

Global distribution of micro–nano technology and fabrication centers: A portfolio analysis approach

Matthias Kautt ^{a,*}, Steven T. Walsh ^b, Klaus Bittner ^a

^a *Forschungszentrum Karlsruhe GmbH, Eggenstein-Leopoldshafen, Germany*

^b *Anderson Schools of Management, The University of New Mexico, Albuquerque, NM, USA*

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Abstract

Micro and Nano Technologies (MNT) are potential economic engines that have the capability to become the basis for regional and national job and wealth creation. Some have even suggested that MNT along with information technology and media form the basis of a new Schumpeterian or Kondratief wave. Many governments recognizing MNT as enabling technologies with exceptional economic potential have embraced them as centerpieces of their technology policy. Many of these same countries and regions as an expression of their technology policy are creating national centers that embrace the promise of MNT. These international Micro and Nano Technology Centers (MNTC) have taken a variety of forms.

Here we review the variety of forms and define the nature of many these major MNTCs from around the world by describing some of their similarities and differences. We provide an insight into many of these centers' demonstrated policy and tactics as they optimize their value to their constituents. Finally we provide a contribution to the literature by providing a categorization scheme for global MNTCs based on our exploration.

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* Corresponding author. Forschungszentrum Karlsruhe GmbH, Nano and Microsystems Program, Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany.

E-mail address: Matthias.Kautt@nanomikro.fzk.de (M. Kautt).

1. Introduction

If micro and nano technology (MNT) is the harbinger of the next Schumpeterian [1] or Kondratief [2] wave and if MNT act like the previous technology platforms that laid the foundation of these waves, then those regions that accelerate their adoption will differentially benefit from that choice. The countries and regions that not only recognize MNT as an element of this nascent Schumpeterian wave and proactively develop a policy that forms the basis for its advancement provide their regions with the best opportunity for future national and regional job and wealth creation based on MNT. This makes regional and national technology policy strategy and tactics critical to that effort [3].

One of the earliest outputs of many MNT national and regional technology policies is the development of MNT centers (MNTC). Here we seek to gain and present an understanding of the variety of forms that emerging MNTCs have taken through the use of a survey instrument.

We provide results of our study dedicated to the evaluation of global MNTCs. The authors identified and contacted eighty (80) such centers of global importance. We received responses from thirty five (35) centers representing worldwide regions Asia/Pacific, Europe and North America. These three regions include governments whose technology policy has generated the largest and most historic funding efforts in the MNT field [4].

Today with the ever-increasing hype centered on MNT, governments, corporations and regions are rushing to initiate MNT programs and centers of excellence [5,6]. Yet to date few academic efforts have been undertaken to understand the phenomena. Here we provide the first such work. This study relates these centers' choice of a comprehensive set of technologies and how they relate to various application areas and industrial sectors. These centers provide us an identification pathway through their choices of policy makers' technological and industrial hot spots. The strategic choices that these MNT centers have made for example demonstrate little or no cultural differences in centers' choice of industry or technology regardless of their location in the world. Nevertheless there are remarkable differences between individual centers. These include the technologies they consider as MNT, their aims, type or way in which they sustain themselves. Here we try to illustrate these differences and provide the reader with a background to these MNTC strategic focuses.

2. Literature review

Governments have been quick to recognize MNT as the harbinger of the next nascent Schumpeterian cycle [1,2]. Heralded as something extremely new, it is actually built on a technology and product history much older than widely believed [7]. Nanotechnology based products have been in commercial use for centuries. Perhaps the first product based on “bottom up” nano properties of a material was carbon black [7]. The fact that this technology base is not as new as the popular press has indicated is indeed a boon to the commercialization effort based on nano and micro technologies. The commercial emergence of micro and nano technology will actually be assisted by this due to time-to-market considerations [8]. These centers have been shown to be focused on reducing the average sixteen (16) to eighteen (18) year cycle between a disruptive technology [1,8–10], product paradigms invention and its resultant commercial use [11–14].

3. What is MNT?

MNT is an acronym for micro and nano technologies. What are micro and nano technologies and how are they related? There are many ways to define or categorize MNT or, as many state, “small

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