adam Smith. The economic orthodoxy is repeatedly failing the business of operation for the U.S. Semiconductor Industry and its ability to sustain Moore's Law. So let heresy get a chance for continued applicability of Moore's Law and the technological-business-economic growth of the U.S. Semiconductor Industry towards maintaining its global leadership.

Chapter One highlights the strategic importance of the US Semiconductor Industry to the U.S. economy. Chapter Two helps the reader to understand (i) the importance of the field of microelectronics Economics involved in manufacturing advanced semiconductor products, and (ii) the significance of retaining a global leadership in this industry. Chapter Three provides an in-depth analysis of causes of failure of US economy based on its macroeconomic and trade policies. Chapter Four deals with policies to mitigate the problems of counterfeit electronics, caused by the import of semiconductor systems from China by American companies based there. Chapter Five then provides a detailed analysis of impacts of globalization on the U.S. Semiconductor industry.

Chapter Six evaluates the US manufacturing supply chain and its impacts on business models in the US semiconductor industry. Chapter Seven offers solutions towards revival of US microelectronics industry, and also introduces a new business model for vibrant growth of this industry. Chapter Eight forecasts the near future of US Semiconductor Industry, by taking into consideration the recent geopolitical events around the world and explains the importance of a vibrant domestic economy and geopolitical dangers of too much reliance of the domestic economy on foreign investments.

Chapter 9 offers solutions for sustaining Moore's Law to overcome the physical and economic limits of shrinking transistor dimensions in order to maintain industry's innovation and to benefit from the business impacts of Moore's Law. Chapter 10 provides socio-economic reforms for a brilliant future of the US semiconductor industry. The final Chapter 11 talks about the national financial matters which would have an impact on sustainability of operation for US Microelectronics and Semiconductor industry. It educates readers about the importance circulation of currency in US economy for achieving higher standard of living for all industry professionals.

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