

Edward Henry Lorenz

Professor Emeritus, University of Nice- CNRS French National Centre for Scientific Research, Paris, France & Vice President, Globelics

I was reading the budget report and the aim of combining a knowledge economy with social inclusion and creating good jobs which was actually the key objective of the Lisbon Agenda, which unfortunately, as Bengt-Ake was saying got turned towards a more liberal austerity-oriented kind of strategy. So, I really congratulate you and I hope this alternative will continue to succeed. I understand that poverty has already been reduced substantially over the last decade. And I also gather your manufacturing sector is increasing. So, you aren't facing increasing deindustrialization, but actually you have a growing manufacturing sector, which is quite an accomplishment in these days.

I worked a lot on the fourth industrial revolution. One thing that is interesting about the data coming out of the research sponsored by the World Economic Forum is that unlike a few years ago, they're now saying Artificial Intelligence is going to create jobs. If we go back five years, most people were talking about the pessimistic prediction that we're going to destroy jobs. And especially for AI and robotics researchers didn't think very much farther beyond that to consider the potential for these technologies to create jobs, transform employment, to create new skills and actually to be positive.

Large firms of course are important drivers of change. However, one thing that we've learned from the survey evidence that's coming out - I would mention the UNIDO surveys presented in the Industrial Development Report for 2020 - is that there's a lot of heterogeneity between large and small firms. Basically, SMEs, and micro firms even more so, are not adopting these technologies to the same extent as large firms. This is an important issue to address as SMEs create jobs and are an important part of any economy.

Kerala of course, has an important population of SMEs which it supports through its innovation and entrepreneurial policy. The problems SMEs face can be multi-dimensional. It can be finance and there can be lack of skills, lack of knowledge, and even lack of awareness of what these technologies can do.

In some cases, new technology is not adapted to small scale production. You aren't going to invest in large industrial robots that are suitable for producing thousands of identical pieces in the automobile industry for a small shop that's doing customized work. But in other cases, it's finance and knowledge. So, I think there has to be a real focus on policies that are partly focused on increasing awareness, and partly on skills development.

And I think that the development of innovation hubs is one way to do it, to bring these technologies more deeply into the economy and to make sure as the UNIDO survey show that they impact on more than a small number of larger firms. Even in the case of Brazil, it's just a small minority of firms that are really at the cutting edge of what we call the Fourth Industrial Digital Revolution.

In a sense Kerala is very well placed because of its inclusive local banking system wherein, virtually every family has a bank account and this is exceptional. When we look at many developing countries you may have 50 percent or more of the population that are still primarily using cash, where cash economy dominates. So, I think you have a lot of things that are positive: good infrastructure and financial inclusion. You have an approach that stresses at the same time the adoption of new technologies and new methods, but with social inclusion and I think this is very important.

A last point I want to address is on the educational side. Yes, we need STEM skills. We also need lifelong learning, which is provided often by the employer. A lot of the training that takes place, it is over one's career. It's not just initial training in the universities. It may be provided by external training institutes, but it's also provided within the firm. So I think the employers have to be bought into the educational training policies and be encouraged to adopt policies that are appropriate for developing these skills. We've seen this in our work on Denmark where surprisingly training on the job through interactions with peers is seen by most of the people as the most important source of skill formation. This, of course, wouldn't be true for data engineers or data scientists. We are talking about people using these

technologies in daily work activities. So, it is important that investments in STEM skills are balanced with investments in professional skills and experience-based training.

Vocational technical institutes play an important role and are often neglected. I want to stress that innovation does not just depend on science-based skills. It also needs applied skills, experience and skills that are acquired through work activity which we refer to as DUI mode innovation (Doing, Using and Interacting), as opposed to STI (Science, Technology and Innovation). You need both.

It's been a pleasure to be able to talk with you. Thank you.