Wells Fargo Case Study: Commercial Mortgage Precision Sensing Through Foot Traffic Flow Data Aggregation

by Patrick Delaney

Summary

The recent financial and credit crisis and resulting regulatory reform highlighted both the importance of managing unanticipated risks, as well as building robust risk management policies. Ineffective risk management can adversely effect financial condition.

In one specific sector, Commercial Mortgage Banking revenue can be volatile from quarter to quarter, including as a result of the change in value in mortgage servicing rights (MSR's), which may change due to general or geographic economic conditions of a particular region. However, there are inherent limitations to risk management models which monitor and predict market risks using financial indicators, which are in essence lagging indicators. Utilizing data aggregation methods which incorporate remote sensing technologies and precision digital market insights is a way for financial institutions to be able to provide more appropriate identification and anticipation of economic conditions, and to take action on said conditions where necessary.

In this paper, we show a methodology for creating a Foot Traffic Flow Data Service which would create data insights necessary to build a case study to understand how sensing technologies would affect risk.

Said Traffic Flow Data Service could create a new class of revenue stream which would open up a **total addressable market size (TAM) of around $1.56B which exists within the Commercial Mortgage Data Aggregation Industry. Further, a serviceable addressable market size (SAM) of $31M in the Retail Commercial Mortgage Data Aggregation industry alone.**

Our methodology uses a digital revenue stream created from various location-aware data sets as well as specific retail location KPIs and a simple sensing method, as well as rapid experimentation to lower the risk of testing out our hypothesis in a business setting.

Introduction - Creating a Digital Revenue Stream from Inter-Store Foot Traffic Monitoring

The Data Prospect - Building a Framework Using Inter-Store Foot Traffic Monitoring

Data is not a new magic tool which solves all problems - there is a large myth going around today that, "the algorithm will figure it out," or " AI will figure it out." The real difference in data today vs. data in the past is the structure in which the data comes.

While it is widely understood that being able to properly structure and harness this, "new data" today increases a company's value in both perception and reality, what is less widely understood and talked about are the underlying assumptions in four domains of strategy necessary to make harnessing that data a success:

1. **Understanding Data Customers**
2. **Competitive Value Chain Analysis**: Breaking Down How to Create Competitive Differentiation Through The "Competitive Value Chain"
3. **Rapid Experimentation**: Setting Up a Rapid Experimental Method to Explore Value and Monitor Return on Innovation Investment
4. **Value:** Analysis and Computation of Digital Revenue Stream Value via TAM and SAM

We in this paper we present an, "IoT Value Innovation Experiment," which illustrates a practical framework for upgrading a company's, "data strategy," to add access to an up to $31M serviceable addressable market, which would add rapid value to the company. Within this framework, we have shown that within a particularly relevant segment for Wells Fargo, namely Wells Fargo Commercial Real-Estate Financing. On a global level, there is a $1.56B digital total addressable market (TAM) opportunity which is largely untapped.

Complex, rich and engaging data ecosystems today can be built within a couple months or even weeks timeframe, with a combination of cheap hobby sensing hardware, which was once extremely expensive equipment, and cheap cloud computing, such as Amazon Web Services (AWS), or Azure cloud computing stacks which was once also cost-prohibitive.

Our team was able to develop one demonstrative instance of a sensing technology, computing environment, and data framework necessary to deploy experiments to help further statistically validate or falsify the above digital market claim.

Understanding the Data Customer

The first step in setting up a new data division (or offering of a currently existing division) is to identify your data customers. Data customers aren't necessarily a company's direct customers.

- For example, Uber's main customers are of course, users of the Uber Taxi and ride service. Uber's data customer — other travel firms — is entirely different from the general public using its service.
- Another example would be video game distributor Zynga is actually much more than just a distributor, leveraging data from each game interaction and selling insights to determine which games users play so similar games can be created.

After understanding a data customer segment, it's important to find out what data that customer segment needs. Some questions to ask include:

- Which insights will have a direct impact on customer's daily interactions?
- How will that information be gathered?
- Will the data be structured such that it can be analyzed immediately, or does it need to be cleaned?

Data is nothing without context, so those setting out to start a new data division need to make sure that the data is translated, cleaned, and put into a production environment such that it makes valuable and coherent sense to the data customer.

Wells Fargo Museum Case Study - Why Commercial Real Estate Mortgages?

According to Wells Fargo 2015 Annual Report, Net Interest Income from Commercial Real Estate Mortgages represented about $3.98 Billion in income for Wells Fargo, or about 5% of Wells Fargo's Total Revenue. In addition to this, Commercial Real Estate Mortgages represented approximately 7% of $1.6 Trillion in Earning Assets owned by Wells Fargo. Wells Fargo diversifies these investments over geographic regions, and accommodates customer flow by taking either short or long positions which may boost buying and selling demand for customers. Wells Fargo can make money by offering additional services from these assets through its Wholesale Commercial Financial Division, in the form of Earned Income in the form of net gains on trading activity.

Commercial Real Estate within the Retail Sector is an excellent area in which to explore sensing solutions because retailers are currently re-examining everything from customer behavior and experience, staff ratios and the ability to re-design store layout. Retail intelligence is at the heart of this decision making process, following trends in analytical methods established by online merchants such as amazon.com. The opportunities for remote sensing within this sphere of economic activity are great - from financing of various shipping locales and transportation methods to advanced analytics of in-store customer behavior.

Risk Assessment of Commercial Mortgage Within The Retail Splace

- Commercial Mortgage Market may be materially affected by general economic conditions, particularly unemployment levels and home prices in the U.S., and a deterioration in economic conditions or in the financial markets may materially adversely affect our lending and other businesses and our financial results and conditions.
- Mortgage banking revenue can be volatile from quarter to quarter, including as a result of changes in interest rates and the value of Wells Fargo Mortgage Servicing Rights (MSRs) and Mortgages Held for Sale (MHFS).
- Wells Fargo may be required to repurchase mortgage loans or reimburse investors and others as a result of breaches in contractual representations and warranties.

While these risks may already built into the price of the asset itself, there is a large opportunity for increasing valuation through efficiency within a data strategy. As stated in the Wells Fargo 2015 Annual Report, "inherent limitations to Wells Fargo's risk management strategies as there may exist, or develop in the future, risks that we have not appropriately anticipated or identified." In certain instances, the model does not provide the means to measure, monitor and predict results which can mitigate the above risks to the fullest extent given the available technology.

Commercial Mortgage Competitive Value Train Within the Retail Sector - Creating a Tool For Unlocking Data

Today, the boundaries of industries are much less static than in previous eras due to rapid technological change. Companies are competing more and more with businesses that do not look like them. We can think of this as a shift from asymmetric to symmetric competitors.

- **Symmetric Competitors** offer similar value propositions to customers, with a similar business models - for example, both Ford and GMC have different brands that appeal to different drivers, but fundamentally they offer similar products through similar supply chain methods.
- **Asymmetric Competitors** may offer similar value but with a different business model, for example Uber, which offers the same value as Ford and GMC, but through digital means.

Forward-thinking business leaders must think of competition less in terms of competition and more in terms of, "arenas," or "substitutes." By thinking of competition as being an asymmetric environment in addition to a symmetric environment, there are opportunities for both removing middlemen or, "disintermediating," services, as well as inserting a company into the middle of a service or, "intermediating."

A tool to help think about this was established by Colombia Business School Professor David L. Rogers, known as a competitive value chain. A competitive value chain starts with a horizontal train of firms leading to a final consumer at the right. The number of firms drawn will depend upon a given business model and means of distribution. Broadly, you have three main types of companies that participate in a value chain. In the traditional competitive value chain, you've got the originator on the left, and the, "Consumer," on the right.
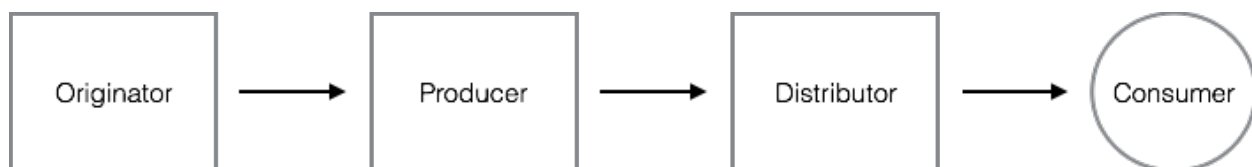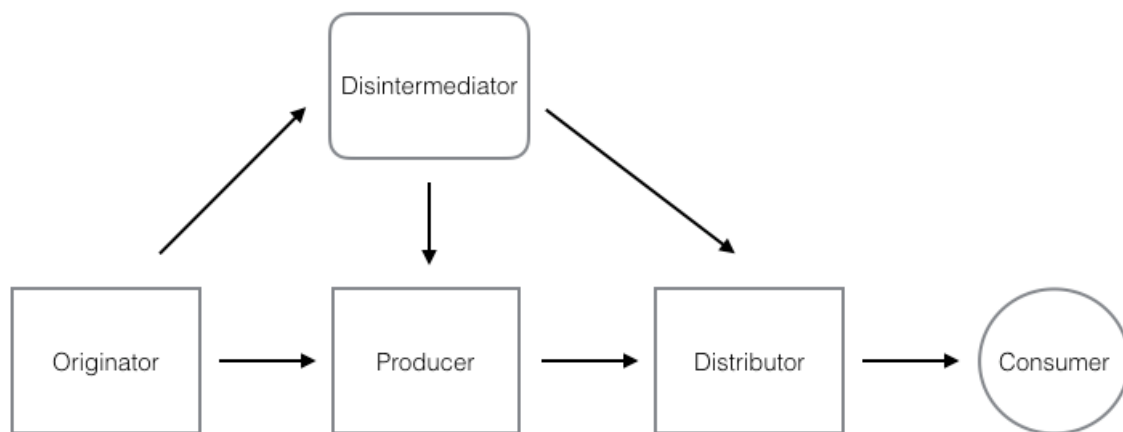

Symmetric Competitive Value Chain

In the case of Wells Fargo Retail Commercial Real Estate Financing arena, the "Symmetric Competition," value chain would be the following:

- **Originator**: Mortgage Broker and Real Estate Agent establish point of sale with Commercial Retail Customer, financial information collected.
- **Producer**: Underwriting, within Wells Fargo and GSE's review regulatory compliance and fund package.
- **Distributor**: In this situation, the Retail Location Company and Construction Companies "Distribute," the Commercial Mortgage in the form of physical space to end consumers as a location in which to buy goods such as groceries, electronics, home goods, etc.

Looking at Wells Fargo from an "Asymmetric Competition," environment lens, we see a few different scenarios that could emerge from a strategic value standpoint.

Asymmetric Competitive Value Chain

- **Originator**: Mortgage Broker and Real Estate Agent establish point of sale with Commercial Retail Customer, financial information collected.
- **Producer**: Underwriting, within a given bank (possibly including Wells Fargo or another bank) and GSE's review regulatory compliance and fund package.
- **Disintermediator:** Digital remote monitoring service through video analytics or other sensing methods provides insights into Retail location's activity, which provides insight into economic indicators of a specific geographic region.
  Distributor: In this situation, the Retail Location Company and Construction Companies "Distribute," the Commercial Mortgage in the form of physical space to end consumers as a location in which to buy goods such as groceries, electronics, home goods, etc.

Total interest income (on a taxable equivalent basis)	50,373	59
Interest expense		
Deposits	963	1
Short-term borrowings	64	—
Long-term debt	2,592	4
Other interest expense	357	—
Total interest expense	3,976	5

There are a few considerations to help gain the negotiating power necessary to have a disintermediating business unit. There must be sufficient unique value in order to exert competitive leverage on its partners upstream and downstream. In this case, the, "Data Service, must provide differentiated value in the form of mitigating the risks discussed in the above section on, "Why Commercial Real Estate Mortgages?"

Leveraging the Template Across the Industry

Using the, "improved data framework," mindset that we started out with at the beginning of this paper, we are challenged with not only coming up with a business plan that would disintermediate an existing system within our own supply chain, but coming up with an actual framework that would build revenue streams across many companies and industries. A framework is defined as a system of strategic thought mentality which puts mapping, "asymmetric competition," at the forefront.

Taking a look at a symmetric competitor, albeit in the adjacent broiler market, rather than egg market, is Tyson Food Products. Doing an asymmetric value chain on this competitor, we get the following:

- **Originator**: Mortgage Broker and Real Estate Agent establish point of sale with Commercial Retail Customer, financial information collected.
- **Producer**: Underwriting, within a given bank (possibly including Wells Fargo or another bank) and GSE's review regulatory compliance and fund package.
- **Disintermediator:** Digital remote monitoring service through video analytics or other sensing methods provides insights into Retail location's activity, which provides insight into economic indicators of a specific geographic region.

   Provides upstream value to the Producer in the form of an indicator which would help to assess risk, even in aggregate.

   Provides business insight downstream to the, "Distributor," who is looking for information and insights on how to grow revenue.

   Distributor: In this situation, the Retail Location Company and Construction Companies "Distribute," the Commercial Mortgage in the form of physical space to end consumers as a location in which to buy goods such as groceries, electronics, home goods, etc.

So given this potential value chain, we are faced with a question of, "how much unique value can be carved out of this value train in order to exert competitive leverage on its partners upstream and downstream?" One of the first lynchpins in establishing value is of course, financial data.

Looking at things from a purely cost perspective, the above table, "Net Interest Income, Non-interest Income and Non-interest Expense as a Percentage of Revenue (in millions)," tells us that $357 million of "other interest expense" is involved in $50.373 billion in total interest income, or around 1%. One level of what we would like to know is what the actual, "cost of risk," is. Cost of Risk can be broken up into two different types - either Total Cost of Risk (TCOR) or Economic Cost of Risk (ECOR). TCOR is essentially the sum of 1) expected retained losses based on prior years, 2) premiums and 3) claims handling costs, while ECOR includes an, "implied risk charge," which takes into account methods to account for the severity and likelihood of detrimental outcomes. While ECOR is a more, "accurate," view of the cost," for the purposes of this whitepaper we can grant that TCOR is sufficient for simplification purposes. Even that being said, we can assume that TCOR is less than 1% of the expenses relating to total interest income. It may be reasonable to assume that TCOR is around 0.5% across the board, or around ($3.98 Billion)*0.05% = $199M. To get the proportion of this cost which would be represented specifically within the, "Retail" sector, we can draw from Table 19 of the Wells Fargo Financial Results, "Commercial and Industrial Loans and Lease Financing by Industry."

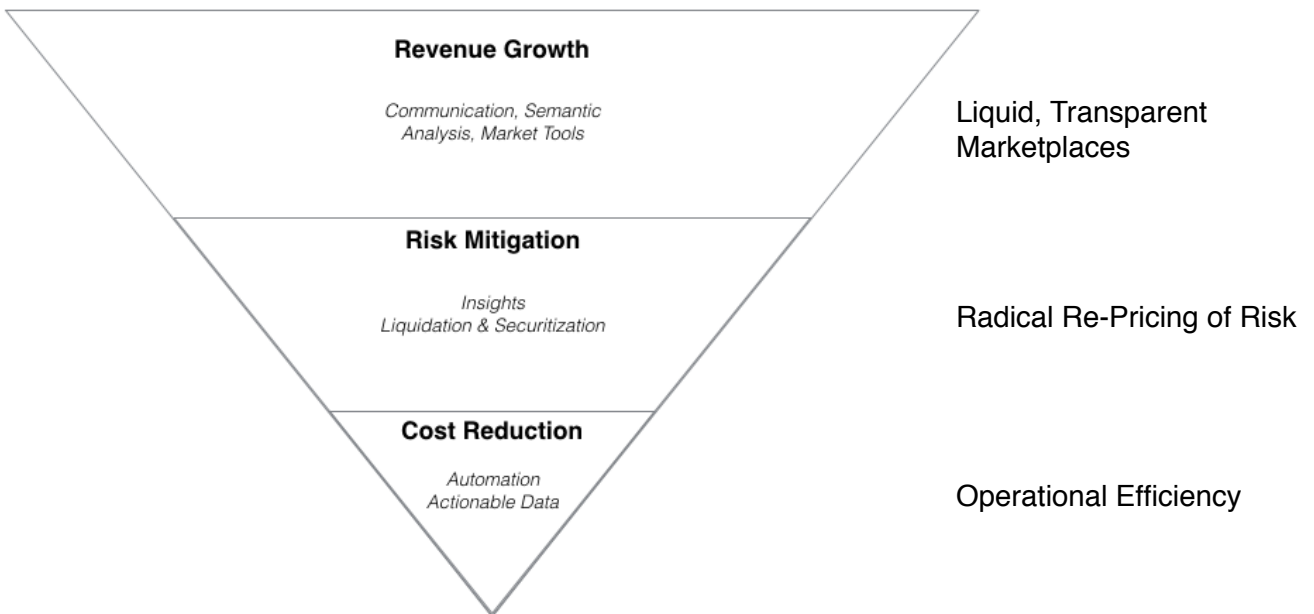| (in millions)	Nonaccrual loans	Total portfolio (2)	% of total loans
		December 31, 2015	
Investors	$ 23	52,261	6%
Financial institutions	38	39,544	4
Oil and gas	844	17,367	2
Real estate lessor	2	15,315	2
Healthcare	41	15,189	2
Cyclical retailers	20	15,135	2
Food and beverage	10	13,923	1
Industrial equipment	18	13,478	1
Technology	27	9,922	1
Business services	28	8,581	1
Transportation	40	8,506	1
Public administration	7	8,340	1
Other	291	94,698 (3)	10
Total	$ 1,389	312,259	34%

While this is not a precise account of Commercial Real Estate Mortgages, it is reasonable to grant for the purposes of this paper that since Cyclical Retailers make up about 2% of the total loan portfolio, they likely make up about 2% of the total Commercial Real Estate Mortgage Net Interest Income as well. Hence, about $3.98M in expenses may be attributed to the TCOR

using the above assumptions. If we were to use a more sophisticated measurement, which takes into account the vagaries and risks associated with the retail industry, perhaps this amount could be as high as $10M per year in ECOR expenses.

Inverse Value Pyramid

All of the above being said, it is important to understand that new data structures bring not just automation and reduction in costs, but more importantly, opportunities for risk mitigation through insights as well as revenue growth through, "market making," activities and "derivative information arbitrage." While the addressable market, as theorized in the previous section may be closer to $10M in costs which could be reduced within the cyclical retailer commercial mortgage there are also opportunities for leveraging data for risk mitigation and revenue growth.

As discussed above, Wells Fargo diversifies its investments over geographic regions, and accommodates customer flow by taking either short or long positions which may boost buying and selling demand for customers. Data captured from sensors, the cloud, mobile and broadband wireless devices can be aggregated, structured and prepared as a, "tradable asset," which helps to mitigate risk by creating, "liquid, transparent marketplaces," out of physical and geographic spaces.

Revenue Growth

Communication, Semantic Analysis, Market Tools

Liquid, Transparent Marketplaces

Risk Mitigation

Insights Liquidation & Securitization

Radical Re-Pricing of Risk

Cost Reduction

Automation Actionable Data

Operational Efficiency

Running The Lean Data Experiment

The, "Lean Data Experiment" method is essentially a way to bridge the world of software with the world of marketing and real, tangible business models by creating an, "endpoint," via Key Performance Indicators (KPI's) and then using rapid experimentation, the type popularized through the "Lean Startup Method," to quickly iterate and land on an execution plan. There are five different steps in setting up a, "Lean Data Experiment," which we will discuss below in sequence. The five "Lean Data Experiment Steps," are:

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[ KPIs ] → [ Value Template ] → [ Concept Generation ] → [ Data Audit ] → [ Execution Plan ]
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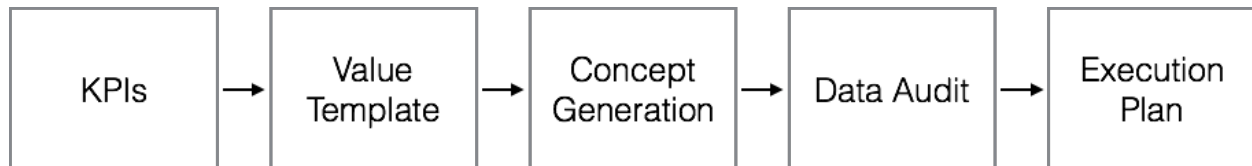
Area of Impact & Key Performance Indicators (KPIs)

There are anywhere from 50-100 different industry-accepted, "Commercial Mortgage KPI's" from the standpoint of an underwriter or the property manager. That being said, a challenge we have is to narrow the field of scope in order to make the best investment impact. Looking within the theme of, "Generating Interest Income," we have a few different potential KPIs that we can concentrate on, out of the pool of 50-100.

Metric	Rationale
Average Occupancy Per Property per Month (%/month)	Higher occupancy per month entails higher revenue, less risk.
Percentage of Billed Rent Collected Each Month (%/month)	Higher percent collected entails less risk.
Percent Dollar Per Property Per Month Spent on Maintenance (%/month)	Intuitively, areas with higher traffic will have a higher maintenance cost.
% Leases Renewed	Renewed leases may imply lower risk in a particular area.

Dollars per property per month ($/month)	From the standpoint of a property manager.
Running net profits per property over time ($)	From the standpoint of a property manager.
Appreciation per property per year ($/year)	From the standpoint of a property manager.
Average Mortgage Loan Value ($)	From the standpoint of an underwrighter

Value Template Selection

After we determine what the most important KPI's are for a particular business case, we need to understand what kind of template (or templates) we are going to focus on using to create value. Templates are really just abstract ideas which help us focus on, "what to think about" and "what not to think about" when looking at the data.

Four main templates that we could select from include:

- Insight - Understanding the Impact of Business Actions
- Targeting - Narrowing the Audience
- Personalization - Personalizing the customer's data
- Context - Relating one customer's data to the larger population

In the case of Retail Commercial Mortgages, we can make a few key assumptions to help understand what kind of, "data thinking," activity we will be focused on. These assumptions can be falsified before moving forward with the project. Also, let's note that we are focusing in on the, "medium section," of the inverse value pyramid, mitigating risk, with the understanding that these risk mitigations can help assist in creating tradable assets at the top of the inverse value pyramid.

Needed Strategies for Value Template Dealing with Commercial Real Estate

- **Insight**: Creating a large pool of data over a number of stores could create correlative effects, which connect sensor data to KPIs using a linear model. This means that the new sensor data could become a leading indicator connected to a financial outcome, rather than a lagging indicator derived from financial analysis.
- **Context**: Comparing brownfield data on large-scale pest control operations within retail contexts could create a baseline for the effectiveness and efficiency of a particular program or method over a large number of stores, in

essence, giving the capability to falsify certain hypothesis within our experimentation.

Non-Needed Strategies for Value Template

- **Targeting**: We will grant or assume, merely for the purposes of discussion, that all retailers are fairly uniform (although they may not be in practice - e.g. retailers could include a store or a restaurant, and may differ widely across industries and sizes).
- **Personalization**: Essentially, looking at an end customer. Understanding the vagaries of every single industry, rather than overall economic conditions of particular real estate locations, is outside of the scope of this investigation.

Concept Generation

- One initial concept would involve deploying a remotely video monitoring foot traffic sensors appropriate locations which selling of goods, food or services on-site at the retail locations in question. These locations likely have a robust amount of extant financial and KPI data which can be used to prove out the data framework and experimental process.
- This initial conceptual model could also include extant foot traffic data.
- A final model would be created by crossing the manually-collected pest control service data and KPI framework over a sufficient sample size, with the framework of another experimental location which utilizes a number remotely connected traffic counters.

Data Audit

The first step in running such an experiment would be to select and categorize a site type, and look at all of the available data at that site for which data is available. Data could include but would not be limited to the following (note the KPIs are inserted in red below):
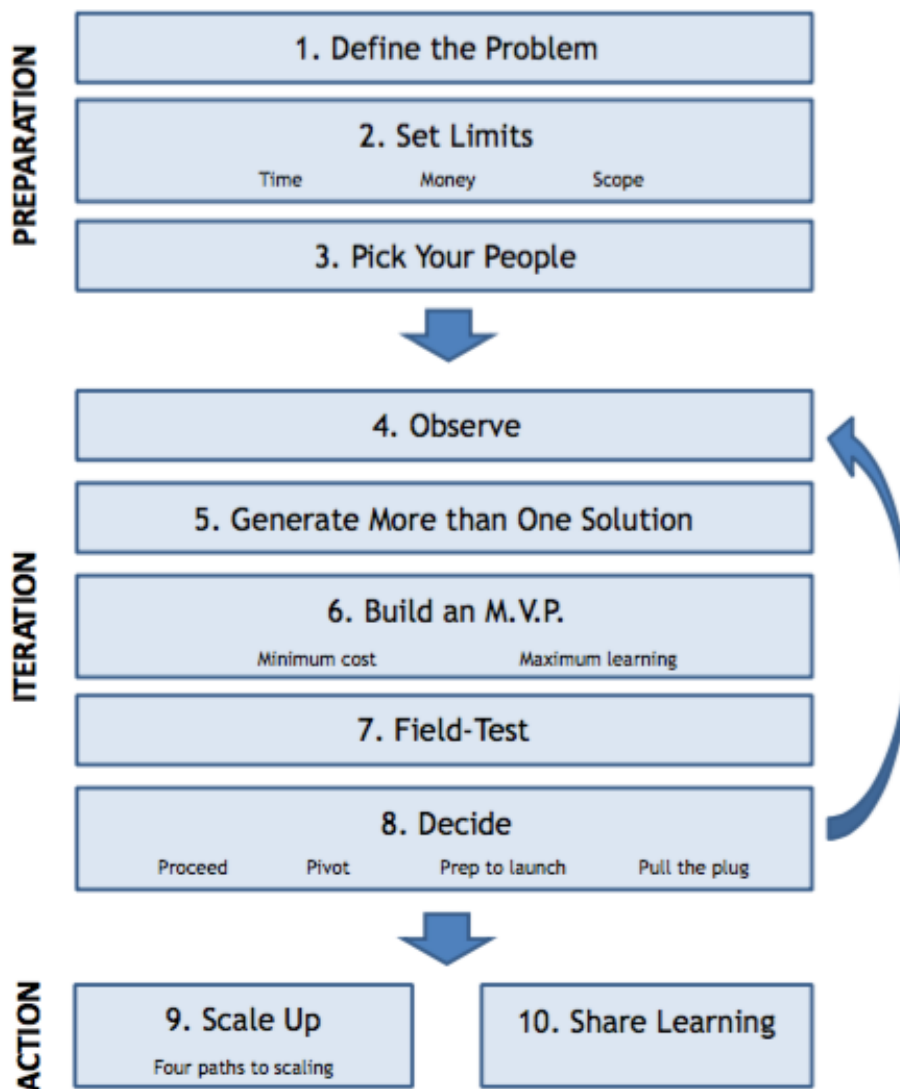
Turnover & Efficiency Rate	Inventory Type Revenue Per Inventory Type Slip Rate of Inventory Type Classification of Causes of Slip Slip Cost Per Facility
Facility Data	Facility Type Goods Types Number of Employees Square Footage for Each Facility Layout of Each Facility Include Critical Retail Locations

Financial Data	Total Gross Revenue Per Facility Number of Traps Per Facility Labor Cost Per Retail Zone Staff Doing Maintenance Internal External Staff Type Staff Doing Extermination Labor Classification of Internal & External Staff Average Occupancy Per Property per Month (%/month) Percentage of Billed Rent Collected Each Month (%/month) Percent Dollar Per Property Per Month Spent on Maintenance (%/month) % Leases Renewed Dollars per property per month ($/month) Running net profits per property over time ($) Appreciation per property per year ($/year) Average Mortgage Loan Value ($)
Other Environmental Data	Weather Humidity Temperature
Data Formats	*Anything is OK* Excel Spreadsheets Paper Scans of Data Data on a SQL Oracle

Execution Plan

- Execution would be driven by the need to measure the ROII (Return on Innovation Investment) within an overall business unit's R&D budget.
- Suggested methods for accounting for innovation expenditures would be to differentiate between, "Divergent Experimental Methods," and "Convergent Experimental Methods," to gain further insight going forward on what it takes to replicate data business models.

Divergent Experimental Method

PREPARATION

1. Define the Problem

2. Set Limits
   Time   Money   Scope

3. Pick Your People

ITERATION

4. Observe

5. Generate More than One Solution

6. Build an M.V.P.
   Minimum cost   Maximum learning

7. Field-Test

8. Decide
   Proceed   Pivot   Prep to launch   Pull the plug

ACTION

9. Scale Up
   Four paths to scaling

10. Share Learning

Straw-man Experimental Procedure & Results

We can consider a hypothetical experiment to demonstrate what a potential "Insight-Generating," and "Context-Generating" value template may look like. Taking the example of a Bar-Restaurant based in downtown Minneapolis, which is the example we have principally been looking at as a, "symmetric competitor," we can look at their current business model, and build a base case in which a hypothetical, "Wells Fargo Data Service," utilizing a remote sensing technology to provide value both upstream and downstream along the competitive value chain. Between December 2015 and June 2016, we implemented such a service to create an experiment which demonstrates some of the value capture discussed in this white paper. As a quick rehash on what we are providing, we can take a look at the upstream and downstream value created:

- Upstream Data Service:
    Provides upstream value to the Producer (Financier) in the form of an indicator which would help to assess risk, even in aggregate.

- Downstream:
    Provides business insight downstream to the, "Distributor," who is looking for information and insights on how to grow revenue.

Context & Business Model

Below are some various statistical features of the restaurant industry across the united states, of which our test case represents one instance.


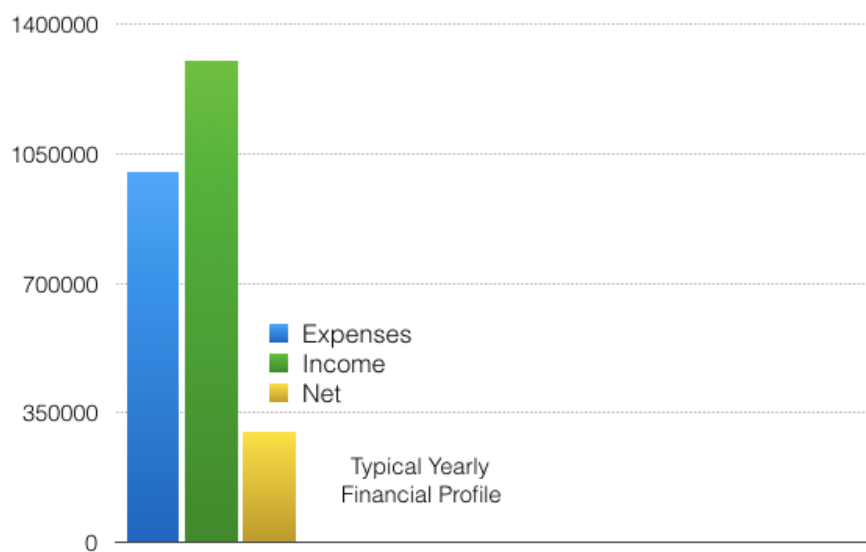The U.S. restaurant industry's sales are larger than 90% of the world's economies

Or roughly equal to the GDP of Switzerland

JOB GROWTH

U.S. ECONOMY **1.3%** RESTAURANT INDUSTRY **2.3%**

The restaurant industry's job growth has outran the overall economy's for 12 straight years

$1.5 trillion impact on overall US economy

Every dollar spent in a restaurant generates $2.05 spent in the overall economy

130 million people will be restaurant patrons in a single day

Minneapolis Restaurant/Bar Case Study

A restaurant/bar located in downtown Minneapolis is a tenant of a landlord in a large high-rise building, on the ground floor. This tenant pays money to the landlord in the form of rent, at around $16-22/SQFT per year for about 20,000 SQFT, paid on a monthly basis. The restaurant/bar owns all revenue and branding through its service partners, and as such is directly customer facing in terms of the value chain analysis which we have discussed in this whitepaper.

- The bar/restaurant keeps a count of patrons manually for certain times during which special events are taking place on a weekly basis.
- The bar maintains a point of sale system which tracks every single transaction individually. Promoters and bar salespeople are paid a salary, but also a bonus according to the amount sold and number of patrons.
- Data on, "foot traffic," is not recorded outside of the window through under which there is not a large number of patrons.
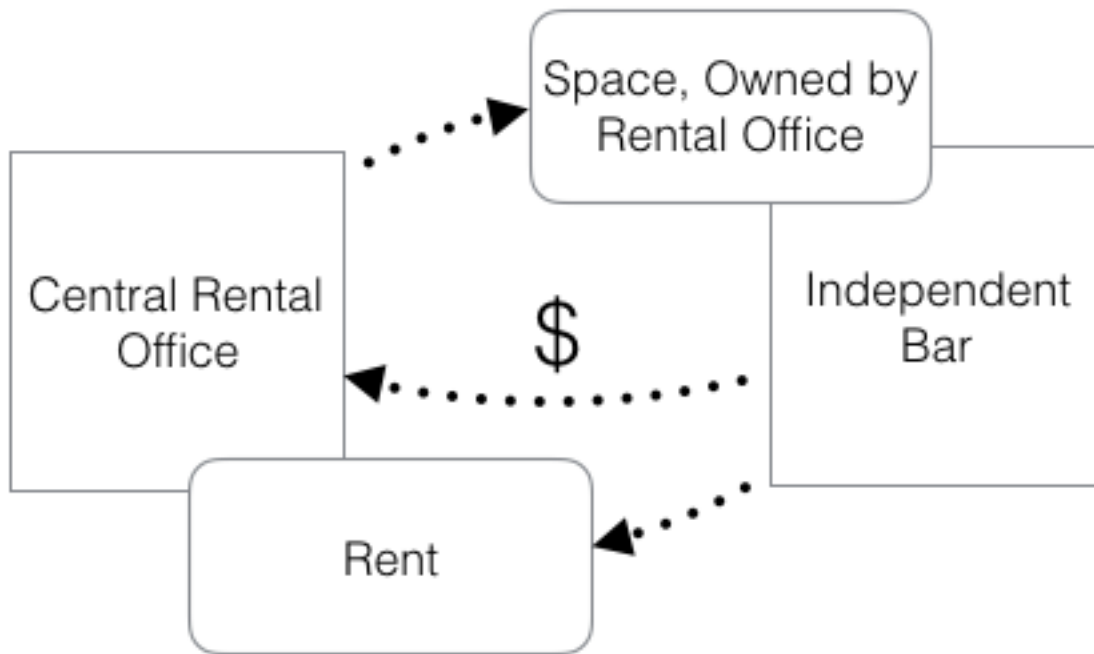
Independent Bar Financial Profile

Independent growers are typically part-time farmers with anywhere from 1-4 barns.

Overall Financial Profile of Building Property Manager Across All Properties

Legend:
- Expenses
- Income
- Net

Typical Yearly
Financial Profile

Y-axis values: 0, 3000000, 6000000, 9000000, 12000000
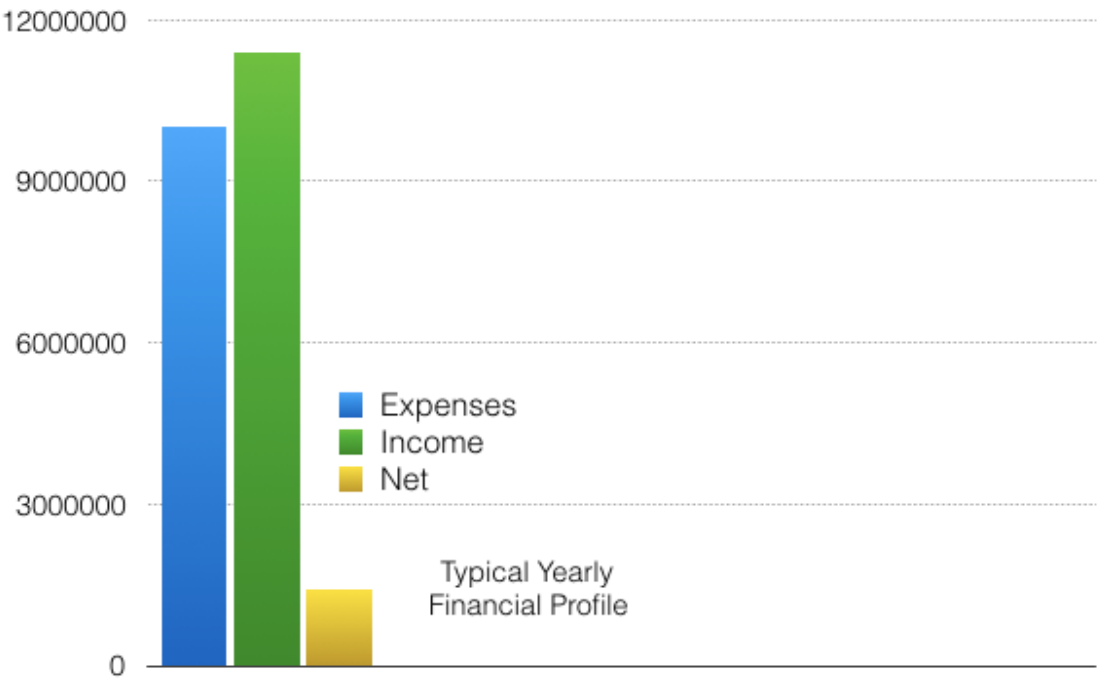
Sensing Scenario

There is no direct "sensing" to tell whether a real estate location is losing traffic or not, it's assumed based upon financial data flows, or potentially employee intuition. But in reality there is no precise count over time.

Our restaurant layout looked like the following, with a dance floor and several bars and seating sections, as shown:

As with many situations in retail environments, the customer ingress is in one particular area.

As a demonstration of the type of data which could be easily captured from open-source methods, we can show an overhead of the Wells Fargo Minneapolis building near US Bank Stadium location at a particular date and time stamp. This can be demonstrative of additional resources affecting foot traffic flow, including but not limited to transportation resources and built-infrastructure for a particular location. We have chosen not to show the precise bar / restaurant in our study for confidentiality purposes.

Sensors are deployed at known customer ingress / egress points around the building to create a, "map" to understand flow in and out of a building at a particular time, and to be able to compare that flow to revenue. A closeup of a what the physical layout of the prototype counting and sensing device looks like is shown in the picture station is shown below.

The counting device calibrates based upon the environment, and is used to detect motion within a given area. The form factor and way that the information is sensed is not important - there are many ways to get at this data, including using extant web cameras within a given location, eliminating the necessity of an actual new device installation on-site hypothetically. Tools exist which allow image recognition of various forms to automatically occur based upon IP Webcam feed data. In this particular instance, the camera was built to have a built-in calibration function and to be mounted specifically overhead, solely to count people, but this is not necessary.
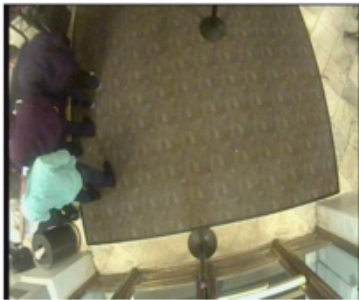
2016-03-11 12:00:46   2016-03-11 11:56:04   2016-03-11 11:51:20

Using this type of sensor, we can capture the amount of customer traffic within a particular space over a particular time. During our experiment, we captured data that was within the instance of Thursday night events. We combined foot traffic count data with Point-of-Sale Data to create new ratio, akin to purchases per web traffic data which would be standard within a website environment.


Directional
Counts Entries and Exits

**Cumulative Attendance On 21 April 2016**
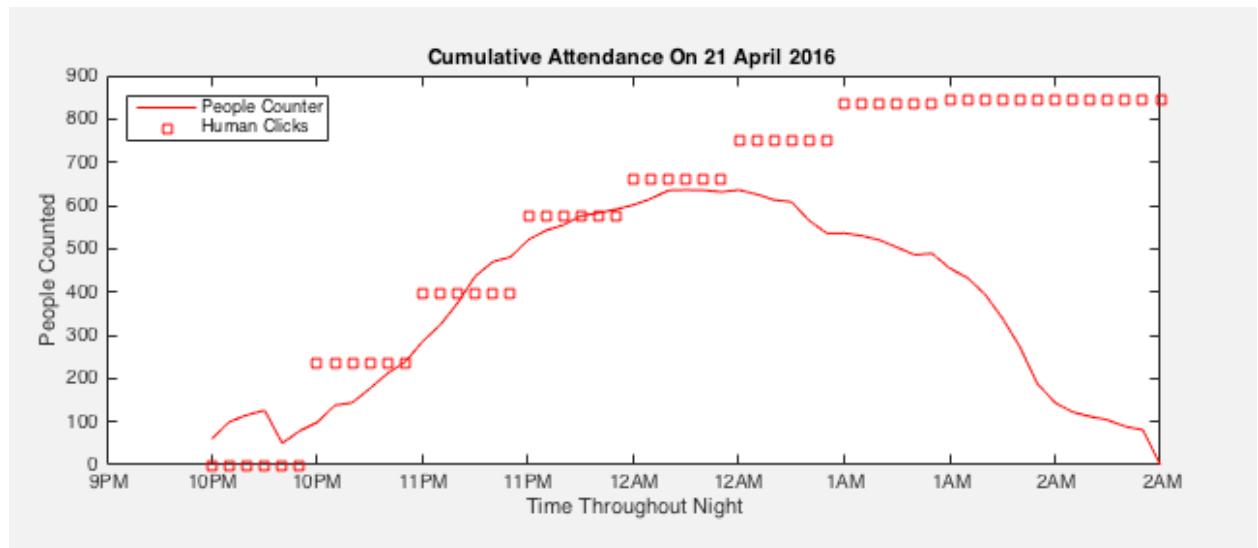
In the above graph, we show the polynomial overlay function of what the camera function recorded vs. what was counted by security guards working at the door (dots). Note - the security guards only counted entries and not exits.

Cumulative Attendance On 21 April 2016
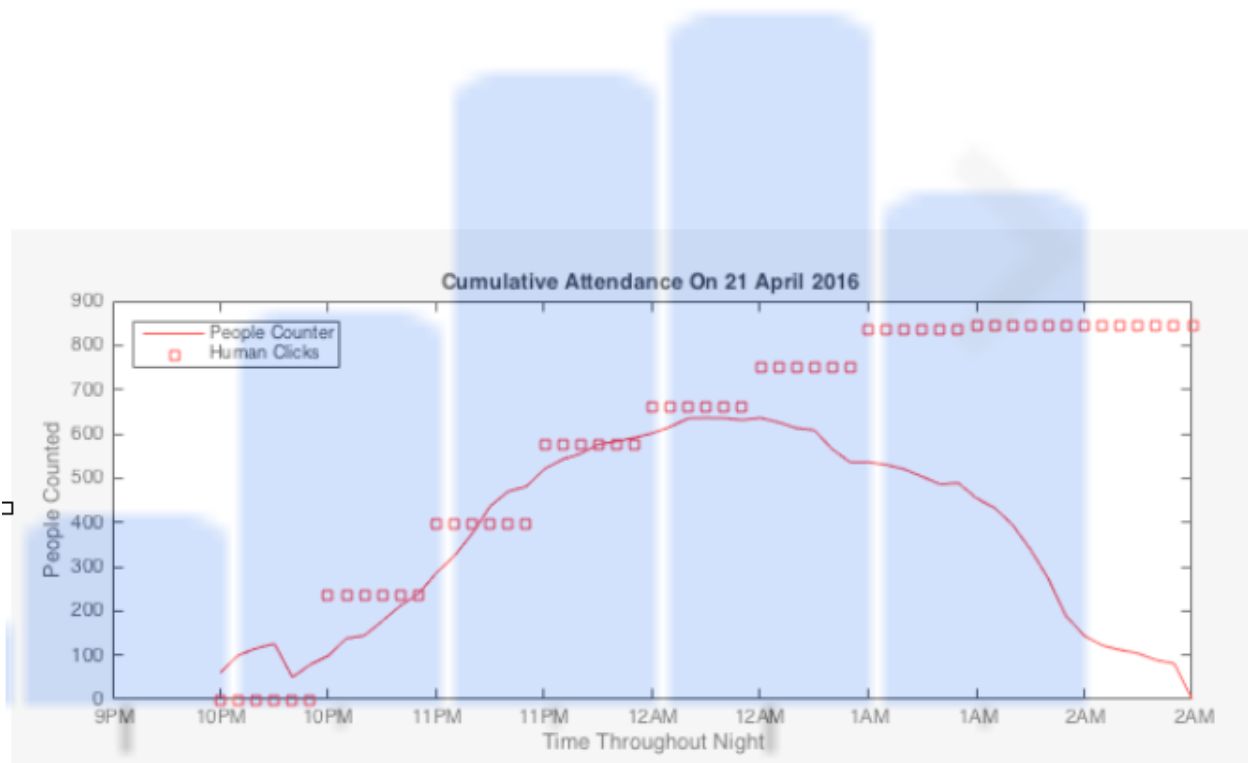
Note the above graph - we can hypothesis test the number of people within a given area using cloud sources of data, such as Google, "Popular Times," API which tracks Android traffic based upon cell phone towers and location sharing information.
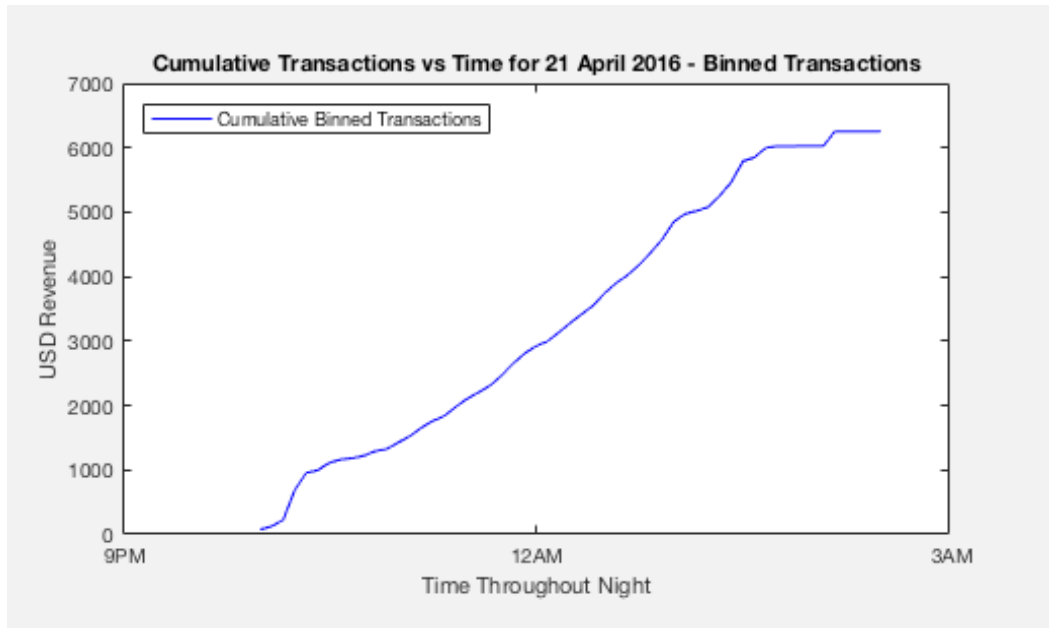
Uploading Point of Sale (POS) information in parallel to the traffic data, we are able to create a ratio of insights which look at actual sales vs. traffic over time, which can create upstream value to the operator of the restaurant.
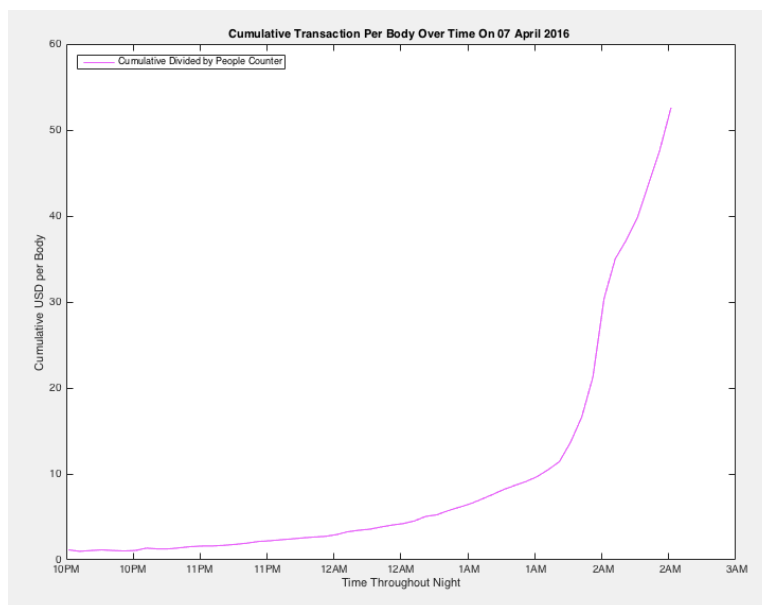
In the above instance, from data collected on April 7th, 2016, we were able to show that the per capita spend increases toward the end of the night, which actually did end up affecting business operations, such that customers toward the latter end of the night are treated differently. This insight provides an augmentation to the, "top" portion of the inverse value pyramid - revenue growth.

Beyond looking at a particular night, we are able to structure trend data based upon other cloud-based obtainable data, such as weather data, or time of year. This can also be normalized with past performance data of a particular location.
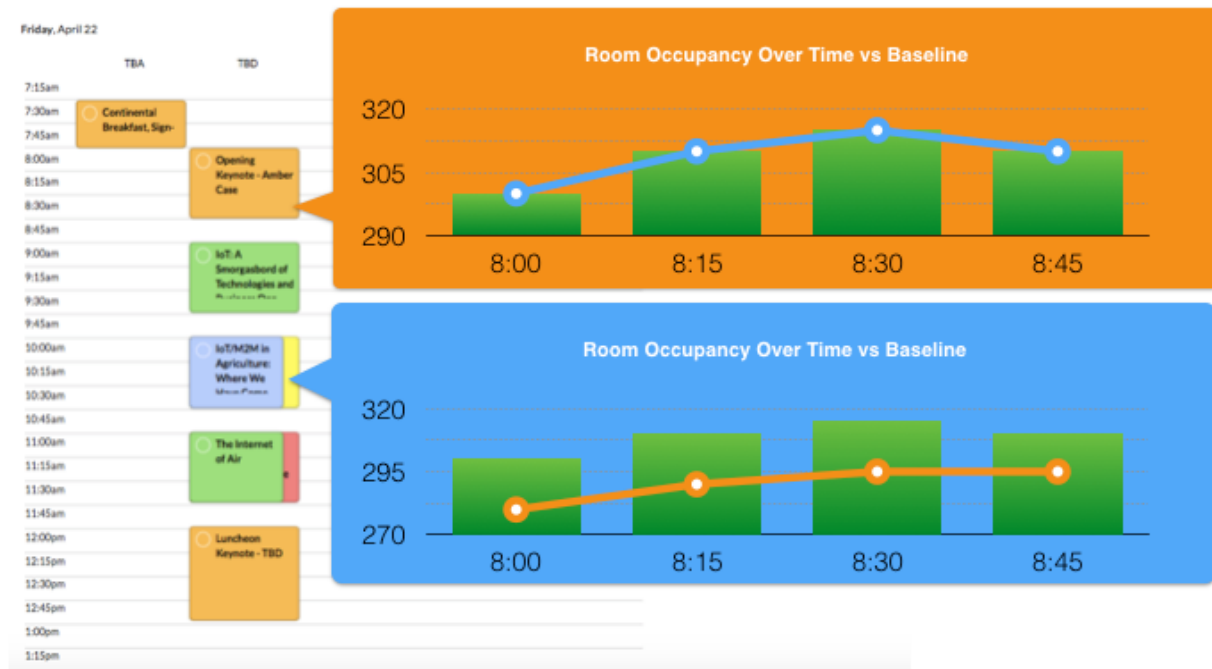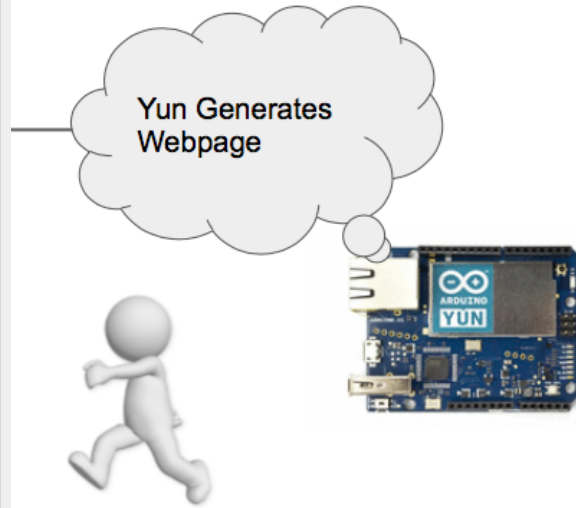

Other Sources of Traffic Data:

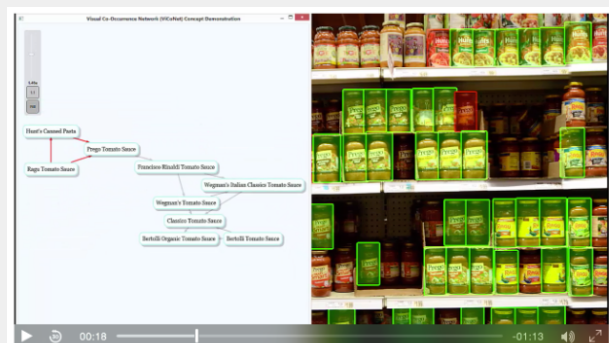|	
Uber API, Amazon API, Google Popular Times API, Various Location & Geographic Traffic Counting APIs.	API's

WiFi Sensing	
Cell Phone Company Precision Market Insights	
Visual Co-Occurance Network	

Lidar, Ultrasonic

Once sufficient data is captured on a given category of retail establishment, normalized by technology type, a, "profile," of a type of visit and revenue class can be built based upon principal component analysis, sensitivity analysis, or simply by looking at the standard deviations among similar industry types. The below graph represents a particular abstract of a given retail type, for the purposes of discussion we could say restaurants, and shows a histogram, "binning," a certain number of types of days over a year.
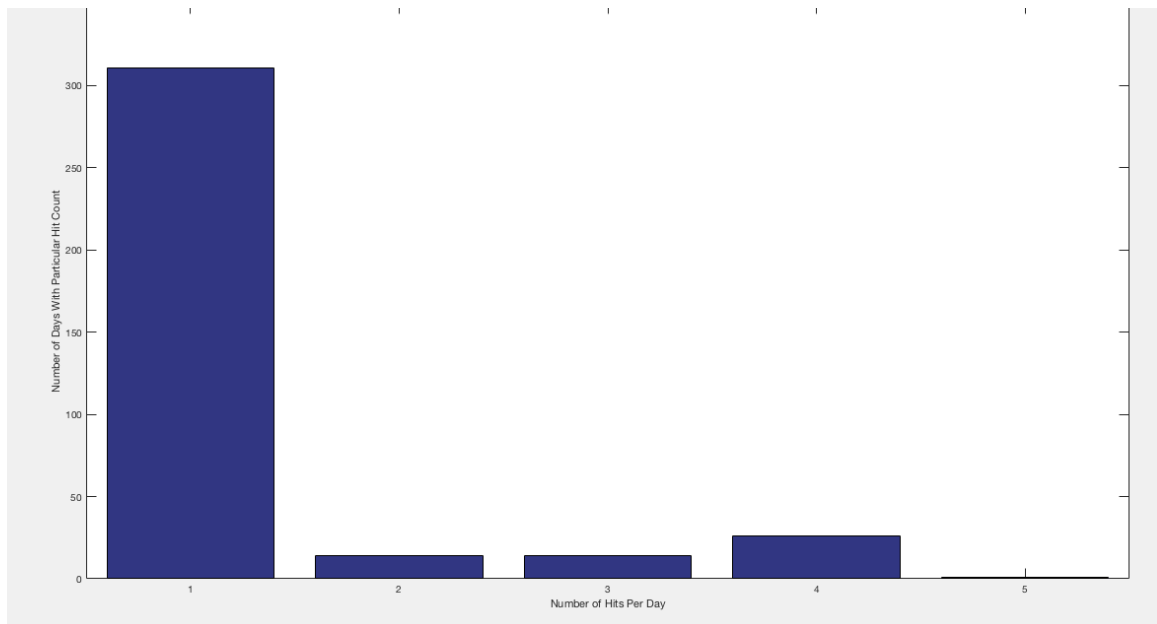
Another type of instance may have a histogram with a completely different shape. This would entail that two different venue types, even if they have similar population profiles, could have widely different standard deviations. These deviations may be correlated to one or more standard Commercial Real Estate KPI's discussed above.
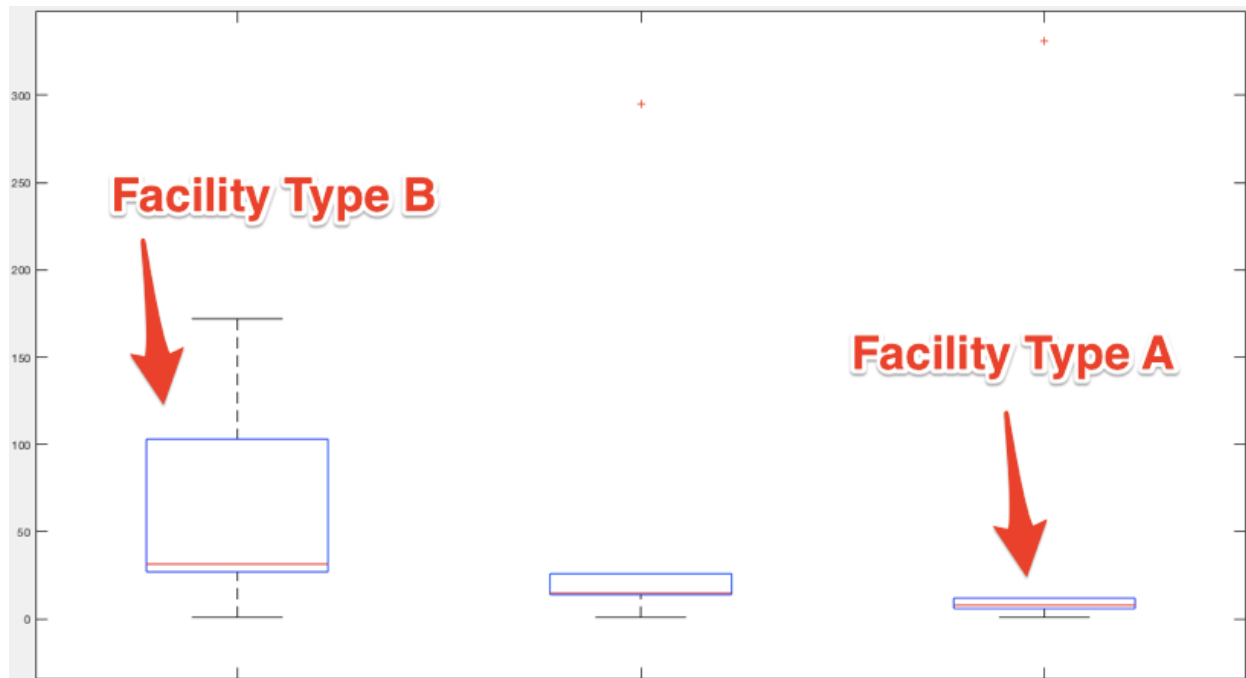
The above box plot chart is demonstrative of a spread which shows, via cluster analysis, a categorization of facility types based upon standard deviation.

Second Degree Polynomial (x) = $p1 \cdot x^2 + p2 \cdot x + p3$
p1 = 5.7769e-06
p2 = -0.00073892
p3 = 0.033628
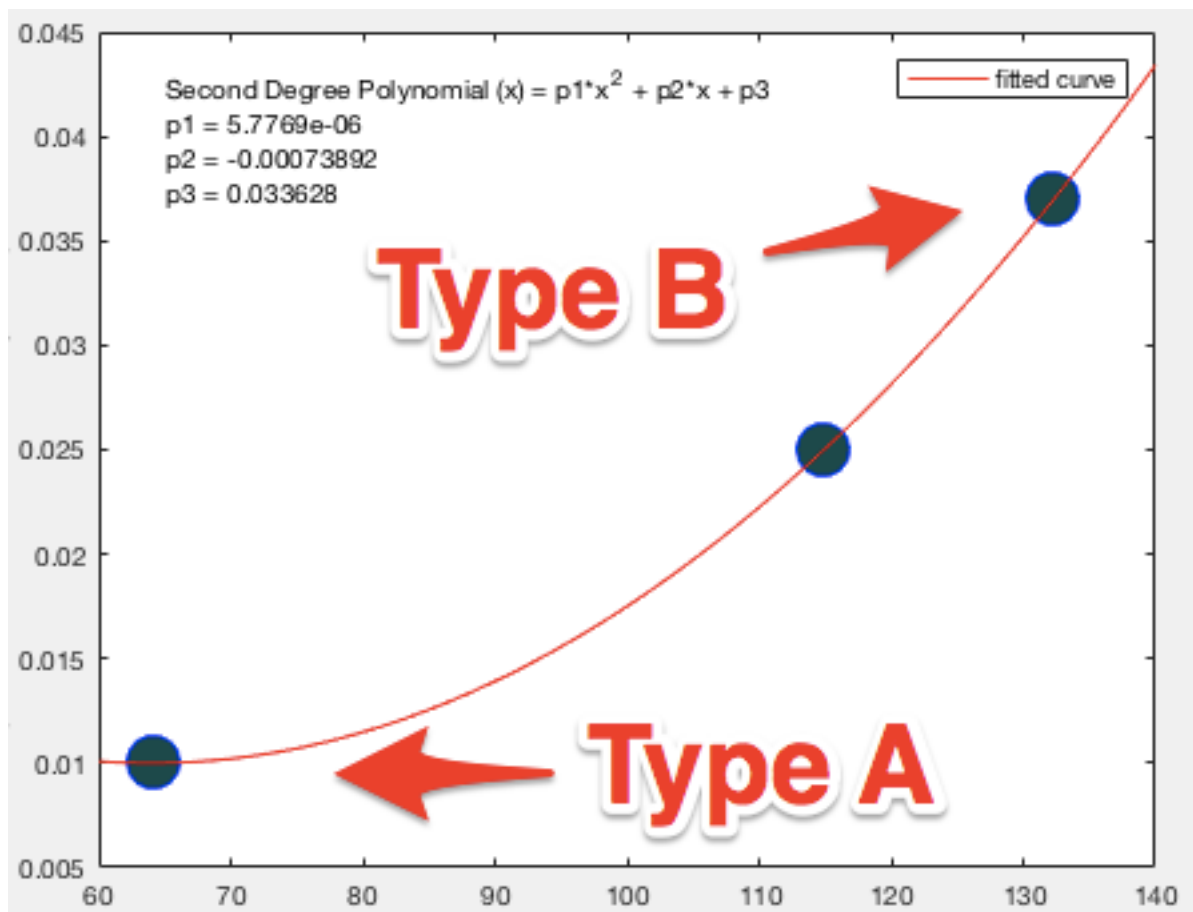
The above chart shows the standard deviations of the various types of clustered real estate establishments plotted against their requisite KPI averages (on the y-axis). Essentially what you find, is that an establishment or management company of type A has a much lower loss function, and therefore lower risk factor, than that of type B. Hence, we have created in essence a, "leading indicator," which reaches, "into the economy," rather than waiting for lagging financial reports to come out months or even quarters later.

This type of data collection can be distilled down to a metric which would be essentially a, "scope cost per hit," showing what the cost per digital, "sense" or "hit," akin to a website hit, albeit in a physical space.

Furthermore, this data may be further translated into higher value, moving up the, "inverse value pyramid," by converting the data into a derivative indicator. Data can be anonymized on the upstream and downstream side through the use of blockchain contracts, thereby increasing the level of trust and marketplace-making activities inherent in the system.

Scope Hit Value Analysis

We can find an approximate, "Scope Hit Value," or essentially what the ratio of asset loss per year vs. hits captured per year may look like, to get a general range.

Location Type	Asset Dollar Figure Loss per Annum, from Customer Conversion Ratio, Per Location	Percent Annual Revenue of Average Location	Scope Value Per Hit, Assuming 185k Hits/Year, 1 Sensing Unit
A	$100k	0.05%	$0.54
B	$230k	0.073%	$1.37

Risk Mitigation of Experiment - Using Rapid Testing

Importantly, we can test these hypotheses using a very simple piece of hardware to start out with, and roll up the sophistication of the data sensing over time as the project becomes more proven, or scale it back with a low expenditure if the insight and context objectives are not reached by a given budget or timeframe.

Any number of other similar sensors could be quickly constructed and deployed to gain greater insights and context with the preceding business case.

Value: Calculating TAM & SAM of US Foot Traffic Data Market, Deriving Data Service Size

Reigning in the Total Addressable Market

Market	Interest Income Per Year, USA
US Commercial Mortgage Market, 2015	$49.75B
US Mortgage Backed Securities, 2015	$1.14B
Total (US Mortgage Market)	$50.89

Assuming a similar revenue percentage from facility type A & B above, we can calculate a hypothetical market size for all feed based upon the entire Commercial Mortgage Data Aggregation Industry. Assuming that we are able to charge 1/10th of the Percent Annual Revenue per Location, and assuming current revenue figures for 2015, we get the following figures:

Location Type	Percent Annual Revenue of Average Location	Scope Value Per Hit, Assuming 365 Hits/Year, 1 Trap
A	0.05%	$1.27B
B	0.073%	$1.86B

Hence, taking the average of the two, we figure that the total addressable market size (TAM) of around $1.56B which exists within the Commercial Mortgage Data Aggregation Industry.

Reigning in the Serviceable Addressable Market (SAM)

We can derive the SAM by taking a look at Wells Fargo's own financial results, and using the portion of Commercial Loans to retailers, which is about 2%.

Table 19: Commercial and Industrial Loans and Lease Financing by Industry (1)

(in millions)		Nonaccrual loans	Total portfolio (2)		% of total loans
Investors	$	23	52,261		6%
Financial institutions		38	39,544		4
Oil and gas		844	17,367		2
Real estate lessor		2	15,315		2
Healthcare		41	15,189		2
Cyclical retailers		20	15,135		2
Food and beverage		10	13,923		1
Industrial equipment		18	13,478		1
Technology		27	9,922		1
Business services		28	8,581		1
Transportation		40	8,506		1
Public administration		7	8,340		1
Other		291	94,698	(3)	10
Total	$	1,389	312,259		34%

Hence, taking the $1.56B TAM, we can derive a SAM proportional to commercial loans to estimate a serviceable addressable market size (SAM) of $31M in the Retail Commercial Mortgage Data Aggregation industry alone.

Conclusion

We have shown a methodology for creating an Retail Commercial Mortgage Data Aggregation Service which would open up a total addressable market size (TAM) of $1.56B which exists within the global and a serviceable addressable market size (SAM) of $31M in the retailer industry alone.

Through a combination of sensing technologies, location data, and satellite information, as well as various ERP information on customer trffic, we can create a new class of financial information which can be scaled and turned into a service of its own which creates cost efficiency, which corresponds to the bottom of the, "Inverse Value Pyramid."

Beyond the bottom of the Inverse Value Pyramid, there are also opportunities to grow within the, "Risk Mitigation," sector in the middle of the Inverse Value Pyramid as well as, "Revenue Growth," at the top of the Inverse Value Pyramid.

The value primarily discussed and focused on within this paper in terms of market sizes, TAM and SAM, are principally focused on cost reduction through market insights on the, "distributor end," of the competitive value chain. One of the advantages of a data service model would of course be the mitigation of risk on commercial properties. However, it is not economically likely that 100% of the extra revenue in a given area will go toward paying the mortgage and then into savings as a deposit - it is likely that businesses will re-invest that money into their business in the form of expansion. Hence, we start moving from the, "middle portion," of the inverse value pyramid toward the top part of the inverse value pyramid, which is revenue growth. This revenue growth creates further opportunities for Wells Fargo, being that it is providing this valuable service, and in effect, participating in, "market making," through the use of this technology. In short, Wells Fargo will have the capability to be a further linchpin for economic prosperity.

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