STRATEGIC MARKETING ASSESSMENT FINAL REPORT

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I.   Executive Summary:

A. Background: Here are some potential problems in big retail stores like Walmart, Target, and Publix:

1. Inefficiencies in picking up orders: Order picking for online purchases or ready-to-pickup items at a large retail store can be time-consuming and inefficient for human workers, resulting in delays and errors in fulfillment.

2. **Management of Stocks:** Overstocking and understocking are two issues that can result from improper stock management. A store may experience financial losses because of unsold inventory if it overstocks. Understocking can result in unhappy customers and money loss from lost sales opportunities. Furthermore, as retail stores grow and expand, it becomes increasingly difficult to effectively manage inventory levels. This can lead to things being misplaced or lost, which can lead to additional supply management issues.

3. **Labor Costs:** Employees are supposed to manually restock shelves, pick, and pack orders for online deliveries and ready-to-pick-up orders. This process is time-consuming and will require many employees for a large number of stores, especially during peak hours.

B. Opportunity: 1. Using RFID-enabled robotic trolleys can also open up new possibilities including better supply chain management, more accurate inventory tracking, and greater data analytics.

2. Retailers may have real-time visibility into their stock levels and make knowledgeable decisions about restocking and order fulfillment by correctly tracking inventory with RFID technology. This may result in fewer out-of-stock circumstances, which may enhance client happiness and boost revenue.

3. In order to make sure that goods are delivered on time and in the proper location, RFID technology can also be used to monitor and optimize the supply chain, from the manufacturer to the store. Cost reductions and increased effectiveness may result from this.

C. Product/Service: The solution to the above problem can be explained below:

1. Increased efficiency in order fulfillment: RFID-enabled robotic trolleys can detect and pick up the products on a customer's shopping list with great speed and accuracy, cutting down on the time needed to complete an order. By Making shopping quicker and more effective can increase customer happiness.

2. Reduced labor costs: Using robotic trolleys can help retailers save money by reducing the requirement for human labor throughout the order fulfillment process. This can increase revenue and allow companies to provide customers with competitive pricing.

3. Improved Management of Inventory: RFID tags on products may be used to track product movement in and out of stores, RFID technology can help merchants better manage their inventory levels. Retailers can quickly and precisely locate products and make sure they are on the right shelf by employing robotic trolleys equipped with RFID technology.

4. Enhanced customer experience: By offering a quicker and more effective service, RFID-enabled robotic trolleys can help customers' overall shopping experiences. Customers don't have to spend as much time

looking for things in the store because they can quickly and conveniently place their orders online and pick them up in-store using the robotic trolley.

D. Market: The market may be significantly affected if large retail outlets use RFID-enabled robotic trolleys on a large scale. Order fulfillment and stock management could be revolutionized by this technology, which would increase productivity, lower labor costs, and enhance client experiences.

E. Situational Analysis:

What are the Overall Opportunities/Threats in the industry?
Opportunities:
  A. Retailers can track inventory in real-time and be able to make sure that all the products are properly stocked and ready for customers to purchase.
  B. Usage of trolleys can decrease the time to locate and pick up the items for online delivery or ready-to-pick-up orders.
Threats:
  A. Potential displacement of as can be the threat as more than half of the tasks would become automated.
  B. This application can be costly to implement, and it can become a barrier to the smaller retailers out there.

What are the overall Strengths/Weaknesses of your solution?
Strengths:
A. Enhanced Customer Experience
B. Reduction in Errors in Order Fulfillment

Weaknesses:
A. Security Concerns for storing Customer Data
B. Technical malfunctions or errors can be possible.

F. **Conclusions and Recommendations:** Commercialization value for this solution is high as the use of robotics is a global trend and a joint venture with companies like GreyOrange which specializes in robotics for warehouse management and logistics will give retail markets a competitive edge in the industry.

Detailed Report

II.   **Inventor Overview**:

A. **Dr. Patrick Fink (Ph.D., M.S, B.S):** Dr. Fink received both a Bachelor of Science degree (with highest honors) and a Master of Science degree in electrical engineering from the University of Texas in Austin. He also earned a Ph.D. in the discipline of computational electromagnetics from the University of Houston. He has worked for NASA for more than 20 years, where he is currently the chief technologist for the Wireless and Communication Systems Branch.

   Expertise: Dr. Patrick Fink has conducted much different research on the application of RFID and its technologies. He wrote many papers on the same and has presented them to many different conferences. Dr. Fink leads technology efforts in several areas, but he is probably most well-known for his work in radiofrequency identification (RFID) systems, which he is applying to NASA's efforts in autonomous logistics management (ALM). ALM can be summarized as the capability to know the location of all items, the health and status of the items, and the availability of spares.

B. **Andrew W. Chu:** Andrew W. Chu was born in Hong Kong in 1963. He received his B.S. and M.S. degrees in electrical engineering from the University of Houston, Houston, TX, in 1987 and 1989, respectively. He has been an Engineer in the Electromagnetic Systems Branch of the Avionic Systems Division at the Johnson Space Center, National Aeronautics and Space Administration (NASA), Houston, TX, since 1989. His interests include microstrip antennas, e-textiles, and RFID.

   Expertise: After completing his education, Chu started working as a Senior Electrical Engineer at the NASA Johnson Space Center in Houston, Texas, for more than 16 years. At NASA, Chu worked on a number of RFID-related projects and played a key role in the creation of RFID-based systems for asset and inventory management as well as for tracking supplies and equipment during space missions. He has also published many technical publications in prestigious scientific journals. For his contributions to the field of RFID, he has won a number of honors and medals, including the NASA Exceptional Achievement Medal and the RFID Journal Award for Special Achievement.

C. **Greg Lin**, **B.S**: Greg Lin graduated from the University of Houston in 2001 with a bachelor's degree in electrical engineering. Lin works for NASA's Johnson Space Center's Engineering Directorate in the Wireless and Communication Systems Branch of the Avionic Systems Division. As the Antenna Test Facility manager, he is involved in hardware design as well as in development and testing, and he has contributed to six U.S. patents.

III.   **Technology Opportunity:**

1. Robotic Trolleys Using RFID for Online Delivery and Ready to Pick up Orders in the Retail Industry is a technology solution that uses autonomous robots equipped with Radio Frequency Identification (RFID) technology to increase the efficiency and accuracy of order fulfillment in retail businesses.

2. The robotic trolleys are programmed to navigate through different store aisles and pick up merchandise based on the customer's online or ready-to-pickup order. Each product is RFID-tagged, allowing the robotic trolley to readily recognize and pick up the object.

3. The robotic trolley scans the RFID tags of the merchandise it picks up as it goes across the store,

updating the inventory management system (Central Management System) in real-time. This reduces the possibility of overstocking or understocking and aids in maintaining appropriate stock levels.

4. Because fewer people are needed to manage the inventory and fill orders, using robotic trolleys equipped with RFID technology can also help cut labor costs. Additionally, by offering a quicker and more effective order fulfillment process, it can enhance the customer experience.

   Overall, this technological solution can help in streamlining order fulfillment procedures in retail establishments, enhances inventory control, and improving customer satisfaction.

IV. **Product/Service:** These trolleys have RFID readers that can read the tags on the store's merchandise using RFID technology. The trolleys can pick up the right items and put them in the trolley thanks to the RFID scanners' ability to identify the products and trace their travel. Even in dynamic and changing situations like a retail store, the robotic trolleys can detect barriers and avoid collisions by employing LIDAR scanners. LIDAR scanners can also be used for localization, which enables the robot to precisely travel to the target area by enabling it to establish its position and orientation within the store.
After collecting all of the products for an order, the trolley can carry them to a specified area for packaging or directly to a customer's vehicle for curb side pickup. RFID technology enables effective inventory tracking and also helps in the prevention of theft and misplacement of items.

V. **Situational Analysis:**

A. **Macro-Environment Influences:**

1. RFID-enabled robotic trolleys can have a significant impact on customer purchasing behavior. Because the system is dependent on accurate inventory and customer orders, any changes in customer purchasing habits can affect the demand for specific products as well as the accuracy of the inventory system.

2. RFID-enabled trolleys can also be used to solve seasonal consumer difficulties. During peak shopping seasons, such as the holidays, shops can use these carts to quickly resupply popular items. This can assist customers identify what they need and may result in greater sales for the firm.

3. RFID technology may cause regulatory difficulties in some countries, as privacy concerns have been raised over the acquisition and use of personal data. To prevent any legal concerns, retailers may need to comply with different restrictions linked to the usage of RFID technology.

4. Domestic and international risks and challenges may arise while implementing RFID technology. For example, RFID may not be compatible with different types of products and packaging, or with different store layouts and designs. Furthermore, logistical challenges associated with the deployment and maintenance of these trolleys, such as transportation, battery life, and repair costs, may exist.

B. **Industrial Competitors:** There can be several industrial competitors for RFID-enabled trolleys. Some of the companies which already have expertise in warehouse automation or robotics can be great competitors for this application. For Instance, Companies like GreyOrange, Swisslog, and Amazon Robotics. These companies have a strong foundation for providing innovative and advanced automation solutions to the industry.

   I'd consider GreyOrange a great competitor in this case, GreyOrange's robotic solutions, such as their

Butler and Sorter systems, are intended to assist organizations in optimizing and increasing the productivity of their warehouse operations. They also provide a variety of software solutions, such as their GreyMatter platform, which provides real-time data analytics and insights to assist businesses in making data-driven decisions.

Furthermore, GreyOrange has formed alliances with major players in the logistics and retail industries, including DHL and Flipkart, giving them a strong market presence, and increasing their credibility as a dependable and effective automation provider.

C. **Issue Analysis:** Talking about current products, there are already some technologies in the market that are trying to solve the same problems in the retail market like stock management or labor costs. Additionally, Big Retail Companies like Walmart and Target would definitely have to pass through the regulatory approval hurdles and be able to prove that their technologies meet all relevant regulations and standards.

Also, Companies will have to spend a lot of money on production, marketing, and research & development in order to bring new technology to market. To commercialize and launch the RFID-enabled robotic trolley technology, a large investment may be needed.

Retailers may be cautious to adopt new technology if there are any significant changes to their present processes and systems. RFID-enabled robotic trolley technology must be simple to incorporate into existing systems and procedures, as well as give tangible benefits to shops and customers.

VI. **SWOT Analysis**: The Whole SWOT Analysis by taking technology, products, industry, and macro-environments into account is as below:

Strength: 1. This technology has the potential to boost efficiency and save labor costs.
2. Improved inventory management through real-time product tracking and monitoring.
3. Improved customer experience as a result of faster order processing and shorter wait times for online delivery and ready-to-pickup orders.
4. Increased security measures have the potential to prevent product losses and thefts.
5. Possibility of gaining a competitive advantage in the retail industry.

Weaknesses: 1. This technology requires a significant initial investment to develop and implement.
2. Count on dependable RFID technology and network connectivity.
3. Adaptability to different store layouts and infrastructure is limited.
4. Employees who see the technology as a threat to their job security may be resistant.
5. There is a risk of technological problems and malfunctions causing service disruptions.

Opportunities: 1. In the retail industry, there is a growing desire for automation and digital transformation.
2. Possibility of expanding into new industries such as healthcare and manufacturing.
3. Possibility of working with different retailers in different sectors and other businesses to further develop and improve the technology.
4. Possibility of leveraging data insights and analytics for better business decision-making.

Threats: 1. Potential regulatory obstacles and legal difficulties concerning data privacy and security.
2. Established players in the robotics and automation industry will compete.
3. Product obsolescence is caused by rapid technical improvements and changes in consumer tastes.

4. Cybersecurity threats and breaches provide a risk of data leaks and system outages.

VII. **Options for Technology Licensing/Commercialization:** After successfully filling out the SMA tool, I came to the following conclusion:

1. Licensing with current companies: One approach is to license the technology to current retail organizations with the resources and infrastructure to integrate the technology into their present operations. This would give a faster path to market while also leveraging these companies' existing distribution systems.

2. Joint Venture: Joint venture licensing can be a viable alternative for commercializing RFID-enabled robotic trolleys in the retail business. It can provide access to additional resources and knowledge, assist in risk mitigation, and allow entry into new markets. Additionally, a Joint venture allows for the sharing of manufacturing facilities, R&D skills, and marketing resources. This can help to decrease costs and shorten the time to market.

VIII. **Conclusions And Recommendations:** According to the research and getting the scores from the SMA tool, using RFID-enabled robotic trolleys for online delivery and ready-to-pickup orders in the retail business has various advantages, including improved stock management, lower labor costs, improved customer experience, and increased sales. The technology may also bring new revenue sources and a competitive advantage in the market. However, there are some difficulties and risks to consider, such as regulatory issues, high initial investment costs, and competition from existing competitors. There are many different ways to commercialize this technology, including joint venture licensing, and direct commercialization. A joint venture would be the best option to commercialize this technology in the market as it can benefit from risk and expense sharing while combining skills and resources.

In a nutshell, while deploying RFID-enabled robotic trolleys in the retail business has enormous potential benefits, it also necessitates careful assessment of the obstacles and hazards associated. A planned strategy to commercialization, such as joint venture licensing or technology licensing, can assist reduce risks and boost success possibilities.

IX. **Implementation Program:** In my understanding, what would be the critical steps for an organization to commercialize the technology are as below:

Month 1-6:

1. Research the market in a deep manner to find possible clients and partners.
2. Create a prototype using RFID and LIDAR Technology to make sure it is worth going ahead.
3. Submit applications for patents and trademarks.
4. Acquire and finalize financial sources for the development of technology and commercialization.

Month 7-12:

1. Rigorously Quality testing of the prototype should be done.
2. Start making relationships with industry leaders for retail markets.
3. Start brainstorming about the marketing and sales strategies.

Month 13-18:

1. Extra testing and evaluation should be done with early adopters.
2. Verify the product with the intended market.
3. Prepare for manufacturing and production.

Month 19-24:
1. Launch and commercialize the technology in the targeted retail markets.
2. Keep on Increasing the distribution at different organizations while scaling up production.
3. Seriously Consider the feedback from customers when changing sales and marketing strategies.
4. Make future plans for the technology's ongoing development and advancement.

X.   **References:**

1. Trolley tracking with RFID technology. Trolley Tracking With RFID Technology | RFiD Discovery. (n.d.). Retrieved May 3, 2023, from https://www.rfiddiscovery.com/en/solutions/trolley-tracking-rfid-technology

2. Person. (2022, July 28). Smart Robots, Rain Rfid, and the future of retail happening now. Smart Robots, RAIN RFID, and the Future of Retail Happening Now. Retrieved May 3, 2023, from https://www.impinj.com/library/blog/smart-robots-impinj-and-the-future-of-retail

3. Journals, G. (2019, January 1). Modeling of future automatic trolley system based on sensors and image processing guidance for supermarket. GRD Journals. Retrieved May 3, 2023, from https://www.academia.edu/39755540/Modelling_of_Future_Automatic_Trolley_System_based_on_Sensors_and_Image_Processing_Guidance_for_Supermarket

4. Amazon Robotic Service (ARS) - Portland State University. (n.d.). Retrieved May 3, 2023, from https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=3309&context=etm_studentprojects

Strategic Market Assessments for New Technologies

PART 1. Technology Assessment Forms

Please complete the following information regarding principal inventors' or investigators' (PI) research activities. Additional support information should be attached as requested or required.

Title of the Technology Being Assessed (i.e., Focal Technology):
Smart Enclosure Using RFID for Inventory Tracking

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==== Section A. PI and Their Research/Intentions ====

1. Principal Inventors or Investigators (PI):

Note: This is to know who are the main persons that created the technology. Later you will review these PI's backgrounds in order to identify their strength and weakness. Why do we want to know that much about inventors? It would give you a fuller picture about the licensing opportunities beyond this focal technology can tell you. Contact information can be left blanked if not publically available.

Name of the Key Contact: Fink Patrick W
Organization.: NASA
Phone:
E-mail:

Name: Chu Andrew W
Organization.: NASA
Phone:
E-mail:

Name: Lin Gregory Y
Organization.: NASA
Phone:
E-mail:

Name: Kennedy Timothy F
Organization.: NASA
Phone:
E-mail:

2. Lay summary of PI's key _research_ and _inventions_:

Note: This is used to describe the PI's research and invention using easy to understand language. Please avoid using jargons and technical terms.

According to Dr Patrick, the main intelligence behind the invention is the packaging. Different Containers
Has distributed different RFID circuits which are the main part of RFID tags. For Instance, if a person
From medical support Needs to keep a track of pill inventory and who has taken how many of each pill.

2.1 Research: Recent relevant PI's published scientific papers (please attach reprints):

Note: The purpose of collecting this information is to later assess PI's expertise related to the invention being investigated. The more research the PI has done related to the invention, the stronger the expertise.

Titles of articles and authors

1) Title: Detection, Identification, location, and Remote Sensing using SAW RFID sensor Tags
Authors: Richard J Barton, Timothy F Kennedy, Robert M Williams, Patrick W Fink, Phong H Ngo, R Reeve Ingle
2) Title: Extended range passive wireless tag system and method
Authors: Patrick W Fink, Timothy F Kennedy, Gregory Y Lin
3)   Title: NASA RFID Applications
Authors: Patrick Fink, Timothy Kennedy, Anne Powers, Yasser Haridi, Andrew Chu, Greg Lin, Hester Yim, Kent Byerly, Richard Barton, Michael Khayat, George Studor, Robert Brocato, Phong Ngo, GD Arndt, Julia Gross, Chau Phan, David Ni, John Dusl, Kent Dekome

2.2 Invention: PI's patent applications and issued patents (please attach copies of patent front pages):

Note: Please include the patents for the focal technology as well as other patents/patent applications of the PI. The purpose is to analyze how successful the PI's have been in patenting in the past. And second, how much the PI have committed and devoted their efforts to the areas related to focal technology. The more related patents, the more committed the PI seem to be.

Titles of patents, dates of issuance or application, patent numbers, CPCs/IPCs, inventors, assignees, and an indicator of how related each patent or patent application is to the focal technology.

1) Frequency multiplexed radio frequency identification, Aug 10,2021, US 11,088,812 B1, IPC H04L5/08, H01Q1/22, H01Q9/04, H01Q21/08   Fink Patrick W US, Lin Gregory Y US, Kennedy Timothy F US, Ngo Phong H US,
United States of America as represented by Administrator of the National Aeronautics and Space Administration, Washington DC(US), Both inventions are using RFID technology for identifying an object in the first case and signals in another case
2)   Systems and methods for RFID-enabled dispenser, Mar 8, 2013, 9031689 , IPC G07F9/02A47F1/12G06F7/10G06Q10/08, Fink Patrick W US, Lin Gregory Y US, Kennedy Timothy F US, Ngo Phong H US. Byerly Diane US, The United States of America as represented by the Administrator of the National Aeronautics and Space Administration (Washington, DC),
3) Systems, apparatuses and methods for beamforming RFID tags, Mar 7, 2014, 9715609 B1, IPC G06K7/10G06K7/00H01Q1/22H04B7/0408, Fink Patrick W US, Lin Gregory Y US, Kennedy Timothy F US, he United States of America as represented by the Administrator of the National Aeronautics and Space Administration (Washington, DC)

2.3 PI's commercialization activities related to the focal technology:

Note: What we are looking here is whether the PI has engaged in any commercialization related activities related to the focal technology, such as contracted research, licensing, consulting, starting a new company. This helps us understand how serious the PI is about commercializing their IP.

Dr Fink Patrick has applied this knowledge of RFID to NASA's effort in Autonomous Logistics
Management which has the capability to know the location of items, the health and the status of items
And the availability of spares.

2.4 Current status of commercial products developed using the focal technology and closely related technologies:

Overview: RFID-Enabled Autonomous Logistics Management by NASA (REALM)
This Project focuses on automated localization and inventory of all physical assets pertaining to RFID technologies. This technology has potential to decrease the crew time expanded on general inventory
Management and searching for lost items
Examples: Talking about the current status of this project is REALM team is collaborating with AS&T (Advanced system and Technologies) to advance RFID tracking system that will be compatible with REALM-1 Infrastructure.
This collaboration will increase the potential of many potential applications such as robotic navigation aid.

==== Section B. Technological Competition ====

3.1 Potential Competitive Issued Patents (please attach copies of front pages) and Patent Assignees of the Competing Patents

Note: This is used to start analyzing the competitive landscape. Students should look for relevant competing inventions or technologies. What we are looking to determine is if the focal technology is within a fierce competitive landscape. While competition signals legitimacy of the domain, it often hurt the commercial potential of the invention. Thus, it is important to know what are competing technologies and who are the organizations generating these technologies. Patent universe provides a good starting point for looking for these competing technologies.

Titles of competing patents, dates of issuance or application, patent numbers, CPCs/IPCs, inventors, and the names of the patent assignees.

1) Title: System and method for combined electronic inventory data and access control Dates of issuance : Nov 16, 2021, Patent Number: 11176765, IPC:G07C9/00G06K17/00G06K19/07G06K19/077G06Q10/08G07C9/20H04L29/08 Inventors : Mlynarczyk Mitchell S US, Kaczmarz Kenneth A US, Mavromatis Jesse US, Jensen Mike US, Grenader Arkady, Assignee: CompX International Inc.
2) Title: Smart instrument tray RFID reader Date of Issuance: Apr 22, 2008, Patent Number: 7362228, IPC: G08B13/14, Inventors: Nycz Jeffrey H , Tethrake Steven M, Assignee: Warsaw Orthepedic, Inc.
3) Title: Rfid Tag Integrated Into An Enclosure Surface Door Date of Issuance: Oct 25, 2011, Patent Number : 2013/0099004, IPC: G06K19/077, Assignee: International Business Machines Corporation, Inventors: Alo Roland K US, Cox Aaron R US, Gotelaere Joel A US, Koschmeder, Max J C US, Lubahn Kenneth E US, Macpherson Michael J US
4) Title: Self-Locking Door and Product Dispensing Enclosure Having a Self-Locking Door Date of Issuance: Aug 9, 2018, Patent Number: 2018/0223565, IPC:E05B47/00E05C19/02G06Q20/18G06Q20/32G07C9/00G07F7/08G07F7/10G07F9/02G07F9/10G07F11/00G07F11/02G07F17/12, Assignee: Life Technologies Corporation Inventor: Carr Thomas US, Spinks Karen US, Thierry Darren US, Willmon Matt US, Curry Justin US, Kascoutas Alex US

5) Title: Movable Rfid Reading Device
Date of Issuance: Nov 29, 2007, Patent Number : 2007/136353
IPC: G06K7/00G01V15/00G06K19/00, Inventor: Oh Cheng Guan Michael

3.2 Top competing inventors and organizations:

Note: This is to narrow down to the top inventors or organizations (universities, government labs, or companies) that are developing technologies similar to the focal technology. They may be those with the most research productivity or R&D resources. Then you can investigate these competing inventors' research and inventions so that you can answer 3.3 below.

Organization Name: CompX International Inc
Key Investigators: Mlynarczyk Mitchell S US,
Kaczmarz Kenneth A US, Mavromatis Jesse US, Jensen
Mike US, Grenader Arkady
Contact Info:

Organization Name: Warsaw Orthepedic, Inc
Key Investigators: Nycz Jeffrey H , Tethrake
Steven M
Contact Info:

Organization Name: International Business Machines
Corporation
Key Investigators: Alo Roland K US, Cox Aaron R US,
Gotelaere Joel A US, Koschmeder, Max J C US,
Lubahn Kenneth E US, Macpherson Michael J US
Contact Info:

Organization Name: Life Technologies
Corporation
Key Investigators: Carr Thomas US, Spinks
Karen US, Thierry Darren US, Willmon Matt
US, Curry Justin US, Kascoutas Alex US
Contact Info:

3.3 View of research competition in the field (how do you rank the focal PI against the competing inventors). How does the PI's portfolio of research outputs (identified in 2.1 above) compared to those of competing inventors (identified in 3.2 above) with quantity and quality? Additional comments may be attached.

Note: Focal PI are those listed in section A. Patent/publication quality can be assessed using the number of citations received by a patent/publication. When evaluating publications, you should also use H-index to account for both quantity and quality.

The PI's portfolio is vast in the field of his focal research. As we can check with patents PI has many patent on RFID technology comparing to its opponent mentioned above. If we talk about citation receive PI has more citation than its closest competitor. Also PI patents covers a lot of claims while compared to opponents claim.

==== Section C. Collaboration ====

4 Collaborating investigators in your field of study working within the non-for-profit settings:

Note: Identify if the focal PI has **collaborators** (e.g., co-authors, co-inventors) in the field related to the focal technology. Focus on collaborators who work within non-for-profit or government settings.

Name: Parker Philip E
Dept.:
Organization: IBM
Phone:

Name: Kennedy Timothy
Dept.:
Organization: NASA
Phone:

Name: Ngo Phong H
Dept.:
Organization: NASA

Name: Lin Gregory Y
Dept.:
Organization: NASA

5   Collaborating investigators in your field of study working within the <u>industrial</u> settings:

<u>Note: Like above in 4, but focus on collaborators who work within the industrial or for-profit settings.</u>

Name: Boose Haley C   Name: ByerDiane
Company: NASA   Company:NASA
Phone: Phone:

==== Section D. Funding ===

6   List any funding awards to the PI. Please attach copies of evidence.

<u>Note: This is used to record the quantity of grants and award money that the PI's have received to conduct research and potentially commercialize their IP. More funding means more resources to help PI's research, invention, or commercialization activities. More funding also signals the quality and importance of the PI's work.</u>

All funding (Funding titles, dates received, funding amount, and granting agencies)

1)Was not able to get information from online sources
2)
3)

7   <u>Current</u> status of PI's research support <u>related</u> to the field of study.

<u>Note: This only focuses on the research support that the PI **currently** has and **is related to the field of study**. This information will help you determine if the PI is still actively receiving support for their research. Moreover, the information will help you identify whether the PI are still working on the areas related to the focal technology or have they already spun off to other areas.</u>

Please record: funding source, funding amount, till when the funding will last, what areas of research is being supported.

1)   Was not able to get info from online sources
2)
3)
4)
5)
6)

8   **How much research support do you believe the PI need for the next three years and for what purposes?**
Note: This is an open-ended question that asks you to use critical thinking and come up with a best guestimate based on the information you've collected.

It is essential to integrate this technology with some other technologies in a bigger level. Planning to integrate RFID technology with
Other Autonomous systems such as Robotic Platforms or Artificial Intelligence algorithms it may require different information and
Research that they work together effectively.

PART 2: Technology Assessment Scoring and Decision Matrix

Technology Assessment Scoring

	Very Weak (0)	Strong (5)	Score (Can be any # between 0-5)
Type of Patents for the Focal Technology	Design	Utility	**5**
Age of Patents for the Focal Technology	≥ 5 years	≤ 1 year	**0**
PI Years of Research in the Domain Related to the Focal Technology	<1	>5	**5**
PI Research Strength Related to the Focal Technology	0 scientific publications related to the IP.	≥5 scientific publications related to the IP.	**5**
PI Number of Patent Applications (regardless technology domains)	< 1	> 5	**5**
PI Number of Patents Issued (regardless technology domains)	<1	>5	**5**
PI Research Impact Related for the Work in the Domain Related to the Focal Technology	Citations received by the focal IP and by the publications and patents related to the IP, all together, being less than 1 on average per year.	Citations received by the focal IP and by the publications and patents related to the IP, all together, being more than 100 on average per year.	**1**
PI Funding received for research in the domain related to the focal technology	<$1,000	>$1 Million	**1**
Patent Competition (Number of Competing U.S. Patents)	≥ 25	< 5	0
PI being Active Consultant to Industry or Universities	0 Years	> 5 Years	2
PI Research Experience in Private Sectors, or Experience of Collaborating with Private Sectors	<1 Year	> 5 Years	2
PI Academic Employment Experience, or Experience of Collaborating with Universities	<1 Year	> 5 Years	3
PI Industry/Academic Association Memberships	No	Yes	0
PI Attending International Conferences	Not At all	Annually	2
PI being Invited Technical Speaker in Last 5 Years	No	Yes	0
Number of Collaborating Scientists or Industry Experts for the PI	0	>5	5
Expertise and Status of PI's Collaborators (co-inventors, or co-authors)	No collaborator in the past 5 years has received patent or publication citations, all together, being more than 100 on average per year.	At least five collaborators in the past 5 years have received patent or publication citations, all together, being more than 100 on	**5**

		average per year.	
Number of licensing on PI's Patents Related to the Focal Technology	0	5	5
Number of Post-docs, Student Interns, Pathways Students (formerly known as coops), and Other Research Staff Working for PI's Research.	0	>5	3
Overall Team Competitive Assessment (Refer to "Factors to be considered…" Below)	0	5	**5**
Total Score			**59**

Factors to be Considered in Team Competitive Assessment:

        PI's Academic and Industrial Stature
        PI's Breadth and Depth of Knowledge of Subject/Technology
        PI's Background/Credentials/Focus/"Track Record"
        PI's "Feel" for Competitive "Space"—Science/Technology/Industry/Competition
        PI's Interest in Developing Technology
        PI's Interest in Developing Business
        PI's Business Experience
        PI's "Business Savvy"

[*]PI = Principal Investigator

Decision Matrix

	TECHNOLOGY INDEX SCORE	**ACTION**
VERY WEAK	< 30	ABANDON
WEAK	31 – 55	SEEK EARLY LICENSE
MODERATE	56 – 74	BUILD VALUE OUT-LICENSE JOINT VENTURE
STRONG	75 – 100	VALUE ADDED → LICENSE JOINT VENTURE NEW VENTURE FORMATION

DECISION TREE

Abandon ← **Weak** → **Seek Early License**

Moderate → **Build Value** → **Joint Venture** → **Out-license**

Strong → **Value Added** → **Joint VentureNew** → **Venture Formation**

Out-license
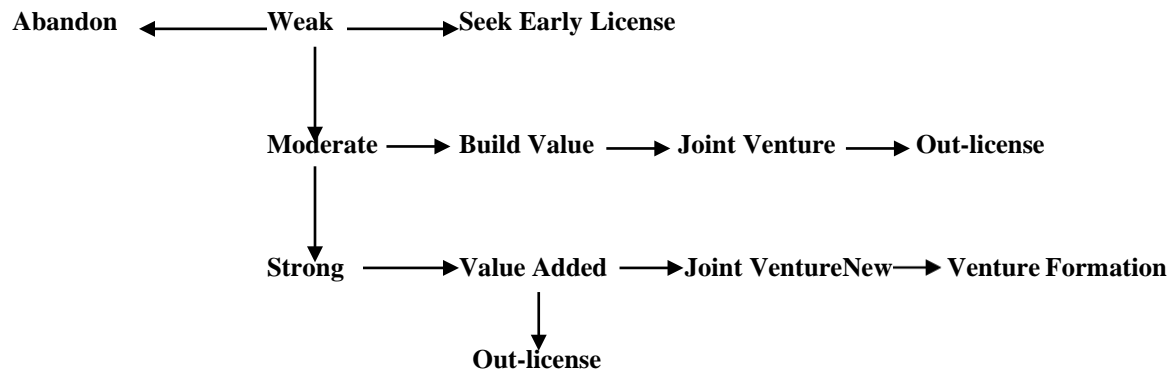
PART 3. Market Assessment Tool: Market Information Report Form

Note: This tool is used to analyze the marketplace for the focal technology, to look for potential partners and companies that could commercialize the technology. This moves the invention from technology to product.

1. Name of researcher(s), their organization(s), and description of potential product(s) to be derived from the technology.

2. The Application Market (Identify one *specific application* of the technology that you believe as having the most market potential or most likely to help the society. Then focus on this application.)
   - Describe the application market for the past 5 years, present and the next five years.
     - ➢ **VMT insurance is relatively new concept and has been slowly growing since last 5 years and in present people have started adopting it as it gives more cost-effective insurance to their customers and going ahead this will significantly grow.**
   - On both national and international levels discuss sales, profits, trends driving the market and growth rates.
     - ➢ **In National Level, there are few of the companies to adopt this technology and providing it to the customers. In International level, there are couple of countries like UK, Italy and Canada are still adopting this technology.**

   *Specific Market Segment
   - *If the application market is broad, identify a specific segment* to do the analysis in "2" here and "3" below for this segment.

3. Competition in the Application Market
   - Complete the following table regarding competition.

Competitor Name	Product Name	Total Sales ($)	Product Sales ($)	Strengths	Weaknesses
GreyOrange	Robots	$534.6 million		Scalability, Reliability	Focuses just on a warehouse automation
Swisslog	Robots	$53.3 million		Proven Experience	Dependence on key customers

4. Market Influences
   - Describe the macro-level factors that have a major impact on sales. Examples include:
     - PESTEL: Political, Economic, Social/cultural, Technological, Ecological/Environmental, Legal.

   - Describe key market and industry factors that may have a significant impact on sales.
     - Market factors: Growth rate of potential demand, buying criteria of buyers (e.g., focus on price, focus on value).
     - Industry factors: competitive force (e.g., question 3 above), possible bargaining power of suppliers and buyers, potential entry threat, threat from substitutes (if any), and presence and strength of potential partners.
   - Based on above, identify the opportunities and threats/challenges that commercializing the technology may face in the application market.

5. Projected sales (including historical sales, if applicable) of the application that uses this technology.

	Year 1	Year 2	Year 3					
Overall Industry	$157.07 billion	$170 billion	$269 billion					
The Specific Application Market	$4.15 Billion	$ 9 Billion	$15 Billion					
% of Overall	2.64%	5.29%	5.59%					
Your Product/Service								
Best Case	$18.75 billion	$ 20.50 Billion	$25 Billion					
Worst Case	$3.2 billion	$ 5.70 Billion	$ 8.75 Billion					
Most Likely	$12 Billion	$ 15 Billion	$ 28 Billion					
% of Overall	7.6%	8.11%	9.42%					
% of Specific	5.1%	6.25%	7.30%					

- Describe your methodology and sources for developing the above analysis.
  I've been doing some research about the GreyOrange and its business and got to get some idea on this figure as it is also one of the robotic company making for warehouse management and got to know about the some of the sales figures about it and if joint venture with this company to commercialize for any retail store. These might be some of the approximate figures for the first three years.
- Provide major assumptions and <u>remember to cite sources</u>.

Note: This is your guestimate of sales for the first few years (at least three years into the future) taking into account all of the above research.

6. The Organizations that Are Most Likely to License this Technology.
   - Names of these potential licenses
   - List the top three-five technology/market needs of these licensees.
   - Explain which of these top needs the focal technology can serve. (Note: the most promising potential licenses are those that has a top need that the focal technology can serve)

PART 4. Scoring and Decision Matrix for Market Assessment

MARKET INDEX SCORE

	Answer by Referring to Question #	Very Weak (0)	Strong (5)	Score (Can be any # between 0-5)
Number of Direct Market Competitors[1]	3	>10	<5	**5**
Market Size (Sales)	3	<$1M	>$100M	**5**
Annual Market Growth Rate for Product	3	≤5%	>20%	**5**
Market Structure	3, 4	VW:Consolidated/Hi-Competitive VW:Regulatory/Difficult Entry VW = Very Weak	S: Fragmented/Lo-Competitive S: No Regulatory/Easy Entry S =Strong	**5**
Realistic Market Share Attainable	3, 5	< 2%	> 10%	**3**
Market Capacity	3	VW-Currently met by participants	S-Currently unmet	**3**
Comparables	3	VW-Largest competitor > 50% Mkt Sh	S-Largest competitor < 20% Mkt Sh	3
Opportunities	3, 4	Single Application	Multiple Applications (Additional Market Segments, Build, License, Partner, etc.))	**4**
Length of Time to Commercialization	4	> 5 Years	<1 Year	**3**
Regulatory Approval to Market Product	4	Extensive	None	**2**
Governmental Exclusivity to Market Product[2]	4	None	Comprehensive	4
Identified Partners for Commercialization	1, 4, 6	0	>5	**5**
Market Potential for Product	3, 4, 5, 6	Domestic Market Only	Domestic + International	**5**
Value Added	4, 5, 6	Commodity Item	Strong Value-Add	**5**
Market Drivers	4	Product Replacement	Disruptive/Novel	**5**
Potential Licensees (Organizations)	4, 6	0	>5	**5**

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[1] Market competitors are those organizations already have competing products/services in the market place.

[2] There are two common types of governmental exclusivity. One is new drugs or medical devices that are subject to FDA approval and may be used exclusively by governments for a certain period. The other is that certain technology may be exclusively used by governments for a certain period before being declassified and released to the public due to security reason. In either case, you need to find out how long the government can use it and at what level of exclusivity. Comprehensive exclusivity can be beneficial for the commercialization of the technology because as an exclusive contractor, government provides guaranteed sales and are willing to pay more.

Purchasing Dynamics	2	Single Purchase	Repeat Purchase	**0**
Expected Gross Product Margin	5	<5%	> 15%	**5**
Overall Team Competitive Assessment	Refer to "Factors to be considered…" Below	Very Weak	Very Strong	**4**
Total Score	-	-	-	**76**

Factors to be considered in Team Competitive Assessment:
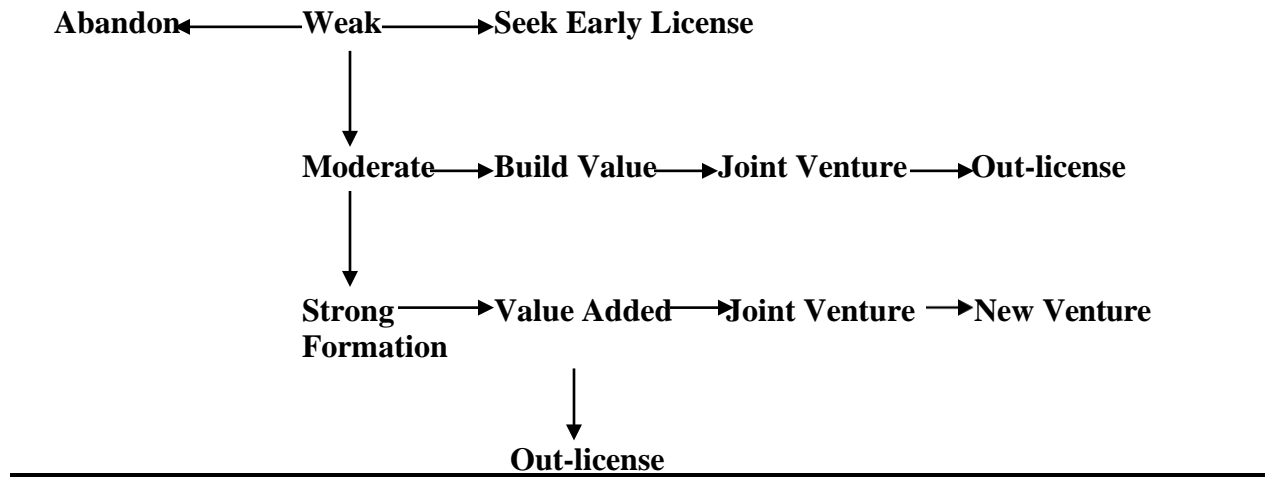
      Is technology potentially "life/world-changing"?
      Application potential of technology within market(s)
      Likelihood of significant market interest in technology (e.g., ease of use, cost, etc.)
      Likelihood of competitive "paradigm shift" (+ or -)
      Ability to generate repetitive sales/cash flows (e.g., "razor blade model")
      Likelihood of significant market resistance to technology/products
      Process required to enter market (e.g., regulatory approval, etc.)
      Other….

MARKET OPPORTUNITY ASSESSMENT
DECISION MATRIX

	MARKET INDEX SCORE	**ACTION**
VERY WEAK	**< 30**	**ABANDON**
WEAK	**31 – 55**	**OUT-LICENSE QUICKLY**
MODERATE	**56 – 74**	**BUILD VALUE** **OUT-LICENSE** **JOINT VENTURE**
STRONG	**75 – 100**	**VALUE ADDED ⟶ LICENSE** **JOINT VENTURE** **NEW VENTURE FORMATION**

MARKET OPPORTUNITY ASSESSMENT

DECISION TREE

Abandon ◄——————— Weak ————► Seek Early License

                                     ▼

Moderate ——► Build Value ——► Joint Venture ——► Out-license

                                     ▼

Strong ——► Value Added ——► Joint Venture ——► New Venture
Formation

                                     ▼

                           Out-license

PART 5: Combining Technology and Market Opportunity Assessment

**MARKET
SCORE**

100

STRONG
LICENSE, JOINT VENTURE, OR NEW VENTURE FORMATION

75

MODERATE
License or Build Value

60

WEAK
LICENSE
(FURTHER R&D)

35

VERY WEAK
FURTHER
R&D
or
ABANDON

0   **35**   **60**   **75**   **100**

TECHNOLOGY S