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Women in IT in the New Social Era

A Critical Evidence-Based Review of Gender Inequality and the Potential for Change

Sonja Bernhardt

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ThoughtWare, Australia

A volume in the Advances in Human and Social Aspects of Technology (AHSAT) Book Series

BUSINESS SCIENCE Reference
An Imprint of IGI Global

Managing Director: Lindsay Johnston
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Typesetter: Michael Brehm
Cover Design: Jason Mull

Published in the United States of America by
Business Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

Library of Congress Cataloging-in-Publication Data

Bernhardt, Sonja, 1959-
Women in IT in the new social era : a critical evidence-based review of gender inequality and the potential for change / by Sonja Bernhardt.
pages cm
Includes bibliographical references and index.
Summary: "This book aims to bring the topic of women in IT to the forefront of discussion about what can be done to correct this lopsided gender distribution by providing an essential guide for government professionals, students, and researchers in the ICT field looking to develop a solution to equalize the retention rate of women in these related fields"-- Provided by publisher.
ISBN 978-1-4666-5860-8 (hardcover) -- ISBN 978-1-4666-5861-5 (ebook) -- ISBN 978-1-4666-5863-9 (print & perpetual access) 1. Women in computer science. 2. Women in technology. 3. Sex discrimination in employment. 4. Information technology--Social aspects. I. Title.

QA76.9.W65B47 2014
004.082--dc23

2013051358

This book is published in the IGI Global book series Advances in Human and Social Aspects of Technology (AHSAT) (ISSN: 2328-1316; eISSN: 2328-1324)

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Advances in Human and Social Aspects of Technology (AHSAT) Book Series

Ashish Dwivedi
The University of Hull, UK

ISSN: 2328-1316
EISSN: 2328-1324

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Foreword

by Dale Spender

The Internet was called "the superhighway" in 1995 when in I published the book, *Nattering on the Net: Women, Power, and Cyberspace*. As the superhighway at that time was dominated by many unruly men, many wise women chose to keep off it. Smart phones didn't exist and only 5% of women—20 years ago—used the Internet! Partly because it didn't connect with their lives, their living, or their imagination.

As a writer and a publisher, I was, however, concerned about women's position in this new medium; publishing houses had effectively been controlled by men and for centuries women had even resorted to using male pseudonyms in order to get into print. Would our reluctance to take our chances on the superhighway become a future limitation?

I knew of course that almost every technological invention was widely believed to be beyond women's capabilities. Even the telephone—which was designed for the businessman—was considered inappropriate for women when first introduced. They might be good at face-to-face talk, but they wouldn't be able to conduct a conversation in the abstract: without someone to look at, they wouldn't know what to say.

Well we all know how ridiculous that belief was; it didn't take women very long to work out that the telephone wasn't for business – it was for communication, the ideal means for keeping up with friends and family. Within a short space of time women took over the telephone and made it their own.

Maybe—I thought—this would happen again. In the meantime, I became a spruiker for women and the Internet. It was made for them:

- It can't hurt you
- You can't break it
- And there is no mess to clean up afterwards

And once the mobile phone appeared on the scene, it didn't take long for women to get the message.

Fast-forward to 2014, and what do you find? Anyone who has attended a "business chicks" event in Australia (or its equivalent overseas) would soon notice that there were hundreds (thousands sometimes) of thirty-something women in the room (some younger, not many older) and that they were all energized "women in business." Any conversations you might overhear—among the buzz—would include sales, Websites, social media, marketing, and security – online and off! They were digitally oriented to their fingertips.

Not much talk about coding, however.

These women are the living evidence of the revolution that has occurred at the workplace and its location. Many of them are online small businesses women—who work from home—like Mia Freedman of Mamamia, for example. Others have big accounting, legal, and fashion businesses, and are equally digitally savvy.

Some are climbing the established career ladders in the new IT industries – as Sheryl Sandberg (2013) makes clear in her book (*Lean In*). A past Vice President at Google and now the Chief Operating Officer of Facebook, she is a symbol of success in an IT business world.

And she wants other women to take up the challenge and join her – to "Lean In" rather than hold back! The women she is addressing need only the opportunity! They are keen to have their careers, to be in charge of their own lives, to own their own homes.

Real estate agents report that young women are more likely than young men to be in the property market; young men go for cars. The Westpac Home Ownership Report—September 2013—found that Generation Y young women have a better grasp of finances than their male counterparts, and that 75% of the women were planning to pay off their loans as quickly as possible. Many gave a higher priority to home ownership than to marriage! They seek to be financially independent. So much for the old stereotype of women waiting for their prince to come.

"Girls just wanna have funds" is a common pattern among young business women who are ambitious and competitive, as well as co-operative, and they are the women in IT. Their career counselors at school may not have advised them to take this path, and they may not have formal IT qualifications from a university, but they are more than likely to have a degree.

They will have been to workshops and courses related to IT and know how to get the best out of LinkedIn, Twitter, Facebook, etc., run by "business chicks" and other comparable organisations. If they aren't classified as IT workers with start-up businesses, it's a failure of our definitions, not of their occupation, skills, and attitudes. They are the workers of the 21st century, and they are doing very well. Better than the men.

For reasons that are not quite clear—in the Western world and in China—women are now better educated than men. They are 60% of the university students and graduates and generally get better grades.

The Mission Australia Youth Survey (2013) questioned 15,000 young people between the ages of 15 – 19 and found that while most intended to complete their formal education, young men were almost three times more likely than young women to say they didn't intend to complete Year 12.

This absence of males in higher education at a time when it is such a major requirement comes as something of a surprise given that men designed the education system in the early 19th century and only opened the doors to women not much more than one hundred years ago. However, male enrolments have declined throughout the Western world, and their drop-out rate also gives cause for concern. Campus surveys suggest that when female students are in the library working, males are watching porn and playing video games.

Female students on Australian campuses are more career-oriented than their male peers; they make plans, organize work experience, even arrange jobs before they graduate. In contrast, male students often express the view that something will come up, and the future can take care of itself (Mission Australia Youth Survey, 2013).

This does help to account for women having become the majority in everything including law and medicine (more than half the GPs), vet science, accounting and auditing, financial management, optometry, dermatology, medical genetics, forensic pathology, among hundreds of others: the US pharmacy industry stands out because 8% of students were female in 1960, and they are 60% today. The exceptions are that men still hold the fort in IT and Engineering, and because of their central and crucial role in today's world, this is generally viewed as something of a problem (Rosin, 2012, p. 118).

In China, India, and other Asian countries, IT in all its forms—including coding—is considered "a good job for a girl." In Brazil, women are also regarded as "excellent engineers." These are much less likely to be the expectations in Australia.

As Washington Correspondent Liza Mundy (2012) points out in her book *The Richer Sex*, "Globally, a generation of young women is entering the job market better educated than young men and poised to become the most financially powerful generation of women in history" (p. 6).

And all of these young women are IT literate. They have entered a new and open market place where there is much less entrenched power, and they have so many of the appropriate skills that they are making their mark. "For the first time in history the global economy is becoming a place where women are finding more success than men" (Rosin, 2012, p. 117).

Just for the record, 40% of wives in America now earn more than their husbands (It's 25% in Queensland). Only 18% of men in the US are breadwinners, and 1 in 5 men of working age is not working. Women are on the rise, changing the established sex roles and the nature of work and redefining the relationships for the entire society in an IT environment.

Women have done this for themselves. Choosing to "start up" an online business wasn't in their curriculum any more than the cultural changes brought about by social media. They spent their time outside school exploring every use of an app, but unless they attended an exceptional school, their lessons didn't cover how to create one; most of them certainly weren't introduced to coding.

Mathematics, which suffers from the false image that it's not for girls, isn't compulsory, and so most are put-off from taking it. When they are confronted with "choices," they sensibly seek subjects that will likely result in the highest marks. These factors then influence career options.

When it comes to the last school hurdle, a written exam, they weren't given the opportunity to show what they could do, what problems they could solve, what extraordinary online communication and verbal skills they possessed – all the basics for the digital world. Instead, they had to write with pen and paper!

For girls who can skim along a keyboard, find anything on their iPads in seconds, and send text messages from under their desks without looking, getting them to write an exam answer is like asking those who have a driving license to manage a horse and cart.

The information they were required to write down on paper was supposedly stored in their heads, when they thought that was what the save key was for! Even worse, their habits of cooperation, collaboration, and consulting each other were not tolerated; they were called cheating. Everyone had to do their own work – no sharing allowed. How would they cope?

Very well it seems, even though these old skills aren't the ones they need now.

In surveys in the United States and Australia, women have undergone a radical transformation. A generation ago, women shaped their lives around the needs of men; they generally had marriage as a goal and work as an interim measure. They gave up work after they were married (as late as 1966 in Queensland, Australia, women had to resign from the public service when they married).

But things have changed dramatically, as the traditional male jobs of the industrial revolution dwindle and the demands of the information economy expand. As Hanna Rosin says, "Women are knocking at the door of leadership at the very time their talents are especially well matched with the requirements of the day" (Rosin, 2012, p. 199). Where EQ is valued over IQ.

Education, childcare, aged care, health, financial management, retail, medical science, are all traditional women's occupations – and while they are also where the biggest gender pay gaps exist, the pattern is that men's wages overall have stagnated over the last decade, while those of women are trending up (in the United States the gap is closing, while over the past years the gap has grown in Australia, but this could well be about to change).

In an information environment, everyone is a learner as technology changes so rapidly. It is more a matter of keeping up with the new than learning the old. The secret to success is adaptation, and women are the experts in this field. Researchers report that many men when confronted with online job applications and forms that are required for employment benefits call on wives, mothers, girlfriends to help them find their way around in the digital world! Whether they have been blue-collar workers or stock market traders!

It is said that print democratized reading; once books were commercially available rather than the texts that were sacred manuscripts locked away for the few in religious institutions, the masses learned to read. And if the printing press opened up the world of reading to anyone who wanted to try it, the Internet has opened up "authorship," creativity, problem solving, and entrepreneurialism to anyone who wants to have a go.

It is gender neutral. And you can do it for yourself, as every toddler with an iPad or mobile phone already knows.

When I got my first iPhone, I revealed my age when I asked the young woman if there was a manual; No, she said quite slowly and patiently, "You just go home and play with it and find out what you want to do. Everyone does it differently." That's the change from the factory system to the realm of creativity.

The legacy education system we have inherited has worked against taking the initiative; it is a standardized system that was perfectly acceptable and even successful in an industrial age where creativity would have completely disrupted the ordered assembly line.

Like the products that were made at the factory, the ingredients that went into the school systems were also "standardized" – starting with what was expected of girls and boys! Everyone started school at the same age, usually had the same curriculum and lessons, passed through the same grade system, sat for the same exams, and had to get the same right answers to succeed.

The assembly line system is still there, and if girls think there is something about IT (and math and science and engineering) as they are currently taught that is a turn-off, they are likely to be stuck with it. They will have little opportunity to take charge and experiment for themselves, except in some rare progressive schools such as Pymble Ladies College (PLC), where they are allowed to take their mobile phones into their exams. However, in a textbook-based classroom they can't try these subjects out for themselves, to play with them and work out what is myth and what is magic, and what they can do once they start.

This is a problem. For while women and IT use have become almost inseparable, they don't build IT!

It was Bill Gates who said that they don't call it programming for nothing. Coding has become the underpinning of our entire lives, and there are many good reasons that women should be in there doing it, reflecting their view of the world, their values, and their skills, just as they should have been in

publishing all these years ago, making the decisions about what was necessary or desirable, rather than having a lop-sided view from only one gender.

One of the findings that emerged from the research on the Global Financial Crisis was that women were better stock market traders than men. It was the men who traded vastly more frequently than women, out of a sense of bravado and authority. This pumped up confidence and competitiveness, which was once regarded as leadership and resulted in heavy losses, has since been redefined as a liability.

Women's caution in contrast, long seen as a failure to take risks, is now valued as a necessary skill, and the guidelines that have been issued for future use call for more women on the trading floor, as this will mean fewer pointless risks. There are implications here for our IT infrastructure. Women are the balance and the safety measure.

There are already predictions about algorithms that can start to operate independently (this has been a reality on the Stock Exchange where on more than one occasion a rogue computer "sold" the shares of a company and almost bankrupted it).

Recently, some serious scientists outlined three possibilities for the cataclysmic end of the world; they were a meteor, climate change, and being taken over by robots. Whether this is science fiction isn't the point; we need more women in IT, and that means we need to offer them the opportunity to explore, play with, create, and enjoy the satisfaction that coding can provide. Sonja Bernhardt's enthusiasm for IT and creating software for specific purposes can light up a room. Why should other women not enjoy the same experience? Currently, few of them get such an opportunity.

We will need a new breed of teachers for whom IT is a way of life and not just another subject; it will mean learning by exploring – and with different students coming up with different solutions. No more same answers that are the right ones! National curriculums that are saturated in print skills are not the best way to prepare for a digital society and workplace.

Some countries in the world have redesigned education for the 21st century, and kids in China, for example, are taught the excitement of coding from kindergarten to Grade 12 (perhaps I should rephrase that and say that they are given the chance to explore all the opportunities of coding from the day they start school). In the UK, Google provided 15,000 free Raspberry Pis (n.d.) for school kids.[1]

Once some schools got them, they all wanted them, and coding is spreading through the system.

At the same time, two fourteen-year-old boys in the United States who were convinced that every kid should learn to code, also recognized it wouldn't be their teachers who taught them. They set up their own business, Menlo App Academy (n.d.), and offered to teach any student between the age of 9 and 18 how to program mobile apps.

Their aim now is to teach 25 teachers who will in turn teach 2,500 other teachers so that the US can become a nation of coders: It's basic 21st century literacy. If school girls were offered such a chance, there would be those who would choose to explore the possibilities. They could even make it their IT business!

It might be a good idea to introduce it in Australia, better than spending days learning spelling, when there is an app for that!

Sonja Bernhardt has long known that women want to learn, adapt, change, and be inspired; that is one of the reasons she was the founder and inaugural president of WIT (Women in Technology) in 1997. Her enthusiasm was infectious, and many a young female students who had breakfast with Sonja at one of the WIT events went into IT.

They knew what they were doing because they had the chance to explore, and question, and watch, and listen, which wasn't every girls' good fortune. Maybe some of them didn't stay (I know a few doctors who don't practice, and a few lawyers who think they made the wrong choice), but there are a lot like Sonja Bernhardt who are in IT and who love it, as she does.

I have asked some young women at Business Chicks and other events for young entrepreneurs what started the passion, and the answer has often been, I went to WIT. Today, they use Business Chicks and other women's professional organisations as a "market square" where they can go to exchange skills, be sociable, make new contacts, and promote their businesses. They are the IT workers, they are financially independent, and they are changing the world. Not a bad achievement.

All girls should have the option and reward of making the model as well as knowing how to use it! However, this will mean an education revolution that is not on the horizon of the educational authorities.

This book will help to not only change minds and understandings about how we learn and work and live and play in the 21st century IT world. It is a crucial contribution to a better-planned and safer future. Sonja Bernhardt is to be congratulated for her long commitment to the importance of IT and her research, energy, and inspiration.

Dale Spender
University of London, UK

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ENDNOTES

[1] The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools.

Dale Spender *has been an author, feminist, educator, and public speaker most of her life. She began as a high school teacher, lectured at James Cook University, and received her PhD at the University of London, where she also taught teachers to teach. She has lectured at many universities internationally. Her book, Man Made Language, exposes the extent to which women's language supports that of men. She sent her first email in 1986 and has been hooked on digital ever since. A former chair of the CAL, she has served on numerous boards in the public and private sectors as well as working as a consultant with AOL, Microsoft, Apple, Fujitsu, the Commonwealth Bank, and DEEWR. She is a former deputy chair of the State Library of Queensland and the chair of Second Chance Program that raises money for homeless women; she is a past deputy chair of the Australian Society of Authors. She has written/edited more than 30 books and is currently completing one on women's status: Money Makes a Difference.*

Foreword

by Pia Waugh

Growing up as a female geek in Australia has been quite an experience. My mum was a techie and worked with software and networks, and there was a grand total of two people in my school interested in computers prior to university. So my enjoyment of computers in my early years was pretty organic and natural.

As a young woman, I was unfortunately told—repeatedly—that my enjoyment of gaming, bleeding edge technologies, fixing computers, and software somehow made me strange. An exception that proved some weird and illogical rule about women and technology.

After a while I started to believe that perhaps I might be an exception, or that maybe I did have a "male brain," or something else peculiar. Then I went overseas and discovered countries where women were 60% of the IT sector and I realised the idea that IT or technology is somehow a male thing was cultural. I, basically, decided then and there to do what I love regardless of what people tell me. I figured the best way to contribute to the IT gender debates that have raged in Australia for decades now was to be the change I wanted to see.

To do IT because I love it. To do awesome projects because they are fun and challenging. To give the men and women around me another example of a female geek to help break down the stereotype.

I am extremely pleased to say that I have seen a genuine change in the last decade. There are more technical women visible in Australia, a more positive attitude towards IT as an awesome industry that young people want to get involved in, and more young girls and boys are starting to identify as change agents with geek super powers throughout school and university.

Many people have contributed to this movement, and the Internet has bred a more socially literate breed of geek that can often transcend the limiting and unfounded biases of generations before. I feel proud now to identify as simply a geek, who happens to be female. After all, with almost everything in modern life depending on technology, the geek will inherit the Earth and all geeks—regardless of gender, age, beliefs, ethnicity, or any other traditional box—have an important role to play as the pioneers of the digital age.

Pia Waugh
GovHack, Australia

Pia Waugh *is an open government and open data ninja, working within the machine to enable greater transparency, democratic engagement, citizen-centric design, and real innovation in the public sector and beyond. She is passionate about improving the world by getting great technologies to people who need them and creating a well-connected global society where anyone can play and succeed. She has worked extensively in the IT sector, as a political adviser, has run her own business, and for both state/territory and federal government. Pia currently works as the Director of Coordination and Gov 2.0 for the Australian Government CTO. Pia was at various times also the President of Software Freedom International, the President (then VP) of Linux Australia, and on the linux.conf.au 2007 organising team. She speaks at technology, open source, and open culture events in Australia and around the world. Current projects include Gov 2.0 and open government, GovCamp and GovHack, Society5, the Distributed Democracy, and data.gov.au.*

Preface

I did not set out to have a career in IT. Rather, I fell into it sideways when a Human Resources job I took turned out to be an HR software support position. I had always been good at math, and the combination of interests made it a good fit for me. Over the years, my career evolved from employee, to consultant, to finally running my own software development company.

When I started in IT back in the 1990s, I looked around and saw how few other women there were. I started to think about the women in IT I knew, who did not know each other. I was determined to do something about it and hit on the idea of founding an organisation for women in IT, to provide a forum for networking, encouragement in a male-dominated field, publicising IT, and otherwise encouraging other women into what we knew was an interesting and well paid career. In 1997, Women in Information Technology (WIT) was born in Queensland, Australia, with a nucleus of ten women (the name has since changed to Women in Technology [WiT] to reflect a broadening of focus).

Over the years, WIT engaged in many programs to help women enter and progress their careers in IT and other scientific and technology fields. They ranged from interventions to encourage schoolgirls to consider IT all the way to board readiness programs to assist female entry onto company boards.

Through WIT, related organisations such as Australian Women in IT, Science, and Engineering (AWISE) and my personal initiatives, I voluntarily dedicated decades of my life to "the cause" of trying to increase the number of women taking up technology studies and careers, but what I observed was that not only were numbers actually declining but also the same arguments and intervention projects were being recycled and recycled across the years and around the world. Then in 2012, I had one of those "AH-HA" moments. I knew I wanted to write this book; I knew I needed to write this book, and I did.

OVERVIEW

"Attraction, Promotion, and Retention" has been the catch-cry of many passionate activists in this field around the globe for more than two decades. Yet to date the secret of attracting females to study technology and to enter technology careers, navigating suitable promotional pathways, and retaining women in technology industries has not been found. Without a doubt, this topic has attracted voluminous research over the past decades and continues to do so. Essentialist Theory, Social Construction Theory, Individual Differences Theory, Structuration Theory, Theory of Reasoned Action, and resulting Gender Modeling, Leaky Pipeline, Life Course Approach, Critical Mass, and Dualism Models have all been used over time to frame researchers' discussions regarding the lack and decline of females in technology studies and careers.

Despite the wide variety of theories proposed in efforts to frame and understand the issues, to date none have been accepted as a universally accurate framework, nor been applicable across varying cultures and ethnicities. However, the problem is deeper than that. As succinctly put by Mitchell (2013):

It's perplexing to make sense of some theories when one looks at the timeline. If social pressures and cultural attitudes were to blame, one would think the numbers would have been consistently low. On the other hand, if social attitudes had changed for the better over the last four decades, one would expect to see a gradual improvement over time. The same applies to changes in the market, such as negative perceptions of IT careers as outsourcing took hold in the '90s and '00s. The numbers also don't track with the unemployment rate, and even if they did, again, one would expect both men and women to be affected evenly.

The evidence presented in this book confirms that despite the reams of global research and decades of well-intentioned work by organizations, activists, and advocates to tackle the problem—including ad hoc, systematic, and comprehensive efforts, comprising career days, computer clubs, role modelling, mentoring, coaching, general promotional events and more—the attempts have been futile. A multitude of things have been done, but their goal of increasing the number of women in IT remains elusive. Yet, belief in the value of the programs persists, despite the lack of objective evidence. It is time to recognise that there has been a massive global failure to stem the decline of girls taking up technology studies and women entering technology careers. This failure has cost many millions of dollars around the globe, and it is time to seriously question the sense of continuing.

Ultimately when looking at the "issue or problem" of recruitment, promotion, and retention of women in technology fields, I propose that the chief problem is the topic is fundamentally flawed:

- It assumes that the "natural" state of the number of women engaged in technology studies and careers is a "problem" that needs "fixing or correcting"; and
- It layers a gender lens over the ensuing discussions, research, and actions.

This matters because the way we perceive a topic determines our responses to it. For example, if we believe artificial external factors are the main cause, it implies that artificial interventions to ameliorate those factors will have a significant benefit. For example, in her TEDx talk, Schiebinger (2013) states, "Fix the numbers of women…ought to shift to Fix the institutions.... We will not be successful in recruiting and retaining more women if we focus on women alone, we need to take the next step and that is transform institutions."

The hard fact is that neither the issue nor the proposals are new. For decades, we have been worried about how few women there are in IT and other technical fields. We have generated theories and interventions relating to surmised barriers that keep women out of IT or drive them from it after they enter it. We have achieved nothing – so why do we think more of the same will achieve more?

It is not that those past focuses were inherently unreasonable. Given the historical fight of women against bias in education and careers, it was not unreasonable to propose that persistently low numbers in a given field reflected the same causes and prejudices. Nor, given that the issue is gender disparity, was it unreasonable to view it through the lens of gender theory. However, when we see the number of women pursuing higher education rising to surpass the number of men, when intervention after inter-

vention in one field has no real effect, while in other fields women come to equal or outnumber men without anybody pushing: it is surely time to question our theories.

In business, when an approach consistently fails to deliver expected outcomes either the approach is adjusted or the "issue" is dropped. In science, when experiments are not consistent with a theory we question the theory. However, when it comes to women in IT, the theories live on while reality is blamed for the results. Perhaps it is time to ask the questions, "Should we really care if fewer women are attracted to IT roles? If women aren't interested in IT careers there is no reason to hold a gun to their heads and force them to into work they don't want to do" (Cave, 2013), and "Why don't we just leave the situation alone and see what emerges, instead of collectively trying to engineer an artificial situation?"

It is notable that the overwhelming majority of respondents to a poll conducted for this book identified personal interest from a young age as their own greatest influence on choosing a career in IT, and a clear majority of the remainder nominated discovering an interest after being exposed to IT in their job. In other words, the vast majority of respondents simply chose according to their internal affinity for the field, whether discovered early or later in life. These results map to a more rigorously designed survey conducted by Lyons et al. (2012). These women neither sought out nor were converted by intervention programs, they just chose according to their personal interests. Women in IT or girls interested in STEM see themselves as interested, competent, and above all, as people who regard obstacles as a challenge to be met and overcome. It is that strength and uniqueness of the individual core that forms the central thesis of this book.

Similarly, the failure of interventions and the stagnant level of female participation in IT, while in other fields it has soared from a small minority to a large majority, point to the answer lying within women, not outside them. It is certainly not that women are not as good at the subject as men. It is not even the case that women are not interested in it: many girls are interested in STEM fields. However, career choice takes more than ability and interest. It takes being *more interested than in any of the other choices available.*

I believe that is the whole secret. Women are under-represented in some fields and over-represented in others because, statistically, their interests differ from those of men. It does not matter how much we tell girls how much *we* enjoy IT, all that matters to them is what *they* are interested in doing.

However, whilst personal interest is the main driver, not all girls have an equal ability to discover their interest, and whilst interest can drive someone to a career, there may still exist barriers such as prejudice that make it an unhappy experience.

That is where the seismic shifts happening within the field of IT itself bring both a challenge and a solution.

The challenge is to researchers and organisers. Our frequently changing technology landscape makes it difficult for a traditionally developed and distributed research framework to keep up with the rate of change and incorporate the current influencing factors. Technology and industry game changers that impact the relevancy of a model or theory are introduced frequently. And when it comes to disseminating information, we are in an era where "trending" and following the latest technology craze is fast becoming not only the norm, but the main source of information for society. Similarly, those engaged in women in technology activities—planning, coordinating, or funding—ought to take notice of the tectonic shift beginning in technology and society and shift accordingly. It would be ironic indeed to bemoan the status of women in a dynamic technology field if we did not embrace the new approaches that field enables.

Perhaps we need to widen our perspective, to step back further and ask ourselves even harder questions about the issue of increasing female participation in IT. If you looked with fresh eyes at this issue