Assessment and forecast of EDA Company Viability in Case of Disruptive Technological Events

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Abstract: This paper proposes a model to analyze, assess and forecast the viability of Electronic Design Automation (EDA) companies that operate in a dynamic environment. Due to the technological advancements and the specific characteristics of this industry, companies that operate in the market are under continuous pressure to innovate their products, to find new policies of investment, strategies and forms of business model organization to maintain viability. Knowledge-intensive industries, like EDA, are known for needing continuous access to new knowledge, talents, and experts and a lot of research and development activity. Not all companies can provide in time the necessary results and innovation to compete in the market, so most of them dissolve, merge, or are being acquired.

Keywords: EDA industry, Company viability, Forecasting, Disruptive Technologies, Technological factors.

1. INTRODUCTION

The research in the current paper is in the framework of a study of the dynamics of Electronic Design Automation (EDA) companies. EDA is a relatively new business sector emerging, following, and enabling the first the semiconductor and later the high-tech industry, manufacturing, and mass production. The first data available are from the year 1961, the sector is about 60 years old. EDA companies need highly specialized staff with STEM expertise. EDA companies are strongly affected by technology development factors and disruptive technological events (innovations) lead to numerous mergers and acquisitions (M&A), emerging start-ups, and the disappearance of those who cannot follow. Paper (Bitri, A. et al, 2020) addresses the global place of EDA companies (EDA_C) and their business models (BM) in the current hyperconnected world, paper (Marinova, G. et al, 2021b**)** proposes formalization and parameters of the BM of an EDA company and paper (Marinova, G. et al, 2021a**)** describes a project of Database with parameters' values for several hundreds of EDA companies. Some initial observations and first statistical data are presented in the paper. Vu that the total number of EDA companies doesn't overpass 1000 and there are about 10 leaders with more than 70% of global market shares the study is fully representative.

The paper proposes a formalization of the Viability of an (EDA) Company in case of disruptive technological events or innovation. It will allow to predict the effect of a disruptive technological event (innovation) on the Viability of EDA company and to help adjust its investments and BM for increasing its Viability.

The study described in (Marinova, G. et al, 2021b) identifies 3 main technological factors: TF1 – The Moor's Law; TF2 – The System integration Law; TF3 - The technological disruptive innovation events – specified by a list of events (innovations) in years. The current paper focuses on the effect of TF3 which has rather a random character and the effect is strongly disruptive.

On a graph from (Marinova, G. et al, 2021a) are presented the numbers of funded and M&A EDA companies in years, concerning TF3 events. The formalization of the Viability of EDA companies in the paper considers the effect of TF3.

The current market expanders for EDA companies are Internet of things IoT and Digital twins. Some of the incoming technological disruptions are nanotechnologies, quantum computers, bioinspired engineering. The formalization of the Viability will help to determine which of the EDA_C has the potential to survive the new Disruptive technological events and/or adapt and expand generation technological innovations themselves or profiting from market expanders.

2. PROBLEM DEFINITION AND GENERAL FORMULATION OF THE VIABILITY IN EDA

The following definitions and notations are adopted:

$\mathcal{V}$ – The viability of a company;

EDA_C(J) – Electronic design automation company J where J=1, N;

N - number of EDA companies studied;TF3(I) – Technology factor 3, technological innovation(I), Technological innovations are listed in time per year;

$\mathcal{V}$(EDA_C(J)) – viability of EDA_C(J);

$\mathcal{G}$(TF3(I)) – generator of the innovation TF3(I);

$\mathcal{R}$(TF3(I)) – reaction to TF3(I) with a Delay $\mathcal{D}$(J,I);

$\mathcal{D}max$ – maximal delay admissible for viability;

D(J, I) – delay of the reaction of the company EDA_C(J) to the innovation TF3(I); FD – factor of the delay;

The investment of the EDA company in R&D is a precondition for the generation of innovations G(TF3(I)).

Table I Feathers of the tool as the main product of EDA_C

Interfaces/Periphery	Math	SW&HW description languages	Processing power	Models	Application area Market
• Graphics • Multimedia • Data acquisition (signal, image) records or real-time. • Communications • Measurements + equipment, devices and testbench setups associated to interfaces	• General math • System of nonlinear integro-differential equations • Digital synthesis and analysis • Digital signal processing • Finite element method • Boundary element method • Finite state machine • Approximations • Topological Place&Route methods • Telegraph equations • Probability&Statistics • Optimization • AI(DNN) • 3D	C C++ CSharp Phyton Matlab VHDL Verilog	Computer Super-computer	Models Digital twins Ips	•Semiconductor •Telecom •Data Centers •Cybersecurity •Automotive •Avionics •Military •Industry •Cyberphysical systems •IoT

The reaction and its delay are a result of the Sensing and Learning processes (Marinova, G. et al, 2021a) in the EDA company and it is related to Human resources HR talents (T_HR) and the connection with academia CA(J).
The viability of the EDA company can be expressed as:
$\mathcal{V}$(EDA_C(J)=$\mathcal{G}$(TF3(I))+$\mathcal{R}$(TF3(J)xF$\mathcal{D}$=
$\mathcal{G}$(TF3(I))+$\mathcal{R}$)TF3(I),$\mathcal{D}$(J,TF3(I))$<\mathcal{D}max$)

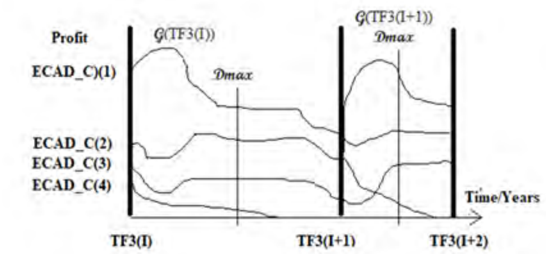

Figure 1. Profit curves of EDA companies

Figure 1 draws a hypothetical curve of the profit of an EDA_C between consecutive Technological disruption events TF3(I), TF3(I+1) and TF3(I+2). If EDA_C generated the TF(I), its profit is maximal, the profit of other EDA_C depends on their Reactions and the Delays of the reactions. A delay superior to $\mathcal{D}max$ leads the EDA_C to disappearance.
This definition of the viability can be implemented to formalize the viability and the rules for its forecast.

3. FEATHERS OF THE TOOL AS A MAIN PRODUCT EDA COMPANY

The main business of an EDA_C is to develop tools. Table I presents the feathers of the tool as the main product of EDA_C and its connection to the market. The feathers are categorized into 6 groups: Interfaces, Mathematical methods, and Solvers (Math), Software and hardware description languages (SW&HW_DL), Processing power (PP), or computer where to tool is run, Models and Application area (AA) representing the Market. These feathers can be connected to innovations, business models and viability of EDA companies.

4. CONCLUSIONS

This paper proposes a model to evaluate the viability of a Business Model that operated in a dynamic environment, such as the Electronic Design Automation Industry. The time and the delay to react to a new technological event or innovation generated by the competitor might be disruptive for the company.

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