מוסד שמואל נאמן
למחקר מדיניות לאומית

תעשייה וחדשנות

מיפוי תעשיות ייצור מתקדם

ד״ר גלעד פורטונה
עידן ליבס
רפי נווה
ד״ר אביגדור זוננשיין

פברואר 2019

מוסד שמואל נאמן
למחקר מדיניות לאומית

מוגש למשרד הכלכלה

מיפוי תעשיות ייצור מתקדם

חוקרים:
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תוכן עניינים

1. תקציר מנהלים

מטרתו של המחקר הנוכחי הינו סקירת עומק של מבחר מצומצם של חברות, כבסיס לגיבוש פורטפוליו של חברות ישראליות חדשניות בתחומי הייצור המתקדם. זאת, ע"י ניתוח פעילותן וריכוז המידע והתובנות באשר לפוטנציאל העסקי שלהן והאתגרים בפניהם הן עומדות. תוצרי המחקר מיועדים לשמש ככלי בידי נציגי משרד הכלכלה ובעלי עניין ולסייע בידם ליצור הזדמנויות עסקיות לאותן החברות – הן כחלק מקידום תעשיית ייצוא בתחום זה, והן כאמצעי לשדרוג המגזר התעשייתי הישראלי כשוק מאמץ ליישום פתרונות ישראליים חדשניים.

במסגרת המחקר קוימו ראיונות עומק עם בכירים בחברות לשם עמידה על ההיבטים הנ"ל כמו גם על איכותה של החברה והנהלתה, ולשם איסוף תובנות פנימיות באשר לשווקי המטרה המתאימים ביותר וצורת ההתקשרות האפקטיבית לפיתוח ערוצי יצוא רלוונטיים לחברות השונות. בנוסף, נאסף מידע על כל חברה ממאגרי מידע, סיורי שטח, כנסים מקצועיים ופרסומים בתקשורת ובאינטרנט. חומרים אלו רוכזו לכדי מסמך בתצורת קטלוג אשר מסכם את עיקר הממצאים לכל חברה, במבנה של תקציר מנהלים תמציתי.

סוננו ונסקרו 19 חברות המפתחות פתרונות טכנולוגיים חדשניים ליצור מתקדם, בחלוקה הבאה:

- 7 חברות המציעות טכנולוגיות לניהול מתקדם (בעיקר דיגיטאלי) של תהליכים במפעל
- 5 חברות ליצור בהוספה, הדפסות תלת ממד והדפסות מוליכים
- 4 חברות בתחומי האוטומציה ו-IIoT
- 3 חברות לתחזוקה חזויה ומתקדמת

מצאנו מכנה המשותף לחברות היותר מוצלחות שהגיעו למכירות של פתרונות בזמן קצר יחסית:

1. חברות שהוקמו ע"י יזמים שעבדו בתעשייה יצרנית וזיהו פערים טכנולוגיים, והם הקימו חברות במטרה לפתור חסמים אלה. כלומר המוטיבציה הייתה מערכתית ממוקדת ולא דחיפת טכנולוגיה חדשנית כשלעצמה.
2. חברות שהוקמו תחת חסות של חברות בוגרות שנתנו להן מתחילת דרכן ידע התחלתי בטכנולוגיה שנבחרה, תקצוב וליווי במימוש בחינת הפתרונות. בעלי החברות הבוגרות היו בהרבה מקרים יזמים בעצמם ולכן נתנו גם הכוונה מניסיונם בניהול חברת הינוקא.

בדו"ח רשימת תובנות עיקריות שעלו מהמפגשים ומהביקורים בחברות .

על בסיס התובנות והממצאים ניסחנו את ההמלצות הבאות שיישומן יכול לקדם חברות של פתרונות לייצור מתקדם ויכול לסייע בקידום התעשייה הישראלית לייצור מתקדם:

1. חשוב לכלול בתהליך בעלי ניסיון תעשייתי שיכולים לגשר על הפער התקשורתי והשיווקי הזה. וכמו כן, להדריך את חברות הפתרונות כיצד 'לדבר בשפת הלקוחות' – בכדי להצליח בשיווק הרחב בעולם.
2. נחוצה זירת מידע על החברות עם פתרונות, בה יוכלו המפעלים התעשייתיים לאתר פתרונות מתאימים לצרכים ולפערים שלהם. (לשקול להקים אתר שמרכז את הידע/פתרונות וגם מנתב שאילתות/התעניינות אל הספקים הרלוונטיים – אולי תחת כנפי המכון ליצור מתקדם" שאמור לקום). **נשמח לעזור בקידום נושא זה.**
3. כדי לחדור חדירה ראשונית לחברות תעשייתיות נכון להימנע מהצורך בשינוי מהותי בתהליכי העבודה בחברה. אבל יש, עם הזמן, לשכנע שחדשנות "משבשת" מחייבת שינוי בתפישה ובתהליכים.
4. יצוא פתרונות לחו"ל מהווה אתגר לחברות פתרונות שחלקן אינן בעלות כישורי יצוא. נכון להקנות כישורים אלו בצורה מובנית ולתת תמיכה לתהליכים אלה.
5. חברות תעשייתיות גדולות מתקשות לסמוך על חברות פתרונות קטנות. לכן, כנראה, נכון שחברות הפתרונות תתחברנה לאינטגרטור או מפיץ גדול וברמה ממשלתית מומלץ ליצור לכך מוטיבציה.

2. רקע

בהמשך לעבודות קודמות שנערכו במוסד שמואל נאמן בתחום הייצור המתקדם הכוללות גיבוש מאגר מידע של חברות העוסקות בתחום זה, כמו גם סקירת מדיניות רלוונטית בעולם, מיקודה של עבודת ההמשך המובאת כאן הינו העמקת הידע וההיכרות עם זירת הייצור המתקדם בישראל.

מטרתו של המחקר הנוכחי הינו סקירת עומק של מבחר מצומצם של חברות, כבסיס לגיבוש פורטפוליו של חברות ישראליות חדשניות בתחומי הייצור המתקדם. זאת, ע"י ניתוח פעילותן וריכוז המידע והתובנות באשר לפוטנציאל העסקי שלהן והאתגרים בפניהם הן עומדות. תוצרי המחקר מיועדים לשמש ככלי בידי נציגי משרד הכלכלה ובעלי עניין ולסייע בידם ליצור הזדמנויות עסקיות לאותן החברות – הן כחלק מקידום תעשיית ייצוא בתחום זה, והן כאמצעי לשדרוג המגזר התעשייתי הישראלי כשוק מאמץ ליישום פתרונות ישראליים חדשניים.

בחירת וניתוח החברות התבסס על היוועצות עם בעלי-עניין רלוונטיים לתחום, ובראשם חברות ישראליות חדשניות הפונות לפלחי שוק תעשייתיים, כמו גם בעלי-עניין אחרים כגון נציגי מפעלי תעשייה וארגונים שונים העוסקים באופן פעיל בתחומי התעשייה והייצור המתקדם.

בשלב ראשון הגדרנו מאגר של 150 חברות בעלות פוטנציאל להיות משמעותיות בחדשנות הפתרונות בתחום הייצור המתקדם. מתוך מאגר המידע הזה וממקורות נוספים, נבחרו מספר מצומצם של חברות אשר נמצאו רלוונטיות במיוחד – על בסיס תחום פעילותן, מידת בשלותן, החדשנות שהן מציגות והצורך שלהן בסיוע לפריצה לשווקים בינלאומיים, תוך שמירה על מגוון רחב של ורטיקלים תעשייתיים, אפליקציות מטרה, וענפי הטכנולוגיות בהן חברות אלו עוסקות.

במסגרת הניתוח קוימו ראיונות עומק עם בכירים בחברות לשם עמידה על ההיבטים הנ"ל כמו גם על איכותה של החברה והנהלתה, ולשם איסוף תובנות פנימיות באשר לשווקי המטרה המתאימים ביותר וצורת ההתקשרות האפקטיבית לפיתוח ערוצי יצוא רלוונטיים לחברות השונות. בנוסף, נאסף מידע על כל חברה ממאגרי מידע, סיורי שטח, כנסים מקצועיים ופרסומים בתקשורת ובאינטרנט. חומרים אלו רוכזו לכדי מסמך בתצורת קטלוג אשר מסכם את עיקר הממצאים לכל חברה, במבנה של תקציר מנהלים תמציתי.

מעבר לעבודת הסקירה שתוארה, פעל צוות המחקר על-מנת לסייע באופן שוטף ולתת מענה לפניות יזומות של גורמים במשרד בבקשות לייעוץ והיוועצות עם בעלי-עניין בתחום הייצור המתקדם, למידע לגבי חברות בתחום, לליווי פעילויות רלוונטיות כולל ייצוג בפני נציגי גופים זרים, ממשלות מתעניינות, השתתפות באירועים מקצועיים בתחום, סיוע בארגון כנסים, ליווי משלחות, הדרכה מקוונת של קבוצות נספחים מסחריים הפועלים במזרח הרחוק, באירופה ובארה"ב, סיוע ביצירת קשרים בעבור חברות ישראליות עם שותפים בארץ ובעולם, קיום דיאלוג עם בכירים בתעשייה הישראלית, קיום שולחנות עגולים בשיתוף האקדמיה והתעשייה ועוד.

3. סקירת חברות פתרונות ייצור מתקדם

להלן מופיעות סקירות של חברות ישראליות חדשניות בתחום הייצור המתקדם. חברות אלו נבחרו עד כה כי הינן כאלו אשר חצו רף ההוכחה הטכנולוגית הראשונית ולרוב נמצאות בשלב של מכירות ראשונות, אך טרם התבססו מסחרית והן עומדות בפני אתגרים של פיתוח שווקים וחדירה לוורטיקלים תעשייתיים משמעותיים.

3.1 Visual Factories

http://www.visual-factories.com/

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Status

Founded: 2014 **Employees:** 10

Privately owned and funded; currently not looking for investment

Overview

Visual-Factories provides Performance Improvement Solutions to discrete manufacturing with its Performance Improvement Management (PIM) system. The system can connect to any type of production machine to deliver cost reduction and productivity benefits.

The overall objective of the company is to lower smart industrial technology entry barriers for manufacturers, making it accessible and to provide a complete package based on an effective system with clear benefits for the customer.

Team

Matti Tiano, the current CEO, founded the company. Tiano holds a B.Sc. in mechanical engineering from Tel-Aviv University. He carries extensive experience with both equipment sales and process improvement project in the manufacturing industry.

The software development is led by veteran inter-disciplinary team of developers, experienced with client, backend and hardware interface development and integration.

Target verticals

Metal cutting, plastics, pharmaceuticals, and other discrete parts manufacturing industries.

Market analysis

There is an opportunity in under-utilization of manufacturing machinery, especially in operational activities. Factories generally have about 250 hours of unutilized machinery time per machine per month, accounting for 30%-40% of inefficiency.

The industry 4.0 challenge is to connect **people**, **resources** and **information**. Small and medium factories lack the attention span, risk-taking capabilities and mindset to consider disruptive solutions and pursue them, effectively making them inaccessible. At the same time, deployment of new solutions in factories should be bottom-up, rather than top-down through large corporate management who lacks the capabilities to work hands-on with the manufacturing sites.

Products/applications

A software suit based on the principle of Performance Improvement Management (PIM). The system continuously captures the production machines activity in real time by utilizing state of the art proprietary algorithms to analyze and present the collected data through unique, easy to comprehend displays and reports.

The PIM methodology enables optimization by learning the existing resources and processes in parallel to motivating and encouraging people to manage themselves in achieving these goals. The system's overall objectives are to measure production efficiency and true manufacturing costs. It consists of three layers:

1. **Communication infrastructure** with the manufacturing machine. This is done either through software protocols directly with the machine itself, or indirectly by placing a dedicated sensory array that gauges its electricity usage in real time.
2. **Analytics system** that collects information from all controllers, calibrates the gathered data, examines actual production performance and compares it to best practice benchmark references
3. **Gamification of work methods** done by "pushing" information to the machine operator and production manager, in order to initiate contact with the user, provide them feedback, and facilitate a work environment of transparency and responsibility ownership.

The utilization of the system as an integral part of the production processes transforms and progresses the work procedures and managerial methods.

Features

The client-side of the system consists of monitors with dashboard interface, and periodical electronic reports. The system offers four complementing applications:

- **Real time machine monitor** – provides information about the current throughput of each production machine, against its benchmark.
- **Shift change reporting** – tracks the individual operator's work shift, provides guidance for troubleshooting production problems, and enables the operator to report issues.
- **Daily report** – a report generated each day and sent to production managers, also containing Overall Equipment Efficiency (OEE) metrics.
- **Monthly report** – a monthly aggregation of performance metrics into a managerial overview report

As for security, the client-side of the system is located on the organization's internal network. Information is only sent outbound, and secured by the cloud's provider security measures. The actual data transmitted contains numbers which in themselves are meaningless for outsiders, and cannot be directly associated with business aspects of the organization.

Marketing, deployment and business model

- Currently there are about 15 customers, including factories of Rolls-Royce and Pratt & Whitney producing jet engine parts. The company is globally active with customers in the US, South America, Europe and Asia. .
- The sales model is Software as a Service (SaaS), with monthly subscription per machines monitored.
- The system is a "plug & play" turn-key solution, after a short configuration and setup time. It is ready for full-time operation within hours from installation.The company offers an evaluation period of few weeks enabling the customer to come to a final decision as for the future usage of the system – if accepted, additional close support is provided in order to finalize integration and maximize value generation.

Scale up and future plans: The company's next steps for scaling involve expanding marketing and sales efforts, and developing the architecture to support bigger operations on higher orders of magnitude.

As for future development, the companyis striving to bring more responsive system behavior, by employing machine learning and AI methodologies.

3.2 Largix

http://largix.com/

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Status

Founded: 2015 **Employees:** 6

Currently at R&D stage.

Owned and Funded by Co-founders and Polygon-tech Ltd.

Received a $500k OCS support grant and $300k by angels. Looking for a $2M investment at a $10M valuation.

Overview

Largix develops autonomous, robotic, large-scale 3D printers. Rather than common prototyping or modeling applications of 3D printing, the Largix solution is designed from day one for the manufacturing of end-use products. Its "cold 3D printing" technology is based on polypropylene (PP) and polyethylene (PE) – the two most commonly used materials in the plastics sector – as well as integrated smart raw materials with unique properties.

Team

Largix founders are long time industry veterans both with over 25 years of executive experience in leading companies. Ronen Orr, the company's CEO, holds a B.A. in Economics and Sociology from The Hebrew University, and held key positions in Keter Plastic, ALBAAD and Plasto-Sac, among others. Amir Sheelo, V.P of Business Development holds a B.A. in Economics and Business Administration from the University of Haifa, and served in management roles at Strauss, Dexxon, Delta Galil and Global Roto Sheka, among others, as well as owned business activity in the realms of 3D printing. The team also consists of top robotics design and development engineers.

Target verticals

Manufacturers of heavy-duty storage tanks; custom-made construction industry, manufactures of shelters (e.g. shades, bus stations), playgrounds and other urban architecture; aviation sector; automotive sectors.

Market analysis

The industrial and commercial world is shifting towards short, personalized and highly customized production series ("lot-size-one"). Consequently, the challenges faced by

manufacturers are with flexibility in planning and execution, manpower productivity, footprint-demanding infrastructure, supply chain inefficiencies and overall manufacturing costs.

The solution requires smarter manufacturing – through reduced manual labor and higher productivity, shorter supply chain – through local manufacturing and smaller inventories, and advanced product – in term of structure and weight.

3D printing offers this type of solution, with projected product cost reduction of about 50% throughout. Yet, for manufacturing application 3D printed products must meet the quality standards, somethings that run-of-the-mill 3D printing technologies are commonly straggling with, as inter-layers bonding is a typical weakness. Moreover, PP/PE – a plastic industry go-to materials for their properties and cost effectiveness – are normally expanding, shrinking and deforming in the process of fusion, and therefore are not used for 3D printing. Largix is overcome these challenges with its unique "cold 3D printing" technology.

Globally, about 50,000 to 60,000 plastic injection machines are sold annually; Largix plans to gain market share in this market as an alternative.

Products/applications

Rather than using powders or gels, the Largix printing technology is based on flexible PP/PE strings, which are fed through a heated die nozzle. The multi-channel die melts the very skin layer of the strings (down to several dozen microns thick) with the majority of the mass remaining cold and unaffected; the base previous layer is preheated as well, and the two layers a bonded under pressure.

The printer is large in scale, measuring 5m x 5m x 5m with printed objects capable of reaching 3m x 3.5m x 3m sizes, however these are only the current specification and technically the printer is modular and its size can be scaled down or up, depending in the target application.

Since the printing resolution (i.e. the printed surface smoothness) is relatively low, dictated by the fed string thickness, a milling tool is employed as part of the printing process for further processing.

Largix has filed two patents for its unique printing and processing processes.

The future technological aspiration is to also develop a small-scale printer ($1m^3$) with more advanced printing materials.

Features

- Printing rate measures at 20 to 30 kilos per hour.
- Being a "cold" printing process makes the otherwise required support beams unnecessary, reducing material waste and post-processing.
- The printing process allows to incorporate unique properties materials within the product, such as UV protection on the outside layer, flame retardants, etc. Moreover, since there's a great degree of control over materiel placement, coloring can be applied only in exposed external layer of the printed product, thus saving on more expensive colored materials.
- Future development will incorporate lasers into the printing process, in order to improve accuracy, precision and efficiency.

- The software layer provides a closed feedback loop, with an array of sensors delivering real-time sampling from the printing process, providing data for control, analysis and quality control.
- The printing machines are developed to be operated through a control room cockpit with remote monitoring capabilities.

Marketing, deployment and business model

- The list price of a printing machine is in the range of $750k-$1M, although Largix also pursue a Manufacturing-as-a-Service (MaaS) business model, were models are printed and charged by the kilogram, covering for hardware, software and service. Ultimately, the company aims for servicing to account for about 30% of its revenues. In addition, Largix will sell consumables directly and it plans to license the formulas for its "smart raw materials" through 3rd party suppliers.
- As for distribution channels, Largix plans to operate directly in leading markets (e.g. Germany, USA) and through distributers in other markets.
- Current customers and applications include:
    1. The company's first customer and beta site is a manufacturer of heavy-duty poly tanks. Poly tanks are currently manufactured semi-manually and designed with complex internal structure where no two tanks are alike. Printing the tanks not only provides a great degree of flexibility in tank customization, it can also save up to 40% in manufacturing cost and 50% of manpower. Globally there are an estimated 2,000 storage tanks manufacturers in the Americas, Europe and Asia, with a market valuated at $2B.
    2. Largix also cooperates with a major German manufacturer of sewage manholes. Manholes are highly customized, very labor intensive – accounting for as much 80% of the cost – and takes as much as 24 work hours to build per part; printing reduces labor by 60% and can increase production rate to up to 2.5 parts per day.
    3. There's a signed contract between Largix's and The Israeli Aviation Industry (IAI) for development of its technology for the sector of aviation.

Largix is looking for strategic partnership with global and major manufacturers in industrial fields..

3.3 MASSIVit 3D

http://massivit3d.com/

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Status

Founded: 2013 **Employees:** 90

Currently at initial sales stage.

Mostly privately owned, with some equity held by Stratasys.

Received an OCS support grant. Raised $28M to date, currently looking for a round B investment of $10M-$15M at a $70M valuation.

Overview

MASSIVit 3D develops and manufacture solutions for large-format 3D printing, covering its hardware, software and materials aspects. Based on its patented Gel Dispensing Printing (GDP) technology, the company's 3D printer enables the production of super-sized, light and durable object for a variety of low volume / high value applications.

Team

MASSIVit 3D's CEO is Avner Israeli, a seasoned professional in 2D and 3D printing industry at Scitex and Stratasys; he holds an M.Sc. in Engineering Management from Northeastern University, USA, and a B.Sc. in Mechanical Engineering from Ben Gurion University, Israel.

The three founders of MASSIVit 3D share mutual experience in the printing industry at Scitex (acquired by HP). Co-Founder & Chief Innovation Officer Gershon Miller founded multiple printing companies in large format digital printing (sold to Scitex) and 3D printing (merged with Stratasys); he holds a B.Sc. in Electro Optics from The Jerusalem College of Technology, Israel. Co-Founder & VP Strategic Projects Moshe Uzan previously held senior positions in Scitex and HP; he holds a B.Sc. in Electronics Engineering from the Ben Gurion University, Israel. Co-Founder & VP R&D Igor Yakubov formerly served in varied top R&D management roles in printing and imaging; he holds an M.Sc. in Physics from Makhachkala University, Russia.

The company has about 90 employees, many of which are PhDs in Chemistry, software developers and mechanical engineers, with most of the R&D based on chemistry and software disciplines.

Target verticals

While currently MASSIVit 3D sales are mainly in the advertising market, as printing materials improve the company looks at offering manufacturing capabilities for limited number, super-size applications. These include shipbuilding, automotive, aerospace, medical devices, construction, architecture and manufacturing of other large-scale structures and interiors.

Market analysis

While three-dimensional (3D) printing is a developing field, it has emerged already at the early 90's. Nevertheless, applications have so far remained focused at prototyping rather than manufacturing.

Generally, as the physical size of manufactured products increases, the manufactured unit count tends to decrease, resulting in materials accounting for a negligible marginal cost as opposed to cost of tooling. This reasoning has driven MASSIVit 3D to its focus over super-size manufacturing, unlike most 3D printing applications which use different technologies and target different markets.

Short run – low volume – high value type of manufacturing is a characteristic of several niche sectors which involve large scale parts of interiors. Such sectors can be found in yacht builders (where about a third of the cost is associated with interiors), caravans / trailers / recreational vehicles (RVs) manufactures, aviation interiors manufacturers, construction molds, and manufacturers of interiors for hotels and similar public spaces.

Products/applications

- The **Massivit 1800** 3D printer is the company's main product, providing a fast and simple to operate tool to create super-sized objects.
- Massivit's patented **Gel Dispensing Printing (GDP)** technology is based on the combination of its proprietary photo polymeric acrylic gel **Dimengel** which has thixotropic properties (i.e. changes viscosity under stress), its dispenser layered printing process and a low energy LED UV curing.
- The print planning procedure also involves a high level of knowledge development, manifested in the **Massivit Smart** proprietary software used in preparation for 3D printing.

The combination these technologies allow the creation of high-quality "hollow-shell" 3D objects are easy to handle and transport, consumes less material than most 3D printers with the need for support structures and post-print processing.

Features

- The printer size is 180cm x 150cm x 120cm (5'9" x 4'9" x 3'9").
- Printing speed is up to 35cm per hour in Z axis per a single printing head.
- Optional simultaneous dual-object printing.
- Non-vertical parts, tops and ceilings can be printed without the need for support structures.
- Fast curing without post-curing or processing required.

Marketing, deployment and business model

- The company's business model is designed so that most of the net revenues are to be gained from sales of expendables that feed the printers.
- Futures plans include local manufacturing of the hardware and expendables in target markets.
- MASSIVit 3D's sales channel is based on distributers who also provide servicing, most of which are operating in the printing sector.
- The company has already sold over 100 printers at a range roughly $250K to $350k per machine, mainly to digital printing houses.
- MASSIVit 3D is open for collaboration in the fields of materials and chemistry.
- One of the main barriers to overcome is the cost of printing materials – achieving lower costs would pave the way for increase in manufacturing potential. The company applies R&D efforts into new and improved materials with better costs, properties and additional applications range.
- As a long-term goal, MASSIVit 3D wishes to grow to attain a status like that achieved by Stratasys as a market leader.

3.4 Atomation

https://atomation.net/

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Status

Founded: 2014 **Employees:** 16 (in Israel, now establishing a US office in St. Louis)

Started in the Explore incubator. Received OCS funding (first through the incubator program, and secondly as a continuing company). Currently looking for round-A investment (~$5M).

Overview

Atomation forms an IoT platform made from a software suite, a dedicated hardware component and cloud-based analytics that together enables to connect any object and sensor. The system is designed to allow quick and simple integration of connectivity onto applications in the agriculture, medical, industrial and logistics sectors, based on generic mobile devices and Atomation's software architecture

The company aims to support every communication protocol available, expand its software development kit capabilities and enable device management on top of monitoring. It looks to connect all types of objects which are currently "offline" to allow real-time analysis and decision making.

Team

Guy Weitzman is Atomation's CEO and Co-Founder, holds a M.Sc. in Management of Technology from NYU, and carries experience in internet, mobile and cyber operations. The second co-founder is Eran Keshet, Atomation's CTO, also an NYU graduate who with over 15 years of experience in development and product management with specializations in robotics, interactivity and computing. The majority of the company is staffed by software developers.

Target verticals

Agriculture, medical, industrial and logistics sectors. Specifically targeting hardware companies.

Market analysis

While large industrial corporations are looking to integrate IoT capabilities into their products and services, having no experience in the field leads them to seek a turnkey solution provider. Consequently, Atomation seeks strategic partnerships that may allow such cooperation – as is evident with its strategic investor CPC, leading provider of quick disconnect couplings, fittings and connectors for plastic tubing.

Atomation currently focuses on US's Midwest, which is characterized by strong agricultural and bio-science industries and privately-owned factories. Following the US, the company plans to expand its efforts mainly in Germany and India.

Products/applications

The Atomation platform enables connecting any type of object or equipment to the web, within three weeks. The platform consists of three major components:

1. **Hardware** – an electronic circuit board called "Atom" which runs a proprietary code that digitize and type of sensory output data. Each Atom has its own power source, communication capabilities with other Atoms, mobile devices and cloud services and a plug for connecting additional enhancement modules - ‘skins’.
2. **Software development kit (SDK)** – a software suite that allows flexible and fast development of mobile applications to communicate with Atom arrays, providing a contemporary replacement for handheld terminals.
3. **Cloud-based analytics** – an online big-data analytics engine located over Amazon servers, which provides access and reporting to the data from anywhere, as well as deep insights, patterns recognition and querying tools.

The heart of Atomation's intellectual property lays in the system's architecture and in the generic algorithm code. The generic code means that in effect the system is agnostic to the type of sensors and data they provide, allowing for fast implementation over virtually almost all types of sensing equipment, regardless of legacy formats, units of measurements, signal characteristics etc. Moreover, the company has patented the actual usage of the inertial measurement unit (IMU) or Bluetooth chips to run its code, thus removing the need for a dedicated computation chip in many applications.

Features

- Depending on the application, data collection from the deployed Atoms is collected wirelessly either "manually" by simply having the user with his mobile periodically move next to them, or through dedicated stationary communication gateways that cover an area with multiple Atoms. Future development may allow using the Atoms in a mesh network topology to further improve data collection and communication.
- The system supports a variety of communication protocols common in commercial and industrial applications, including BLE (Bluetooth Low Energy), LoRa and more.
- Atomation developed a code that runs the data computation algorithm over the communication chip, thus preserving communication and cloud computation loads (a practice commonly referred to as "edge computing").
- Communication is encrypted.

Marketing, deployment and business model

- Atomation operates at a B2B model, providing its solution to integrators, rather than distributers or consumers. Its business model is based on an annual fee per tracked sensor (~$2-$5 / sensor / year), following an initial integration project.
- Currently over 2,000 units are deployed in the field, with most used for agriculture applications.
- Current customers and applications include:

1. Syngenta – built a capsule of sensors suite for monitoring environmental parameters for farmers and growers, with Atomation providing the capsule its connectivity means.
2. Nidec – a world leading motor manufacturer for a wide range of applications. The Atomation solution is integrated into pumps, enabling them with connectivity and activity reporting capabilities.
3. Ameren – a major US electricity and natural gas utility. Atomation provides connectivity to Ameren's natural gas pipeline leakage detection sensors; it also provides connectivity for sensors monitoring electric transmission towers for vibration and tipping over.
4. DynaQuip Controls' WaterCop – an automatic water shut-off system for building floods prevention. The Atomation component connects the system's sensors into a central mobile-based central control and network gateway, allowing remote monitoring and control of the system.

3.5 Augury

http://www.augury.com/

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Status

Founded: 2011 **Employees:** 57 (39 in Israel, 18 in NYC, USA)

Bootstrapped the first couple years, recently secured round-B investment of $17M (a total of $26M raised to date).

Overview

Augury is a mechanical diagnostics platform of internet of things. It uses vibration and ultrasonic sensors to perform vibration analysis of rotating mechanical systems over its cloud-based automated diagnostics platform, providing factories, commercial buildings and homes with an advanced predictive maintenance solution.

Ultimately, Augury aims to reach every application where there are moving parts, including in a residential setting.

Team

Saar Yoskovitz is Augury's CEO and Co-Founder, holds a B.Sc. in Electrical Engineering and a B.Sc. in Physics from the Technion, and previously worked as an analog architect at Intel. Gal Shaul, the company's CTO and Co-Founder, holds a B.Sc. in Computer Science from the Technion, and previously worked as head of software development at EndyMed (a medical devices start-up) and as a firmware engineer at Zoran (a chip manufacturer). The R&D team consists of mainly algorithm development, signal processing and machine learning specialist.

Target verticals

OEMs of rotary electric motors, including fans, pumps and compressors.

Market analysis

Sensory hardware has met a critical stepping stone, now capable of providing high quality sampling at low costs, enabling deployment of large scale arrays of sensors and high resolution real-time monitoring. Consequentially, continuous monitoring is expected to increasingly become an integral and embedded feature in a growing range of machinery.

As the traditional "sales and service" business model (where generally about 70% of profits are derived from service alone) becomes challenged by increased technical reliability and low interest rates, more manufacturers are bound to shift towards an "equipment-as-a-service" model. This transition provides an opportunity for advanced maintenance cost-saving solutions that not only serves the end-customer, but first and foremost the equipment manufacturers' bottom line.

Interestingly, another implication is that the risk model changes as it is shifting from the end-users up the value chain back to the manufacturers, effecting the way the insurance companies' businesses as well. This manifested in the fact that one of Augury's investors is a major US reinsurer firm.

Preventive maintenance can significantly lower downtime, as well as reduce energy consumption. Moreover, it decreases the need for technician staff. However, it is generally conducted by highly qualified specialists, requiring unique expertise, and is costly to perform. The global predictive maintenance market is estimated at $2 Billion. Predictive maintenance, however does not follow pre-scheduled routine and is rather based over actual machinery status.

Augury operates at factories and commercial buildings, which operate mission-critical auxiliary equipment and rotary electric motors, including fans, pumps and compressors. Typical costs of this type of machinery range between tens- to hundreds of thousands of dollars per site, and so early warnings of impending malfunctions decreases severe failures and the resulted maintenance costs, as well as extend the machinery's operational life.

Products/applications

Augury's solution provides online monitoring and real-time maintenance alerts for buildings' infrastructural and auxiliary machinery.

Sensory data acquisition is done either through a dedicated handheld inspection device, or through stationary sensors array which is installed on the target machinery. The acquired data is sent to cloud servers and get processed using Augury's proprietary mechanical diagnostics algorithms. The resulted monitoring data, insights and alerts are displayed back to the user over a management platform.

Augury employs a network of crowd-sourced vibration analysts by which it validates the quality of its system analysis results

Features

- On terms of security, on top of common best-practices for cloud security, the company employs hackers in efforts to actively locate possible cyber vulnerabilities and secure its system accordingly.
- The company's vision is for its system to match and surpass the capabilities of human vibration analyst, through the addition of more sensory data, improved reporting and refined analysis, to further establish its credibility as a top-quality predictive maintenance solution.

Marketing, deployment and business model

- Augury has several major customers in the US, including PepsiCo and Mueller, as well as Intel Israel. Among its other customers are OEMs, such as manufacturers of industrial-grade chillers and motors, as well as maintenance companies which performs building management and operates teams of technician, serving about 15,000 buildings and facilities in US and Canada. The company also has a pilot program underway with the State of New-York for energy efficiency and maintenance savings.

- Augury acts as a solution provider for OEMs who wish to embed IoT capabilities into their products and services but lack the know-how and experience in its implementation.
- In addition, vibration analysis specialists also use the Augury system as part of their toolset.
- The business model of Augury is Diagnostics as a Service, where customers receive maintenance advice and recommendations, without investment in the sensing equipment or the analytics platform hardware.
- The current Augury customers were acquired directly, but marketing through distributers' channels is also being pursued.
- The company focuses its marketing effort at the US market, with future plans for Europe and China down the road.

3.6 Lightapp

lightapp

http://www.lightapp.com/

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Status

Founded: 2011 **Employees:** 22 (15 in Israel, 7 in USA)

Series A funded.

Overview

Lightapp is a comprehensive data collection, analysis and engagement software for industrial manufacturers. Lightapp's products span the full life-cycle of an IoT program from initial sensor-level data acquisition to employee action and engagement. Our software focuses on three areas of value at the facility level: energy optimization, production optimization and predictive maintenance. Additional arena tools are available at the corporate level for tracking performance across multiple facilities and justifying capital expenditure. Lightapp is hardware and software agnostic and is designed to unify disparate data sources to create a central, digestible IoT solution.

Team

Guy Peer and Elhay Farkash are Lightapp's cofounders. Elhay Farkash is the company's CEO, located in the USA. The founders hold an extensive experience with supply chain management demand planning and industrial software applications.

Target verticals

Lightapp's target verticals span the full breadth of the manufacturing industry; food & beverage, plastics, metal casting, aerospace, pulp and paper and mining.

Market analysis

Lightapp focuses on "midway" sectors, which on the one hand are not highly advanced in manufacturing and operational processes (e.g. semiconductors), and on the other hand such industries that are not lacking any basic application of IT infrastructure in their operation.

Additional common property of the target market for its solution are industries which are energy-intensive.

At the moment, the company focuses its efforts at the US and Israeli markets.

Products/applications

Lightapp's solution is based on four core products:

1. **Data collection hardware**, for realtime information acquisition from sensors, controllers, plcs, and manufacturing execution systems (MES)

2. **Platform**, where the system continuously analyzes the data, generates indices for performance measurements, charts trends, automatically detects anomalies and trigger pre-configured workflows (e.g. tasks, personnel assignments, etc.)
3. **Marketplace,** where service providers, hardware manufacturers and 3rd party consultants can connect with qualified leads in the industrial space to strengthen their value added services and increase their sales.
4. The fourth aspect of the solution is called **the arena**, a cloud-based platform where inter- or intra- organization performance data collection and benchmarking. The platform provides manufacturing units with the ability to assess their efficiency and effectiveness compared to other units or organizations. Whether the different participants in the platform use the same or different machinery, and regardless of their respective industrial sector, the system provides anonymous and objective performance measurements, giving users insights on how well are they doing and how much better they can expect to become.

Features

- A key unique component of the Lightapp solution is its sharing platform, which effectively translates the benefits of social application of data onto the industrial arena, generating meaningful insights and guidance to all levels of the organization .
- Another key aspect of the system is a robust process of data validation, which proves to be crucial when dealing with hundreds of sensors and other data sources per site.
- The data is stored on Amazon Web Services servers, utilizing its advanced cyber security and cloud connectivity abilities.
- The data from each factory is stored separately, to prevent data leakage and unintended exposure of sensitive business information.

Marketing, deployment and business model

- Lightapp has partnered with the joint initiative E2e by Berkley, MIT and the University of Chicago, to participate in a program funded by the California Energy Commission (CEC) through a $5M grant. Under this program, a statistically-controlled group of manufacturing plants are invited to participate in a pilot for energy efficiency. The Lightapp system is installed in participating factories, measuring energy consumption of their compressed air systems and their actual outputs in real time. After an initial 3 months control period where data is only collected, the pilot shifts into an active engagement mode and the system starts providing feedbacks to the plant in the form of alerts, reports and analysis, for a total of one year. As part of the program, participating factories receive partial funding for the implementation of the pilot system. Currently, 100 California factories are participating. The future plan of the company is to deepen the application of the system within the pilot participants' corporation, extending its reach into additional resources to be measured, as well as presence in more manufacturing facilities.
- Lightapp has also partnered with Pratt Industries under a binational program by the BIRD Foundation, to develop and deploy a paper optimization solution for the pulp and paper industry.
- The deployment process is as follows:

1. Mapping resources suppliers and consumers in the facility, including metadata (e.g. model and make, generation capacities, etc.).
2. Surveying the possible data streams which the equipment and machinery can provide.
3. Mapping staff and position holders in the organization
4. Data acquisition

- The company has 30+ customers in the Israeli market and more than 130 facilities in the US, including some of the most dominant industrial players.
- The business model of Lightapp is based on the Software as a Service (SaaS) model, with costs of its system to their customers based over the number of sensors connected and the software modules in use.

3.7 3DSignals

https://www.3dsig.com/

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Status

Founded: 2015 **Employees:** 154

Currently at market penetration stage.

Raised pre-A round investment from Grove Ventures VC, as well as strategic investments and partnerships with Samson, totaling at $7M raised in cash and equity.

Overview

3DSignals developed a sound-based asset performance monitoring solution, enabling asset managers and operational excellence leaders to meet and exceed Overall Equipment Effectiveness (OEE) KPIs. Using patented, acoustics-AI technology, the 3DSignals solution extracts operational performance parameters such as utilization, speed, and health of machines in industrial environments.

Team

The 3DSignals team is made up of a combination of signal processing and mechanical engineers and business executives with proven track record.

Ariel Rosenfeld, 3DSignals CEO, led M-Systems' worldwide Disk-on-Key Unit to over $300M in revenues, ending in M-Systems' acquisition by SanDisk. David Koren, 3DSignals' VP Operations, is also an M-Systems veteran, where he led technology and product. 3DSignals three co-founders have previously shared experience in key positions at eyesight Tech, an embedded computer vision solution company. Amnon Shenfeld, President & co-founder, has previous experience from Check Point and holds B.Sc. in Computer Science and Bio Informatics from the Ben-Gurion University. Ofer Affias, CTO & co-founder, and Amit Ashkenazi, VP R&D & Co-Founder – both have previous experience from Freescale and hold B.Sc. in Electrical Engineering from the Ben-Gurion University as well.

Target verticals

Discrete Manufacturing enterprises as well as their machinery OEMs in industrial component manufacturing such as valves, connectors, drives etc.

Target verticals include the automotive, oil & gas, chemicals and aerospace industries.

Market analysis

There are 60 million machines in the world, and 90% are not connected (source: McKinsey). Meanwhile, factories underperform – OEE (Overall Equipment Effectiveness) score is generally low. While industry 4.0 is the promise for change, the reality is that even just basic connectivity

is a major hurdle for most companies - $140B must be invested in Europe only in order to connect machines (source: European Parliament Report). Therefore, the target market for the 3DSignals solution are European companies in the discrete manufacturing market, with machines that are not connected, and experiencing poor OEE. These companies are looking to transition their operations onto digital-centric processes. 3Dsignals can help these companies bridge the gap to industry 4.0 with a solution that is simple, easy to implement, low cost, and quick to show value.

Products/applications

The 3DSignals solution in composed of two layers:

Product Components

3DAPM™ Data Acquisition System - dEdge™

3DSignals free-standing edge device and microphone provide 24/7 acoustics data collection at up to 2.5MHz frequency range.

- 24V power
- WiFi / Wired Ethernet connectivity
- 7 channel 24V machine interface for operation mode messages (optional)
- 2 Analog Sensor interfaces
- 3DSignals dMark™ data labeling worker HMI (optional)

3DAPM™ Dashboard - dView™

Customizable, browser-based dashboard for data visualization, analytics, and alerts for monitoring assets' performance and health.

- Cloud hosted, accessible on-premise and on mobile devices in the hands of operational and reliability managers
- Detailed availability views from production floors down to single assets

Features

- **Non-invasive** freestanding sensors operate independently from pre-existing OT networks. The platform does not require integration into existing control systems or change in equipment design.
- **Fast implementation**: Installation of equipment takes less than an hour per asset. Sensors are installed with magnetic fittings with no equipment downtime or drilling requirements.
- **Machine and vendor agnostic**
- **Intuitive**: Listening to machines has always been part of industrial equipment maintenance routines. Our technology enhances this established practice.
- The dEdge™ data acquisition system supports any off-the-shelf analog vibro-acoustic sensor input such as acoustic emission, ultrasonic airborne, etc.

- Provides wide coverage with fewer sensors, including in use cases where vibration-based sensors are not applicable
- The module is certified for industrial-grade working environments
- Continues and remote monitoring, as well as early warning of impending failures

Marketing, deployment and business model

- The system has been deployed at SAMSON AG, a global manufacturer of measurement and control technologies based in Germany, and the scope has expanded to cover several production facilities globally after an initial successful pilot. The company has an additional client in the US in a funded pilot stage.
- The 3DSginals solution is also targeted at machinery OEMs to be integrated as a sub-system within their applications
- The company has two patents pending for its IP in condition-based management root cause analysis, covering signal processing, identification of acoustic behaviors, sound signatures and advanced machine learning techniques.
- The business model revolves around one-time fee for installation and software licensing packages.
- The target markets are mainly in the USA and Europe, with a current focus on direct sales.

3.8 LeaderMES

http://leadermes.com/

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Status

Founded: 2000 (rebooted into startup at 2015) **Employees:** 20

An Emerald Information Systems subsidiary.

Raised $5M in pre- Round A from the Firstime fund and several private investors.

Overview

LeaderMES provides small and medium factories with advanced manufacturing management capabilities, allowing them to digitalize their processes and improve performance. Based on big data, machine learning and cloud computing, the LeaderMES solution gives managers and operators tools to improve manufacturing monitoring and control, data collection and analysis, knowledgeable decision making and feedback communication – all in real-time.

Team

LeaderMES's team consists of software developers, sales, marketing, implementation and support specialists. The company's CEO and founder Amir Aloni hold a B.A in Computer Sciences and Philosophy from the University of Haifa, carries 13 years of experience in production management. Eran Polak is the Development Team Leader, holding B.A.Sc. in Computer Science from the Open University of Israel and experience in a variety of software development skills. Nathan Tiomkin is LeaderMES's Director of Sales and Business Development, holds an M.B.A. from the Open University as well, and has over 12 years of experience in sales and marketing.

Target verticals

Plastics, rubber, paper and packaging materials, textile, metals, pharma, food and beverage – and all other mass-production traditional industries

Market analysis

There is an underserved market of small and medium manufacturers ($10M-$250M annual revenues) looking to go through a digital transition of their operations. These are typically family-owned corporations, characterized by high level of owners' involvement in management, low margins (5-10%), high proportion of operational expenses and small batches – i.e. companies where operational efficiency is a critical element. An example of that are the many factories in Europe which were originally started as an agricultural-related business, which is prevalent in

the corporate mindset – family businesses which passes on through generations, looking at maintaining long-term prosperity. This type of customers is inclined to favor turnkey solutions, ready out-of-the-box for implementation with minimal upfront costs, but capable of scaling up down the road.

Common management software solutions are usually centered around financials (e.g. ERP systems) or, conversely, on the micro-level management of machinery from the engineering perspective. The LeaderMES solution takes a more holistic approach based on industrial management approach.

Products/applications

LeaderMES is a real time operation intelligence software solution, providing a window into the manufacturing environment.

It is structured in four layers:

1. **Data collection** from available data sources
2. **Data infrastructure** in a production context, at the machine-level
3. **Production support process** at an aggregated level
4. **Call for action** on a global level

The system interacts with the operators and managers via several interfaces, designed to empower the employees and their engagement with the work environment:

- **Web application -** provides online operational monitoring dashboards and management tools, in a cloud-based server running on Amazon Web Services (AWS)
- **Operator App -** providing real-time information for the machinery operators, and collects their inputs and feedback reporting on anomalies in the process, e.g. causes for machine failures etc., as well as multilanguage support (for foreign workforce)
- **Manager App –** provides real-time reporting and alerts

The underlying principle the system follows is the Overall Equipment Effectiveness (OEE) concept. OEE management generate a robust information infrastructure and leads to significant savings within a short period, through identification of bottleneck and immediate failures in the manufacturing process. The use of cloud computing enables enhanced computational capabilities using artificial intelligence methods, facilitating high level energy and materials control and management and their impact over products attributes.

Features

- The system is plug-and-play, with a setup time of only one day in a typical factory
- As usually over 90% of the machinery is over 10 years old, a common data protocol is in place – this is provided by a Wi-Fi edge controller attached to each target machine
- Security is covered through the use of a Cisco-based platform called InCloudFactory (patent pending), where raw manufacturing data goes through initial processing, encryption and compression locally on a dedicated network and transmitted on-directionally to the LeaderMES cloud

- The system user control and monitoring are carried over multiple platforms including web applications and apps for mobile phones, tablets and wearable devices, with designated interfaces tailored for each of the different users according to their role in the corporation and manufacturing process

Marketing, deployment and business model

- LeaderMES has over 80 customers with deployment at about 100 sites, of which about 80% are in the Israeli market
- Most of the current customers are from the Plastics sector, with about 10-15% of Israel's plastics industry working with the LeaderMES system
- LeaderMES has established partnerships with Cisco, Amazon and Deloitte, among others
- Overseas marketing is carried through distributers and field agents, with partners such as Deloitte and Tefen also acting as distributers as part of their manufacturing consulting services, and integrators offering the system as part of their solution package
- Global expansion strategy currently focuses on the European market, with possible next target in China
- The business model is Software as a Service (SaaS), with a proof-of-concept (POC) time of two months in which customers get to experience the system and its effect of their operation

3.9 Weldobot

http://weldobot.com/

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Status

Founded: 2012 **Employees:** 10

Currently at market penetration stage.

Owned by Polygon-tech Ltd., a 20yo company that develops industrial automation and robotic systems, Heller Industries Inc. and a group of private investors from the US.

Raised $1M joint project grant through the BIRD foundation program. Received an OCS support grant.

Looking for market business development support.

Overview

WeldObot develops and manufactures advanced welding systems and solutions for industrial robotic welding applications. Its solutions address the shortage of proficient welders, increase consistency and quality of welds, and improve welding throughput.

Aiming to improve traditional welding processes, the company acquired and develops unique IP for proprietary technology to combine plasma cutting with MIG welding, building the next generation technology to optimize the performance in merging these techniques.

Team

WeldObot team are long time industry veterans. The management team are:

Mr. Douglas Steyer – President and CTO for the US and Asia activities: carries extensive international experience in market development, product launches, commercialization and operations in the metal fabrication segment, as well as in productivity improvements and quantification of cost savings in manufacturing. MBA – university of Phoenix, B.Sc. Mechanical Engineering, Federal University of Rio Grande do Sul

Mr. Menachem Gilad – COO for Israel and Europe activities: has over 40 years of experience in the industry, including founding "Gevim" – a successful projects and consulting company in the field of robotics, machinery and industrial automation – as well as long managerial experience in various companies. Specialized in assembly automation.

Mr. Gadi Binyamini – Head of R&D and Engineering.

Mr. Alfonso Rubin – Head of lab & customer support.

The company employs engineers from varied fields, including mechanical, electrical, electronics and software engineering.

Target verticals

Welding industries, including heavy steel, armored steel, stainless steel, aluminum constructions, and heavy equipment industry e.g.: Automotive, transportation, ships, trains, vessels welding, pipe line and wind turbines manufacturers.

Market analysis

Pipelines are non-reproducible products, and the manual welding it entails requires a highly specialized labor, in a process which is unstable in quality and performance. The shortfalls of manual welding hold true also in other small batch manufacturing jobs of parts and assemblies, in which high-level automated welding can significantly contribute to the bottom line. These include tier-1 and tier-2 suppliers of metal products to a wide range of applications.

WeldObot products offer manufacturers major improvements in welding throughput and quality while providing a robust, productive and cost-effective solution compared with conventional processes.

Products/applications

WeldObot products are based over two welding technologies:

- **WOB101:** a patent pending smart robotic pipe welding system, which is essentially an autonomous orbital welding robot. Easy to setup and operate, the WOB101 is a chain or ring mounted welding dolly with a unique tracking head, capable high precision welds of large diameter pipes (e.g. 100″) with butt or overlap joints, dramatically increasing pipe welding throughput.
- **SuperMIG:** a patented hybrid system combining a powerful plasma arc with a gas metal arc welding (GMAW) in one torch, used for automated welding facilities. The system includes a torch and a control module, both of which designed to be integrated with common robotics, automation and power sources hardware. The combination of metal inert gas (MIG) / metal active gas (MAG) welding process and a plasma-arc in one processing torch can replace and improve most welding results achieved by either standard welding method and provides a full welding solution for most metal and alloys, joint configurations, applications and thicknesses. The system and process were tested and validated by the US Navy labs and by major heavy crain manufacturers.

Features

The WOB welding robot employs advanced sensing technology, resulted in improved pipeline welding throughput, at an ROI of less than a year. The system benefits include:

- Wide range of operational specification, capable of welding pipe diameters of 600-3,000mm and thicknesses of 5-25mm, at speed rates of 2-12mm/sec.
- The system is easy to deploy and operate in the field with no guide rails required, providing either fully- or semi-automatic welding capabilities.
- The WOB has a unique laser seam tracking head with a built-in position correction, as well as optional features including QA modules and remote management.
- Designed for both water pipes and gas lines.

- Based on a conservative estimate, the welding robot efficiency is at least 2.5x higher in throughput compared with manual labor rates.

The SuperMIG's torch is compact and light-weight head is fully water-cooled and supports quick changes of consumables; the control module is compatible with most motion systems and robotic controllers' protocols, and handles water cooling, digital gas flow and mixture control, as well as the welding programs. Its advantages include:

- More than 2x increase of welding speed, reaching a rate of 1 meter per minute, up to 80% quicker weld
- More than 2x increase of welding penetration depth, also enabling penetration welding of overlap joints with no access holes, with almost no grooving or edge-preparation required
- Narrower heat affected zone results with reduced part distortion and weld spatter, and reduced need for pre- and post-weld treatment and use of filler wire
- Increased potential of use in new materials and challenging applications
- The final result is a very significant reduction in the welding cost per piece and per inch/cm.

Marketing, deployment and business model

- WeldObot solutions help address the acute need for new welding personnel and better throughput. While a conventional industrial-grade welder costs about $20k-$25k, WeldObot's SuperMIG is priced at about $75k; however, since it can be operated by a lower-skilled operator and provide higher output efficiency in terms of time and costs, the added cost is quickly outweighed by the economic benefits, in suitable applications.
- The company operates in a B2B business model, with marketing and distribution operations based over cooperation with welding solutions integrators in order to attain a wide customer outreach, as well as formation of strategic alliances.
- WeldObot's main markets are the European, US and China industries; efforts are invested in order to strengthen markets towards North American, China as well as the Japanese markets.
- The target audience for the company's solutions within the customers' corporate structure are usually their head welding engineers, who can properly evaluate the benefits they may provide to manufacturing operations.
- The WOB system was selected by Hyperloop One as a welding solution for the large diameter, near vacuum tube test track it builds in the Nevada desert.

3.10 Plataine

https://www.plataine.com/

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Status

Founded: 2008 **Employees:** 70 (mostly in Israel)

Founded and completely privately owned by Prof. Moshe Ben-Bassat, a leading AI scientist and the founder of ClickSoftware.

Currently looking to raise investments for expanding marketing and sales.

Overview

Plataine develops software for manufacturing process automation and optimization, as part of its advanced manufacturing solution for discrete-production industries. Its solution provides digital assistants for production management powered by AI systems that rely on real-time data from machinery and sensors around the plant.

Plataine aims to form an intelligence layer above the typical ERP, PLM and MFS systems as well as along the supply chain, helping factory staff and managers make optimized decisions in real-time, every time.

Team

The Plataine team is made of people mainly with software and mathematics background, as well as industrial management - covering a wide range of knowledge fields relevant to the manufacturing sphere. The company's management includes a set of highly-skilled, highly-experienced professionals in their relevant fields of responsibility, all with remarkable credentials.

Plataine's President and CEO is Avner Ben-Bassat, holding an MBA from Duke University and a BSc in Mathematics and Computer Sciences from the Tel Aviv University, with over 15 years of experience in optimization software for services and manufacturing applications. At the role of Chief Scientist for over 13 years is Eduard Goldner, holding a PhD in Applied Physics from the Hebrew University of Jerusalem and past experience in multiple companies including ClickSoftware. The company's VP R&D is Naaman Lifshitz, who holds a BA in Psychology and Management from Tel Aviv University and has over 20 years of experience in software development and leadership. Amir Ben-Assa is the Chief Marketing Officer, an Executive MBA graduate from the Tel-Aviv University and holding a B.Sc. in Mechanical Engineering from the Technion, bringing over 20 years of experience in marketing and business development as well as management role in Siemens, among others. The VP of Product Management is Michal Diga, holder of B.Sc. in Industrial Engineering from Ben-Gurion University with 10 years of experience in multiple roles in SAP.

Target verticals

Discrete production industries including aerospace, wind turbines, automotive, defense, industrial manufacturing, furniture and upholstery, etc.

Market analysis

In some industries, such as the aerospace or wind energy sectors, production inputs include composite materials which are highly time- and temperature-dependent, creating an operational and logistic challenge in maintaining rigorous quality standards while also keeping an economic efficiency in the production process.

The analytical methodologies taken to tackle these challenges range in complexity and the resulted competency. At the base is *Descriptive analytics* by which data is collected and organized in meaningful ways to reflect the target processes' status. Next, there is *Predictive analytics*, used to provide estimates to probable outcomes and impending failures in order to prepare accordingly. Then there's *Prescriptive analytics* which based on data collection and predictions creates sets of instructions to follow in order to achieve the operational goals.

The Plataine's system is of the Prescriptive analytics class. Relative to competing solutions, it is a mature system which has robust underlying technology to drive it, capable going beyond alerts to provide actionable recommendations and instructions, a feat which requires deep technical capability.

Products/applications

The Plataine system is connected to the production line and gathers data from the organization's enterprise resource planning (ERP) and Product lifecycle management (PLM) systems, as well as from sensors and human operators. The system serves as group of digital assistants providing predictive and prescriptive analytics, where information is given with context – meaning not only alerting abnormalities but also providing guidance to solve them. This approach and the solution's capabilities facilitates decision making which accounts for broader-picture efficiency considerations.

One of the key aspects of the system is tracing a "digital thread" of materials and parts throughout the manufacturing and logistics processes. This digital history tracking is used for algorithmics purposes serving the goal of process optimization, as well as for regulatory requirements as needed in some markets and sectors.

Evidential outcomes in employing Plataine's solution measured by higher production throughput, fewer quality problems, better scheduling and faster time to market are the key drivers in the product design and implementation.

Features

- The solution is comprised of a suite of applications, selected in order to meet well-defined problems and challenges, allowing for a quick initial setup time of several weeks.
- User interface is available on mobile phones, tablets and Google Glass; the operator receives concrete job instructions.

- Results from implementing Plataine's solution show improvements of 2%-5% in throughput and production capacity, 3%-8% of savings in raw materials, 2%-5% labor savings and 10%-20% reduction in cost of poor quality (COPQ).
- The typical ROI for the system is about 4 to 6 months.
- Typically, the system operates over the cloud (AWS), but in some more sensitive applications local onsite installation take place. In both cases, it employs encrypted communication protocols and permissions.

Marketing, deployment and business model

- Plataine focuses at industries which are engaged with manufacturing of advanced parts from a variety of materials.
- The company's customers and include major players in the Israeli aerospace and defense industries as well and international ones such as Airbus, Boeing, Siemens, GE, and more, based in the US, China and other far-east countries.
- Plataine partnered with AMRC (University of Sheffield's Advanced Manufacturing Research Centre), McKinsey, Airbus, Boeing, Google, Siemens and GE in creating a demonstration center for the "factory of the future" based on its technology, among others.
- New products are released about once in a year, a result of designation of a new target market, specification of a tailored solution and consequent product development.
- Plataine currently holds two patents and has five more pending patents.
- The company carry out its R&D in Israel, and in addition has sales and implementation staff in the US and China. In Europe the company cooperates with local distributers and partners.
- The company looks to penetrate additional markets and increase its exposure.
- As for marketing, Plataine's focuses its efforts on forming partnerships, and plans to also cooperate with integrators in the coming future.
- The business model is Software as a Service (SaaS), with initial implementation cost followed by ongoing periodical fees dependent on production scale (e.g. measured relating to manufactured parts or used raw materials).
- Typically, a customer starts with a pilot installation in a single site in which implementation expands, later followed by further expansion onto other production sites; sales efforts target both individual sites as well as the overseeing corporate level.

3.11 Nanofabrica

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https://www.nano-fabrica.com/

Status

Founded: 2016 **Employees:** 10

Raised seed investment from VC and a strategic angel investor.

Received a grant from the Israel Innovation Authority

Overview

Nanofabrica develops an ultra-precise 3D printer for mass manufacturing of small parts. It's technology and design provide a highly-accurate, cost-effective, fast and flexible additive manufacturing solution.

Applications are varied and include precise tooling attachments for the semiconductor industry, small and customized connector housings, complex heat sinks, diffractive optical elements, lenses and optical alignment jigs, ceramic substrates and more.

Nanofabrica aims to lead the digital precise manufacturing market through the development of additional advanced printing materials and printing capabilities for additional applications.

Team

The CEO Dr. Jon Donner holds a B.Sc. in Physics and Electrical Engineering from the Tel-Aviv University, a Master in Photonics from the Universitat Autònoma de Barcelona and a PhD in Nano Optics from ICFO, where he also served as an Entrepreneur in residence.

The CTO is Eyal Shelef, who holds a B.Sc. in Physics from the Tel-Aviv University and carries 16 years of R&D experience in HP including management of 70 researchers in multiple groups and 33 registered patents.

Target verticals

Semiconductor, sensors, medical devices, optics.

Market analysis

The manufacturing of small and precise parts by additive manufacturing is projected to get to about 5% of the relevant manufacturing market, amount for a $7B of a total addressable market. However, current manufacturing processes for small parts are slow, complex and expansive. While these circumstances highlight the potential benefits of parts 3D printing, most available solutions suffer from the same shortfall, and are generally not manufacturing-oriented.

Compared to competing solutions, Nanofabrica is unique in its capability to provide both high precision as well as higher throughputs, making its solution applicable for mass manufacturing.

Products/applications

The printing solution Nanofabrica develops is characterized by ultra-high precision, cost effectiveness in short manufacturing runs (up to 5,000 parts), fast manufacturing time and limitless design and geometries.

With up to x50 improvement in precision achieved through advanced optics enables new applications and markets, the lower printing hardware cost compared to alternative manufacturing methods opens the door for high volume and throughput manufacturing. Planned additional printing heads will also increase printing speeds.

The printing materials are ABS and Polypropylene, as well as ceramic materials in R&D stage. The printing resins are proprietary materials developed at Nanofabrica, which enable ultra-high-resolution 3D printing.

Applications include printing complex ceramic heat sinks (e.g. used for advanced thermal management of delicate electronics), antennas, Optical alignment fixtures (e.g. lenses frames and filters), as well as in semi-conductor and medical devices applications.

Features

- features of down to 15 microns (the diameter of two blood cells)
- Lateral resolution of 1µm and vertical resolution of 1.5µm
- Maximum printing volume of 50X50X100 mm^3
- Stereo lithography based technology

Marketing, deployment and business model

-
- The company is currently chosing beta sites for its first industrial machine. It has closed 2 sites and is looking for another 3.
  - Nanofabnrica seeks to interact with companies via POCs, specifically by printing parts, so that companies can test and evaluate quality of printed parts.
- The target business model is B2B sales of machines and proprietary consumable materials.
- Sales are usually targeted at the corporates' engineering unit, and plans are to use local distributors as channels for reaching new customers

3.12 Kitov Systems

https://www.kitovsystems.com/

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Status

Founded: 2014 **Employees:** 25

Completed Round-A investment by strategic investors on October 2018.

Raised $10M in total from RSBG, a leading international equity firm led by Hahn Group, a leading solution providers in the area of industrial automation and robot solutions and GiTV, is an early-stage Japanese boutique venture fund.

Overview

Kitov Systems develops AI-based solutions for smart visual inspection in industrial manufacturing. The systems developed by Kitov reduce manufacturing costs, eliminate inefficiencies and improve quality without the need for any programming or automation expertise. Kitov Systems technology is leveraging Computer Vision, Artificial Intelligence capabilities including Deep Learning, advanced Robotics and Big Data Analytics.

Team

Originated from RTC Vision, Kitov Systems was founded by Dr. Yossi Rubner who serves as the company's CTO. Rubner holds degrees in electronics and computer sciences, with a Ph.D. from Stanford University. He previously served in roles including CTO and VP R&D at leading tech companies Scitex, Parc, CogniTens, Applied Materials and RTC Vision.

Hanan Gino is Kitov's CEO, holding a Bs.C. in Electronics from the Technion and an MBA from Boston University and extensive experience as a former Verint Israel CEO and senior management roles in Orbotech, among others.

Adam Tabor is the company's COO, holding an M.Sc. from Stanford University and experience assuming leadership operations, service and supply chain management roles in Orbotech, HP and more.

Adi Weinberger is Kitov Systems Vice President for Sales and Marketing, holding Bs.C in Industrial Engineering and MBA in Marketing and wealth of experience in sales and marketing supporting penetration of new products and technology and growth for companies such as Comverse, M-Systems, Orbotech, Verint and mPrest.

Avner Hadad is the VP Customer Success, Holding Bs.C in Mechanical Engineering and proven records in driving customer success for companies such as: Verint, HP, Orbotech and Scitex.

The team includes algorithm specialists, software programmers, mechanical engineers, application engineers, sales and marketing specialists.

Target verticals

Contract Manufacturers, Electronics Manufacturing Service providers (EMS) High end electronics OEMs, and manufacturers in Automotive, Defense and Medical Devices industries.

Market analysis

Most manufactured products undergo manual quality control and human visual inspection. The biggest challenges in automating quality control (QC) are the long setup and actual inspection duration times that characterize automated QC systems. The market size of manual inspection is valuated at $18B (directly, not including cost of quality loses), of which 95% is carried manually and the remaining 5% share using a customized automated inspection solution.

Products/applications

Currently Kitov Systems is offering Kitov One which is an end-to-end inspection platform, including optical head, robotic arm, solid inspection table, server and dedicated SW. The company also offers offline planner and a stand-alone review station as complimentary products.

The Kitov solution is based on three main technology aspects – machine vision, advanced algorithms and artificial intelligence. These are at the foundation of its core technologies:

1. **Smart planning** – tailoring testing procedures and quality specifications to match a specific product, using 3D image reconstruction, semantic understanding, optimized pathway planning and virtual shield for operational safety.
2. **3D inspection** – executing tests based on the same 3D reconstruction coupled with machine vision and pattern recognition techniques, supplemented by deep learning insights analysis of data gathered about variability in manufactured product, feeding back the production line.
3. **Analysis and automation** – leveraging deep learning, the system conducts big data analytics and provides cloud-based reporting with integration to existing management systems.

For setup, the system shots 360º hi-res pictures of the product targeted for inspection, and a digital model is created. The user then selects elements for inspection and defines the desired tests. This way, the whole QC setup process for a new product is reduced to several hours as opposed to several months in other automated QC systems.

In inspections the system mimics the level of human vision as a benchmark target.

Next in development are further improvements and enhancements to the planning process, reporting dashboards, and stationary camera configuration for additional suitable applications.

Features

- A system is priced at $150,000 and a $15,000 per annum licensing, support and maintenance fee
- The system installation takes only a couple of hours, and requires product restraining fixtures to be added in by the implementing customers as well as close chamber in which the system can operate

- Double the inspection speed of that of a human
- ROI in replacing human labor is less than 18 months
- The system is capable of interfacing with handling and loader systems, as well as with the organizational defect specification location IT systems

Marketing, deployment and business model

- Kitov has established partnerships and customer base with the major global manufacturers including T1 manufacturers such as: Flex, Jabil, USI, Mellanox, Keter Plastic and Denso.
- Kitov One is currently installed in multiple sites in Israel, China, USA, Mexico and Italy and Japan.

3.13 XJet

http://www.xjet3d.com

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Status

Founded: 2005 **Employees:** 120

Currently at Beta stage, working products, acquiring leading customers in key markets (Europe and US)

Owned mostly by investors, with a small share held by the founders and employees. Raised circa 130M$ to date. Received some OCS grants – circa 5M$.

Overview

XJet is a provider of metal and ceramic additive manufacturing technologies and solutions. Founded in 2005, XJet has developed and introduced the revolutionary NanoParticle Jetting™ (NPJ) technology. With a decade of research behind it, the NPJ technology enables the production of metal or ceramic parts with the same ease and versatility of inkjet printing without compromising throughput or quality.

Their world-class team of skilled industry veterans and dynamic R&D specialists holds over 75 registered and pending patents. Leveraging their proprietary technology and proven expertise, XJet is redefining the metal and ceramic AM industries.

Team

The company leadership has impressive experience and track record with over 20 years of relevant experience, each. Most have 2-3 prior successful start-ups under their belt – most noticeably the founding and management of Object – that merged with Stratasys in a $3Bn deal.

- **Hanan Gothait - Founder and CEO:** Hanan Gothait is a widely recognized and respected industry expert in the fields of inkjet and 3D printing. An innovative game changer, Hanan co-founded Objet Geometries (later merged with Stratasys), which reinvented the 3D printing space with the introduction of polymer jetting technologies and photopolymer 3D printing systems. Prior to co-founding Objet, he founded Idanit (later merged into HP Scitex), which developed the world's first wide-format printer. Hanan holds a B.Sc. in Mechanical Engineering from the University of Bridgeport.
- **Dror Danai - Chief Business Officer:** Dror Danai brings to XJet a strong track record of over two decades in leading successful business operations at technology-driven companies. As VP Sales & Business Development at Objet (later merged with Stratasys), Dror directed its business operations from a fledgling company to a front-runner in its field. Dror also served as VP Sales & Business Development at Scodix, where he was instrumental in creating a world leader in digital print enhancement. Previously, he was the European Channel Director of Creo-Scitex as well as the Global

Product Manager for the Scitex CTP product line. Dror holds a B.Sc. in Industrial Engineering (summa cum laude) and an MBA (summa cum laude), both from Tel Aviv University.

- **Udi Bloch - COO:** Udi Bloch is an experienced executive with a long history of leading high-tech companies, including more than 20 years in the printing industry. Prior to joining XJet, Udi served as the COO at Scodix, a company in the digital print enhancement arena. Prior to that, he worked at HP Indigo for well over a decade in several positions including Worldwide Service Manager, Mechanical Engineer, Systems Analyst and Business Development.
- **Igal Zeitun - CTO:** Igal Zeitun has over 20 years of experience in leading complex organizations at various global companies, specializing in integrating advanced technologies and customer needs to create innovative and successful services and products. Before joining XJet, he was Senior VP of R&D, as well as VP of Product Marketing and Sales Operations, at Stratasys. Previously, he served as Director of Worldwide Service and Support at HP Scitex, VP of Customer Support and R&D Program Manager at Nur Macroprinters, and held roles in the R&D Division of Objet (later merged with Stratasys). Igal holds a M.Sc. and a B.Sc. in Mechanical Engineering from the Technion – Israel Institute of Technology and completed an Executive Education program at IE Business School.
- **Yaron Hermeche - CFO:** Yaron Hermeche has extensive experience in the high-tech industry, having served in a variety of C-level positions including CFO, COO and CEO. During his work with Scodix and Objet (later merged with Stratasys), Yaron successfully raised funds from some of the world's leading investors and managed business growth from early-stage to high-volume sales in various markets such as the US, Europe, China, India and Japan. Previously, he served as Corporate Treasurer of Machteshim Agan (now Adama). Yaron earned a bachelor's degree in Economics & Accounting from Ben-Gurion University.

Target verticals

XJET aims at serving customers that need industrial high scope/volume Additive Manufacturing of Metals or Ceramics .This includes varied verticals such as Automotive, Industrial, Medical and other large-scale manufacturers.

Products/applications

Leveraging XJet's disruptive NPJ technology, The XJet Carmel line of AM systems enables the production of metal and ceramic parts with unprecedented levels of geometrical complexity, detailing, surface finish and accuracy.

Marketing, deployment and business model

- The long-term revenue model is based on a combination of systems sales and materials (the 'ink') sales. The Inkjet-like technology requires specific and uniquely matched materials that are proprietary and sold only by XJetT.

- A typical system will cost circa 700K$ (and weigh about 3 tons), with projections for volume growing from tens of systems in the early years to hundreds (saturating at about 400 systems, or 250M$) over the years
- The materials (‘ink’) sales will grow exponentially, as the number of systems in use increases and as the volume in each installed system will grow
- After 5 years or so the Materials sales should exceed the systems sales
- XJet has 80 patents either filed or issued, covering all aspects of their proprietary technology
- Initial Sales will be direct, including intimate interaction with every customer
- Ove time, in certain geographies XJet plans to use distributors for indirect sales

3.14 Neural Flow

http://neural-flow.com/

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Status

Founded: 2018 **Employees:** 3

Owned by MGT Industries, a privately-owned company which specializes in the design and manufacture of custom stainless steel reactors, mixing systems, and process solutions.

Received a support grant from the Israel Innovation Authority.

Currently looking for an investment.

Overview

Neural Flow focuses on serving the process industry manufacturing, providing process optimization, increased production yield, and improvement in operational efficiency by bringing together Artificial Intelligence and Process Engineering.

Neural Flow solves the core challenge of the process industry, by combining Process Engineering with Artificial Intelligence (AI) tools, to achieve process optimization. At Neural Flow they strive to provide beneficial insights to the process industry. They offer prediction of the manufacturing process target parameters by analyzing control parameters, deriving correlations between process parameters, and developing a mathematical model of the process. From this data, Neural Flow identifies process anomalies and detects process drifts and hidden patterns providing conclusions and operative suggestions for improvement and optimization, preventing resources & time wastage.

Team

Founder & CEO - Amir Trifman

VP Business Development: Motti Koren

Director of Product: Olesia Solianik

Target verticals

All fields of the process industry, such as chemicals, food & beverages, paint, polymers etc.

Market analysis

While current (competing) market offerings mostly deal with global data analysis without engineering base, Neural Flow takes a different approach than other AI companies, targeting

specific facility in the plant (bottom – up), analyzing and providing recommendations regarding the specific facility. They combine process engineering model with AI predictive model.

Products/applications

Optimization and effectiveness improvement of Manufacturing processes, using Artificial Intelligence. The Neural Flow system enables the prediction of the process behavior and thus provides recommendations for improving the process performance in real-time. Furthermore, the system focuses on specific control points, defines parameters that should be optimized and adapts accordingly.The system identifies process problems, drifts and anomalies and provides recommendations how to overcome them. The findings and recommendations are being displayed in clearly understandable means.

Marketing, deployment and business model

- Neural Flow's business model is Software as a Service (SaaS)
- The company uses provisional patents owned by MGT Industries
- There are undisclosed beta sites in leading global companies
- Start of sales expected at 2019

3.15 Seebo

www.seebo.com

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Status

Founded: 2012 **Employees:** 50

Owned by the founders and investors, with primary investors including Viola (formerly Carmel ventures), TPY and Pritzker (Chicago).

Raised 25M$.

Overview

Seebo provides an Industry 4.0 platform with solutions that minimize downtime and quality issues in process manufacturing production floors, including all machines, sensors and any element that provides data.

During setup time, production process flows are mapped, together with the relevant OT and IT data sources .Once in operation, the Seebo solution monitors all parameters and looks for patterns, deviations, anomalies or indicators that may suggest a current or future problem. It alerts the users early, enabling prevention of the problem ahead of time, thus, eliminating down-time or quality issues.

Team

- **Lior Akavia - Co-Founder & CEO:** A driven entrepreneur focused on integrating the physical and digital worlds to drive meaningful business impact. Prior to Seebo, successfully launched Playfect (acquired), delivering value to investors, employees, and the market. Holds an MBA from Tel Aviv University and a bachelor's degree in Computer Science (earned at age 19).
- **Liran Akavia - Co-Founder, COO:** Liran is an innovator, entrepreneur and sales expert. He is dedicated to assisting businesses in achieving growth through new initiatives. He leads the design and execution of innovative business development programs. Liran began his career as a software developer and the owner a small software development studio. He grew up in Israel and during his international career lived in Australia, China and France.
- **Oren Ezra - VP Marketing:** Business and technology-savvy with international experience in all aspects of B2B SaaS marketing, product management, pre-sales, and professional service. Held leadership positions at start-ups, young IPO up-starts, and well established software giants. Worked for cutting-edge software companies, specializing in enterprise solutions that are SaaS & cloud-based, catering to huge Fortune corporations all the way to Small and mid-size business.

Target verticals

Process manufacturers across industries.

Market analysis

Most manufacturing companies suffer from lengthy down-time and product quality issues in their production lines. The implications on profitability and customer satisfaction are immense. Adequate data collection infrastructure, advanced analytics, real-time monitoring, and professional management may improve both.

Products/applications/Platform

The Seebo Industry 4.0 Platform is comprised of visual tools that enable quick configuration and customization of its business solutions:

- **IoT Modeler -** visualizes the solution blueprint, with the necessary technology layers and data flows, as well as the business use cases to be implemented
- **IoT Simulator -** quickly validates the solution blueprint and enables you to gain stakeholder buy-in
- **Predictive Analytics & Machine Learning -** automatically translates the business use cases to rule-driven alerts, and provides an iterative means to automatically learn from historical data, perform accurate root-cause analysis, and derive actionable insights
- **Digital Twin dashboards -** visualizes the KPIs, alerts, and reports in the context of your production lines, enabling you to drilling in and drilling through your sites, machines, and sensors to drive your operations to excellence

Features/Solutions

- **Predictive Maintenance:** the Seebo predictive maintenance solution cuts maintenance costs, eliminates unplanned downtime and extends remaining useful life of key assets
- **Condition Monitoring:** gain deep visibility into asset health and actionable insights - to improve overall equipment effectiveness (OEE), reduce time to repair (TTR), and minimize cost to repair (COR)
- **Predictive Quality:** Anticipate production quality issues before they happen – get automated suggestions for root cause of issues and increase first pass yield
- **Digital Twin:** Quickly uncover and resolve process and asset issues in your plant by using intuitive digital twin analytics and dashboards

Marketing, deployment and business model

- Seebo has a working product since 2015
- Seebo has over 30 paying customers, including Nestle, Procter & Gamble, Grundfos, and Ralph Lauren
- While so far the company has applied direct sales, it is currently accelerating its go-to-market through its strategic alliance with Microsoft, where Microsoft sales persons get Seebo commission on a sale
- Current market focus is on Western Europe and North America.

3.16 Pzartech

https://www.google.com/

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Status

Founded: 2015 **Employees:** 4

Owned primarily by the founders.

Currently looking to raise 1M Euro investment.

Received a 80k Euro grant from the European Union.

Overview

Pzartech develops visual recognition technologies that enables user of complex mechanical equipment to quickly identify parts using image processing and deep learning.

The company aims to enable maintenance operators to receive info regarding the mechanical parts they are working on using cameras from smartphones and tablets.

Team

- **Jeremie Brabet-Adonajlo - Founder & CEO:**
  - Business Development Manager at Intlock throughout 2014
  - Independent business consultant from 2011 until 2014
  - Business Development Manager for Europe at IMM star 2008 – 2009
  - Education:
    - Tel Aviv University - Master in Business Administration (MBA) - 2011
    - Université Panthéon Assas (Paris II) - Bachelor in Law, Graduation in 2007

The other team members are primarily Technical: Data scientists and/or SW developers.

Target verticals

Aircraft maintenance service, engine manufacturers, naval and machine-tooling maintenance.

Market analysis

Identification of part number (PN) and serial number (SN) represent a significant loss time in the process of production and maintenance of complex mechanical systems.

For instance, production or review of aircraft engine require to generate inventories of SN that are time consuming and generate numerous mistakes. Re-assembly of aircraft engines during the maintenance process often requires accessing the documentation through the PN which is not always easy to retrieve.

Products/applications

There are two products: SnapR PN that enable to retrieve the part number through object recognition and Snap SN that enable to read the serial number.

There are 2 fundamental technologies used:

- Object recognition: using computer vision and machine learning, to recognize the part(s) .
- Image treatment: in order to enhance the work of the OCR, a lot of image treatments are being performed.

The combination of both tools – provides the technicians with easy and fast means to identifies the parts of the system being maintained or serviced.

Features

- Two solutions to cover comprehensively the issue of identification:
    1. **SnapR PN (Part Number):** extracts the part number through object recognition
    2. **SnapR SN (Serial Number):** simple and intuitive steps to extract the serial number either through image treatment and optical character recognition (OCR) with no setup required, or semi-automatic data entry providing the technician with an improved image and with the characters recognized by the OCR
- Simple setup: ordinary and affordable hardware for data acquisition and recognition

Marketing, deployment and business model

- The product is in prototype stage, and is deployed in a couple of beta-sites, one of which is at IAI
- The business model is SaaS, where Pzartech provides the service, for monthly fee, to large customers (e.g. GE, Pratt & Whitney, etc. or airlines)
- The product will be sold to companies such as airlines, engine manufacturers etc. for a monthly usage fee (of about several thousand USD)
- The company focuses on direct sales for the near term and considers future distribution through Industrial cloud, (e.g. SAP)
- Initial target markets are in Western Europe, with expansion to Asia next
- Pzartech owns an issued Patent

3.17 Okapi

http://www.okapivision.com/

Contacts:
Iris Tsidon, *Co-Founder & CEO*
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Status

Founded: 2013 **Employees:** 15

Founded and owned the founders and private investors.

Currently looking to raise investment.

Overview

Okapi uses artificial intelligence technology in real time to achieve operational excellence. It learns, simplifies and presents the relevant information in a way that supports decision making and becomes a personalized operational assistant for every user.

Okapi implements the concept of a personalized operational assistant in the enterprise software world. Okapi does this with user-friendly real-time alerts, based on performance metrics, sales targets, and even instantaneous feedback from managers.

Team

- **Iris Tsidon - Co-Founder & CEO:**
  - Prior: VP & BI Division Manager at Ness Technologies, COO in Gilon BI
  - M.Sc. – Technion – IEM – Management
- **Maya Gal - Co-Founder & Chief Revenue Officer:**
  - Prior: VP at Ness Technologies, R&D Manager at Microsoft and KM at Amdocs
  - B.Sc. IEM from TAU
- **Gal Haselkorn - Co-Founder & VP Business Development:**
  - Prior: VP Sales at Screemo, ObserveIT, Radcom and more.

Target verticals

Manufacturing, Property management and Services

Market analysis

Today's companies are inundated with a constant barrage of data, which has the potential to provide them with valuable insight. This time-consuming data analysis emphasizes mostly the financial, letting the all-too-important operational perspectives and company goals fall by the wayside. Employees and their superiors don't have a transparent view of their own results and don't know whether they are aligned with company objectives, much less have access to relevant data. If they can't effectively filter, analyze and leverage the tsunami of data, it's useless to them.

Okapi, using a SaaS-based platform via a mobile app or the web, provides meaningful data-driven recommendations and notifications to help users execute and monitor their own progress in real time.

Products/applications

Okapi uses AI to capture the data required to achieve your goals. The platform connects to organizational data sources via automatic interfaces and predefined packages. Proprietary Artificial Intelligence and Machine learning algorithms alert users to underlying problems and trends in their performance, while Collective Intelligence algorithms gather recommendations for potential solutions from the company's internal knowledge base and external sources.

Features

- Okapi's collection engine is equipped with predefined interfaces that automatically connect to your organization's data. Data is collected at different intervals – from every few seconds to once a day – depending on the subject area
- It has database with more than 4,000 metrics and algorithms that are profiled to different verticals and goals, allowing their setup process to quickly identify the metrics and the supporting data that is most relevant for each organization
- Okapi identified 4 groups of algorithm types that have the strongest effect on Operational Excellence:
  - **Sensitivity analysis:** combining the best practice database with live data from the organization to help recommend the main operational metrics driving the required outcomes
  - **Anomaly detection:** automatically learning the pattern of the data at all levels and finding anomaly behaviors (without the need to set manual rule-based thresholds).
  - **Cause & effect:** providing ongoing root cause analysis for automatic detection of underlying problems.
  - **Predictive engine:** supporting forecasting, preventative actions and effective planning. This can give team leaders a tool to allocate their resources according to predicted work load.
  - **Notification manager:** weighing the different outcomes of the algorithms, and sending personalized notifications to each user, based on his role and settings. This is the most crucial that to make Okapi a real operational assistant.
- It gathers data from IT data residing in operational applications such as ERP, CRM, HR or others and OT data from sensors to notify on real time anomalies. It then combines data from sensors with IT data to gain the most value.
- It may create saving of millions of dollars in the bottom line

Marketing, deployment and business model

- The business model is Software as a Service (SaaS) and includes a set-up period and on-going support
- The company has a working product and 20 active/paying customers
- Current focus is on North America (Canada, California, Georgia) and Israel

3.18 Caja Systems

Contacts:
Guy Glass, *Founder & CEO*
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https://www.cajasystems.com/

Status

Founded: 2014 **Employees:** 30

Privately owned the founders and top angel investors, including Dr. Ilan Cohen (founder of Servotronix), Gigi Levi (leading angel investor), Polygon group (leading robotics company).

Received a $1M grant from the Office of Chief Scientist.

Overview

Caja develops an automation solution for replacing manual labor in existing warehouses with adaptable and scalable robots' array and management software, optimizing inventory management performance in time and costs.

Team

- **Guy Glass - Founder and CEO:** highly experienced in eCommerce as a co-founder and at top management of the largest eCommerce fashion in Israel StyleRiver among others, including leadership roles over development teams, establishment of warehouse and fulfillment centers and more. Holds a B.Tech. in Computer Software Engineering from ORT Braude College.
- **Reuven Della-Torre - co-founder and CTO:** experienced in the Media Content Providers, Telecom, web and Mobile markets as CTO and manager of large software groups. Holds an M.Sc. in Mathematics and Computer Science from the Bar-Ilan University.
- **Avi Lifshitz - Co-Founder and Chief Product:** long-time experienced in leading roles at one of Israel's largest Inland supply chain companies, among other positions. Holds a degree in Industrial Engineering from Shenkar College of Engineering and Design.
- **Michael Cahn – VP Business Development:** Former investor with expertise in strategy, business development, global sales and growth.

The company employs dedicated teams for robotics, algorithms and operation.

Target verticals

Third-party logistics (3PL), production lines, facilities with physical item management needs

Market analysis

Robotics is prevalent in the field of logistics for over 30 years now and is largely commoditized. By nature, these automation systems are suited for corporation which are static in terms of size,

SKUs portfolio, sales, etc. And while the potential market is huge, there are no such robotics systems which are fast to install and simple to operate with a short ROI period.

In eCommerce, about 10% of gross sales is expended over order fulfilment; of which, about 80% are in human labor. About 95%of human labor in warehouses is manual.

An interested future business model in this field is RaaS – Robotics as a Service – in which customers don't buy the robots and are billed according to the number of operations the system executes.

Products/applications

Currently the system operates two types of picker robots – a small robot which picks from the first shelfing level (and can also travel bellow the shelfing, giving it more freedom in route planning) and a large picker which can rise and pick from the second shelf level all the way up. All the robotics is developed inhouse, and currently have three (customizable) modules – driving, lifting and gripping. The company plans to add more functionality to accommodate for more automated operations. All the system's heavy-lifting computing is done in the cloud, with robots equipped with cameras and other sensors, bar code scanners and communications.

One of the unique aspects of Caja's warehouse automation solution is the algorithmics it uses to dynamically plan the travel routes of the robots in the warehouse. In most other current solutions, the robots are rather slow, and their future actual locations are unpredictable. Caja developed the concept of 4D navigation, where the system constantly generates a map of the planed locations and speeds of the robots forward in time. This method provides accurate planning and forecasting of the warehouse performance. As an extension to this concept, the system can generate a virtual robot for the purpose of simulating the effects of changes in the robots' array. This allows customers to estimate the expected improvement in throughput with the addition of robots as the scale of activities in the company grows and its needs changes, as well as permitting commitment to customers for guarantied performance gains.

Originally aimed at warehouse, the Caja solution can also cater production line, and is well suited for a wide variety of applications related to inventory and items physical management. It specifically excels in circumstances where an operational flexibility is required.

Another key advantage of the system is it ability to adjust and get immediately deployed and operational over existing infrastructure, with almost no special changes needed other than a placing dedicated plastic shelfs adapters.

Future developments plans include improvements in performance, maintenance requirements, algorithmics, and the addition of robotic arms in some applications.

Features

- 24 hours for installation; 85% less manpower; 40% increase in throughput
- The robots can lift items up to 30kg, compared to manual picking standard limited to 17kg
- While the robots are capable to operate autonomously and have a fail-safe mechanism, they do not communicate directly between one another, and are rather communicating only with the central management software
- The system's management software resides in the cloud (AWS) and uses encrypted communication

- Upon initial setup, the system's management software interfaces with the organization's Warehouse Management System (WMS) within a few weeks on integration
- Unlike batch mode of operation, which is a common approach for warehouse picking processes, Caja Solution operates at a constant real time optimization operating mode
- The system recognizes unpredictable demand spikes and can optimally modify SKUs location within the warehouse accordingly
- Caja can "squeeze" a manual warehouse due to it doubling in shelfing height, reaching 3.5 meters as opposed to 1.8 meters for manual warehouse shelfing; such densification decreases the number of robots required as well as warehouse footprint per items

Marketing, deployment and business model

- The company holds one approved patent for the concept and 4 other pending patents for other aspect of its technology and solution
- Caja has a partnership with top distributors in Europe and Asia.
- The business model is based both on sales of systems and servicing fees
- Distribution in the USA is done directly, and in the rest of the world via partners and local/regional distributors
- Manufacturing of the robots is planned to remain in Israel

3.19 PV Nano Cell

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http://www.pvnanocell.com/

Status

Founded: 2009 **Employees:** 17

Owned mostly by investors, as well as traded over-the-counter in OTCQB.

Valuated at circa. $12M.

Received several grant from the Office of Chief Scientist (MAGNET) and European programs.

Overview

PV Nano Cell developed state-of-the-art conductive inks that meet and exceed the demands of printed mass production electronics digital printing applications for customers worldwide, enabling new electronics (flexible, customized, thinner, lighter, new designs…).

Team

- **Dr. Fernando de la Vega - CEO and Chairman (Founder):** Fernando de la Vega holds a PhD in applied chemistry (Casali Institute, The Hebrew University). Fernando has a strong technical and management background with more than 20 years experience in the industry, performing different successful tasks (R&D management, QA, VP operations and General Manager at Chemada, Tosaf and Cima NanoTech). He is a Co-inventor in more than 11 patent families (nano materials and technologies, alternative energy), author and co-author of many papers and publications, including a book chapter in conductive inks for ink jet printing, made numerous presentations at worldwide conferences. He has performed consultant work in the fields of DOE, SPC and technology management. He is the Co-founder of Nano Polymer, Co-founder and served as Chairman of the NFM consortium (generic research in the nano field in the framework of the Magnet program, OCS, a five year, $25 M project), and Co-founded three R&D consortiums in the EC framework.
- **Eyal Shpilberg - COO:** Eyal Shpilberg has over 30 years industrial experience, CEO of technology based companies and Corporate Vice President Consumables Division, of Creo Ltd. (Israel and Canada). Experience marketing & business development executive, defining and executing vision and business strategy. Expert in leading business development processes, marketing and sales in global markets, leading business negotiation processes though conclusion of transactions. Experience in team building, recruiting professional staff members and driving teams towards goals, setting protocols and work processes. Extensive technical multi-disciplinary background - physics, software, hardware, materials, biology, chemistry, diagnostics. B.Sc. in Mechanical Engineering, Dean's Honors List and BA in Computer Science, Dean's Honors List from The Technion Institute of Technology.

- **Evyatar Cohen - CFO:** B.A. in Business Management (2000) and was awarded his Master of Law degree from Bar-Ilan university (2003). Evyatar also worked in the PwC New York branch for five years as an audit manager. Evyatar is a licensed certified public accountant in both the US and in Israel and a member of the AICPA and the Institute of Certified Public Accountants in the US and Israel respectively.

Target verticals

Market analysis

Digital Printing	Sicrys inks	Complete Solution Approach
Quick setup, start and stop	Low sintering temperatures	From design to production through prototypes
Easy and quick design changes	Enhanced electrical properties	Same technology same material through the whole process
No need for masks	Environmental resistance	Printers for high throughput available
Customized printing (each part different)	Wide range of substrates compatible (including temperature sensitive and flexible substrates)	Printers for flat, 2.5D and 3D printing available
Fewer steps (printing & sintering)	Narrow patterns, down to 70 µm	High accuracy and registration
Low manpower requirements	Small pitch, down to 70 µm	Low capex
Clean technology	Good adhesion	Equipment, process and inks integrated into customer process and application needs
Can print on rough and step surfaces	Soldering compatible	Flexible processes
Thin patterns feasible (> 0.5 µm thick)	Enable: customized, flexible, thinner, denser and lighter electronics	First Integrated Printer for design, prototyping and small volume printing
Thin and thick patterns in same layer in one printing step	Best cost efficient	Ten inks printing, high accuracy and fast
Different product designs can be produced in parallel	Silver and Copper available	All in one tool – printing, drying, sintering…
Replaces: LDS, etching and screen-printing technologies	Silver and copper inks available	Favorable business models available

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Products/applications

- **Sicrys™ -** The Sicrys inks are based on an innovative technology that enables additive manufacturing processes through digital printing in mass production applications. The inks' unique qualities ensure optimal performance while reducing manufacturing costs and environmental impact.

  Nanometric Copper Solution - The copper Sicrys conductive inks are unique copper-based nanometric solutions that utilize copper metal rather than precursors like copper oxide to provide a stable low cost ink. Sicrys copper inks are competitive with high metal content (50%) and increased stability, both physically and chemically.

Features

- Low viscosity at 50% and higher metal loading
- Proven narrow pattern printing
- Low resistivity: < 2.5 x ρ bulk
- Low contact resistance
- Low sintering temperature
- Excellent physical/chemical stability – over 1 year
- Excellent printability compatible with high throughput printing and high frequency jetting

Marketing, deployment and business model

- The company has several patents granted and/or pending
- The company has started commercial sales.

4. תובנות והמלצות מסקר חברות המציעות פתרונות ליצור מתקדם

◄ כללי

סוננו ונסקרו 20 חברות המפתחות פתרונות טכנולוגיים חדשניים ליצור מתקדם, בחלוקה הבאה:

7 חברות המציעות טכנולוגיות לניהול מתקדם (בעיקר דיגיטאלי) של תהליכים במפעל

5 חברות ליצור בהוספה, הדפסות תלת ממד והדפסות מוליכים

5 חברות בתחומי האוטומציה ו-IIoT

3 חברות לתחזוקה חזויה ומתקדמת

מצאנו מכנה המשותף לחברות היותר מוצלחות שהגיעו למכירות של פתרונות בזמן קצר יחסית:

1. חברות שהוקמו ע"י יזמים שעבדו בתעשייה יצרנית וזיהו פערים טכנולוגיים, והם הקימו חברות במטרה לפתור חסמים אלה. כלומר המוטיבציה הייתה מערכתית ממוקדת ולא דחיפת טכנולוגיה חדשנית כשלעצמה.
2. חברות שהוקמו תחת חסות של חברות בוגרות שנתנו להן מתחילת דרכן ידע התחלתי בטכנולוגיה שנבחרה, תקצוב, ליווי במימוש בחינת הפתרונות. בעלי החברות הבוגרות היו בהרבה מקרים יזמים בעצמם ולכן נתנו גם הכוונה מניסיונם בניהול חברת הינוקא

ניתנת להלן רשימת תובנות שעלו מהמפגשים ומהביקורים בחברות . בחלק מהמקרים מוצעות המלצות לשימוש בתובנות לפיתוח פתרונות ליצור מתקדם בישראל.

◄ תובנות

1. חברות פתרונות נוטות להדגיש את ההיבטים הטכנולוגיים בפתרונות, ואילו המפעלים התעשייתיים מתקשרים בשפה של תהליכים ותועלות תעשייתיות. כמובן שזה גם קשור לרקע של היזמים.
3. חברות תעשייתיות גדולות, המחפשות פתרונות נקודתיים, מתקשות להבין את התועלות של הפתרונות הטכנולוגיים החדשניים המוצעים, כי זה מחוץ לתחומי התמחות שלהן.
4. משך המכירה בתחום זה הוא ארוך יחסית. החברות צריכות לפתח "נשימה ארוכה" מבחינת משאבים.
5. החברות התעשייתיות היצרניות הן בדרך כלל עם מוכנות נמוכה לחדשנות טכנולוגית. נכון לפתח בחברות התעשייתיות היצרניות ידע בתחומים טכנולוגיים רלוונטיים וחדשניים.
6. תחום התחזוקה החזויה הוא פופולארי ויש בו מספר חברות פתרונות עם עקרונות מדעיים - טכנולוגיים שונים המתאימים למשפחות ציוד שונות. נכון בתחום זה לתפור את הפתרון המתאים ביותר לציוד המופעל שדורש תחזוקה חזויה.
7. שותף אסטרטגי בדמות ספק חומרה או אינטגרטור של פתרונות לא תמיד מתאים למכירת תוכנה.
8. הטכנולוגיה החדשנית המוצעת על ידי ספק הפתרונות היא זו שגורמת "לפתיחת הדלתות", אבל תמיכה כספית מצד גורמי הממשלה וסיוע מחקרי מצד האקדמיה יכולים לסייע למכירת ויישום הפתרון.
9. החדירה השיווקית לתוך חברות היא לרוב דרך אנשי המקצוע הרלוונטיים כמו מנהלי מערכות מידע, מנהלי ייצור ותפעול, מנהלי תחזוקה.
10. הפניה לרשות לחדשנות לקבלת תמיכה במו"פ כרוכה בלא מעט ביורוקרטיה, ולכן לפעמים אינה משתלמת.
11. השימוש בפתרונות טכנולוגיים חדשניים ומתקדמים יכול למנוע סגירת מפעלים יצרניים שמרניים.

12. כרגע יש התעניינות גדולה בחברות סביב AI, IIoT תעשייתי ונושאים אלה גם מביאים משלחות רבות מחו"ל. התחומים האלו מובלים היום על ידי האקדמיה, חברות ייעוץ וחברות השקעה. נכון לגבש צעדים פרואקטיביים לפיתוח נושאים אלו בישראל, כדי לנצל את ההתעניינות.

13. פיתוח הפתרונות בישראל הוא קל יותר, עקב הדיאלוג הפשוט עם המפעלים והפתיחות בדרך כלל בשוק הישראלי. נכון לנצל מצב זה ליצירת תנאים המקדמים יישומי חלוץ במפעלים בארץ, ועל ידי כך נוצרת תרומה כפולה, WIN- WIN, הן לחברות הפתרונות והן לתעשייה היצרנית. כך שלתעשייה המקומית יש חשיבות גדולה לפיתוח היכולות, גם אם השוק המקומי אינו גדול.

14. הפתרונות המערכתיים של INDUSTRY 4.0 מכוונים למפעלים מורכבים מבחינה תפעולית, ונדרשת גישה מערכתית ליישומם בצורה ראויה ואפקטיבית.

15. סטרטאפים שהם תולדה של חברת אם גדולה, יכולים להשתמש במוניטין ובקשרים של חברת האם לקידום עסקיה אצל לקוחות פוטנציאליים.

◄ המלצות

1. חשוב לכלול בתהליך בעלי ניסיון תעשייתי שיכולים לגשר על הפער התקשורתי והשיווקי הזה. וכמו כן, להדריך את חברות הפתרונות כיצד 'לדבר בשפת הלקוחות' – בכדי להצליח בשיווק הרחב בעולם.

2. נחוצה זירת מידע על החברות עם פתרונות, בה יוכלו המפעלים התעשייתיים לאתר פתרונות מתאימים לצרכים ולפערים שלהם. (לשקול להקים אתר שמרכז את הידע/פתרונות וגם מנתב שאילתות/התעניינות אל הספקים הרלוונטיים – אולי תחת כנפי המכון ליצור מתקדם" שאמור לקום). נשמח לעזור בקידום נושא זה.

3. כדי לחדור חדירה ראשונית לחברות תעשייתיות נכון להימנע מהצורך בשינוי מהותי בתהליכי העבודה בחברה. אבל יש, עם הזמן, לשכנע שחדשנות "משבשת" מחייבת שינוי בתפישה ובתהליכים.

4. יצוא פתרונות לחו"ל מהווה אתגר לחברות פתרונות שחלקן אינן בעלות כישורי יצוא. נכון להקנות כישורים אלו בצורה מובנית ולתת תמיכה לתהליכים אלה.

5. חברות תעשייתיות גדולות מתקשות לסמוך על חברות פתרונות קטנות. לכן, כנראה, נכון שחברות הפתרונות תתחברנה לאינטגרטור או מפיץ גדול וברמה ממשלתית מומלץ ליצור לכך מוטיבציה.

5. נספח - שאלון מנחה לסקירת חברות

◀ תיאור החברה

- שנת הקמה
- מספר עובדים
- בעלות
- גיוסים והשקעה מבוקשת
- האם נעשה שימוש בכלי תמיכה ממשלתיים / בינלאומיים
- רקע יזמים
- מידת ההיכרות עם המגזר התעשייתי
- שלב בשלות החברה
- מודל עסקי

◀ פתרונות / מוצרים

- מהות ה-IP ומקורו
- מידת החדשנות ביחס למצב הקיים (בתעשייה) וביחס לפתרונות מתחרים
- האם הפתרון הוא גנרי או ייעודי לאפליקציה או צורך ספציפי
- קישוריות, מוגנות לסייבר
- בשלות מסחרית
- תכניות להמשך הפיתוח הטכנולוגי

◀ תכנית ויעדים לצמיחה

- מכירות
- לקוחות
- ערוצי שיווק / הפצה
- הפצה ו/או מכירה ישירה, או אינטגרציה עם מוצר/פתרון רחב יותר
- שת"פ עם שחקנים אסטרטגיים / רצון לחבור לחברות גדולות
- אתרי בטא
- שווקים גיאוגרפים
- סגמנטים רלוונטיים
- סוג פערי הידע – רמת החדשנות הטכנולוגית ומסחרית הנדרשת ושלה החברה צריכה לתת מענה (ידע קיים כן/לא, שוק קיים כן/לא וכו')
- ניסיון / רצון לעשות שימוש בערוצי סיוע ממשלתיים (לדוגמא נספחים)
- אסטרטגיית צמיחה ו/או יציאה
- כוחות מניעים – שוק, משקיעים
- חסמים והדרך להסרתם

תעשייה וחדשנות

מוסד שמואל נאמן
למחקר מדיניות לאומית

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