INNOVATION AND TECHNOLOGY IN YOUR BUILDING DEPARTMENT

A Report by CALBO
Innovative Practices (I.P.) Committee
3-19-2019

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CALBO
CALIFORNIA BUILDING OFFICIALS

INTRODUCTION

2017 CALBO I.&T. Committee Report:

https://www.youtube.com/watch?v=SFRODW6X_VU&feature=youtu.be

2018 CALBO I.P. Committee Report:

Committee devised a twenty-five (25) question survey that complemented the 2017 CALBO IPC survey.

- The Committee produced and published four (4) articles this year that 3 were published and last one will be at the upcoming CALBO NEWS.
    1. Survey Result Analysis
    2. Cloud & Software as a Service (SaaS)
    3. Productivity at B&S operations
    4. E-Code Libraries

TECHNOLOGIES NECESSARY FOR BUILDING & SAFETY OPERATIONS

1. Permitting/**Online Processing**
2. Electronic plan check
3. On-line/Mobile inspections
4. Queuing
5. Data management - Archive
6. Website
7. Social media
8. Financial/Cashiering
9. **Electronic Code Library**
10. **Other Technologies**

Online Processing

Permitting

Electronic Plan Review

Online Inspection

Queuing System

Data/Document Management

Agency Website

Social Media

Cashiering

E. Code Library

Other Technologies

Survey Analysis General

- There are no two Building & Safety operations that are exactly the same.
- A mandate from the agency's higher leadership can resolve a lot of uncertainty and hesitation across various departments on utilization of technology.
- A successful implementation of technology requires both:
  - An active leadership of management
  - Buy-in from staff who will be using the technology.
- Many building officials are aware of “Cloud Based systems”, “Software as a Service (SaaS)”, and “E-Code Libraries”, but such technologies are not widely understood and utilized in our industry yet.

Survey Analysis Specifics

- 50% of the agencies surveyed - use technologies that are on the **same platform**. The other 50% want or are trying to link their systems together.
- Less than a 33% feel their system's integration is/was smooth transition.
- 50% of agencies surveyed - do not have an **on-line permit system** and public can not apply for any kind of permit on-line.
- Some of the more progressive cities are inquiring about cloud technologies or have implemented some cloud services through their consults and privatization of services such as plancheck services.

Survey Analysis Specifics

- 66% of agencies surveyed - have implemented an **Electronic Plancheck** system.
- Implementation of a **robust portal** (web service application) is critical in providing on-line services and electronic plan submittal.
- To avoid double entries permitting system and electronic plancheck systems shall be on the same platform or communicate with each other.
- Some agencies through a third-party portal system receive plans and after certain QA by their permit technicians the projects are routed to their Electronic Plancheck system.
- Almost all agencies surveyed have an **electronic archive system** and a website.

Survey Analysis Specifics

- 50% of the agencies surveyed - are utilizing **Mobile Inspection and Inspection On-Line Services** to some extent but laptop/tough book connectivity to their permit systems are problematic.

- **Social Media** is not widely used at Building and Safety departments of various agencies, but there is growing interest on this medium.

- **Electronic Codes & Standards Libraries,** while growing in private sector thus far are not widely used by building officials. There are several reasons for this:
  - Building officials traditionally are more comfortable with paper copy of codes and manually marking code books.
  - Most E-code libraries are not all inclusive or cloud based and only a few systems provide an electronic markup tool for notes.
  - Most E-code libraries are generally not ready early enough during code adaption process by agencies.

E-Codes Library

E-LIBRARIES OF CODES & STANDARDS

Providing building officials & construction industry access to codes via internet/cloud in various formats pdf, hardcopy or other electronic formats

Access & format varies by service provider, some provide note fields

Some provided by Standards Development Organizations (SDOs) only cover their own codes and/or standards

A few provide nearly every construction industry related codes and standards

One available with instant interlinks to relevant sections of all codes & standards in library through secure connection to every type of electronic device – computers, ruggedized laptops, tablets, droids.

HOW ARE BUILDING DEPARTMENTS USING?

HOW MANY OF YOU ARE USING NOW?

Narrow use:

Replacing or supplementing hard copy of a few codes & standards

Remote access in field for a few codes and standards

Expansive uses:

Complete electronic library of virtually all current codes & standards & older editions

Plan review staff can operate remotely

Inspection personnel use

On-line dialogue between architects and building department using same service on plan reviews & inspections

DIFFERENT TYPES OF SERVICES

Those covering limited Codes & Standards: NFPA, ASHRAE, ICC, Upcodes AI

Those covering wide-range of Codes & Standards: IHS Global, MADCAD, Techstreet (Clarivate Analytics)

Those in PDF format: NFPA, ICC, Techstreet, IHS Global

Those in multiple formats & can access from multiple devices with immediate interlink between diverse documents in library: MADCAD

COMPARISON OF E-LIBRARY SERVICES

Company	Type of Service	Codes & Standards Covered	Pros & Cons
SDO's - ASHRAE, NFPA	Some have on line	Cover only their own standards	(See chart in CALBO eNews)
ICC -	Electronic data files of Icodes – has notes	Cover all ICodes & some State Codes	(See chart in CALBO eNews)
IHS International	PDF based	500,000 standards in wide range of industries	(See chart in CALBO eNews)
MADCAD	Secure cloud based electronic data files all interlinked –has notes	Covers over 80,000 codes & standards & 23,000 local codes	(See chart in CALBO eNews)
Techstreet – Clarivate Analytics	PDF & print	90 million standards in wide range of industries	(See chart in CALBO eNews)

SUGGESTIONS TO REVIEW

Which service covers your specific codes & standards needs?

Which provides maximum flexibility in terms of use on multiple devices, anywhere, anytime? Note fields? Expandable as needs change?

How complete is the library? e.g. Does it include state & local codes and referenced standards?

How long has this company has been in this field?

Are other jurisdictions using? If so how are they using? Would they renew?

Make sure you are doing an apples to apples comparison - a number copy promotional language of other services but do not provide the same service or coverage. Pricing varies.

Other Technologies

OTHER TECHNOLOGIES

Technologies being used in industry which building departments can adopt:

- Drones
- Virtual and Augmented Reality
- Collaborative VR, Lidar (Light Detection and Ranging),
- Robotics & combinations of new technologies
- Microgrids
- AI-Artificial Intelligence
- Exoskeletons

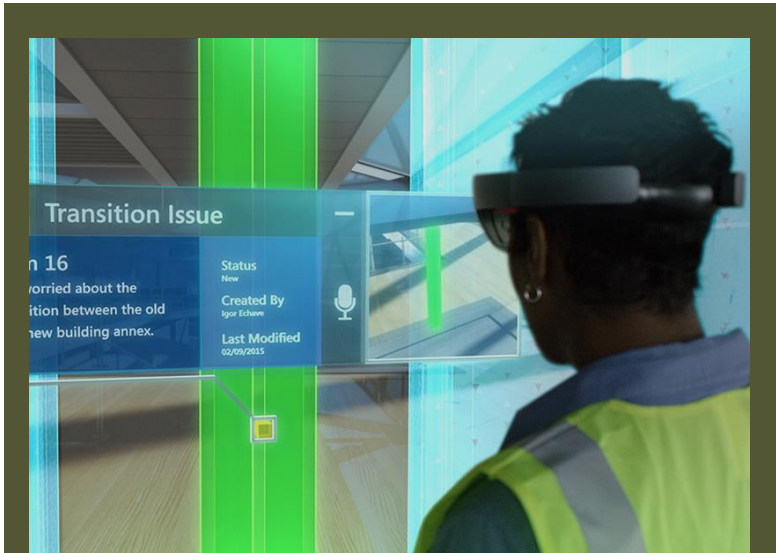
DRONES

Rapid post disaster damage assessments

Rapid overviews of construction progress in remote locations

Spot inspections on tall structures

Pipeline inspections



AVAILABLE ROBOTICS/LIDAR & AUGMENTED REALITY

- Robotics - Inspections of difficult to access spaces
- LIDAR - Checking underground structures prior to excavation
- Augmented Reality – Training of specialty inspectors
- Comprehensive job site monitoring for safety with wearable sensors
- ARE ANY OF YOU USING?

TECHNOLOGIES NOW BEING USED IN CONSTRUCTION INDUSTRY WHICH WILL IMPACT US SOON

- Artificial Intelligence & Sensors in buildings
- Virtual Reality for training
- Exoskeletons

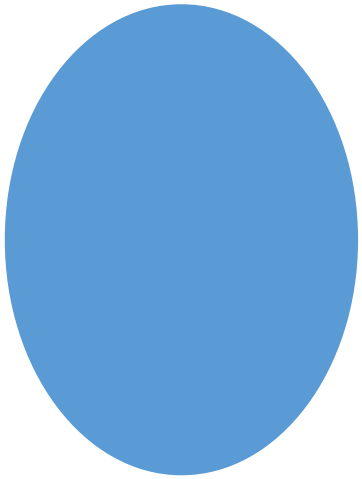
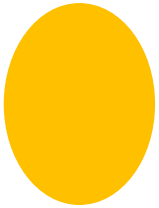
TECHNOLOGIES COMING SOON

Artificial Intelligence – Already being used by industry to identify & avoid costly design, construction and operations errors

Collaborative Virtual Reality – Already being used by AEC industry and owners to work out and monitor design issues

Exoskeletons – Can now rent robotic assist technologies

Others including – Microgrids which the IPC will track/report in 2019-2020

Cloud & Software as a Service

How many have at least one Software as a Service in your department?

Show & Tell

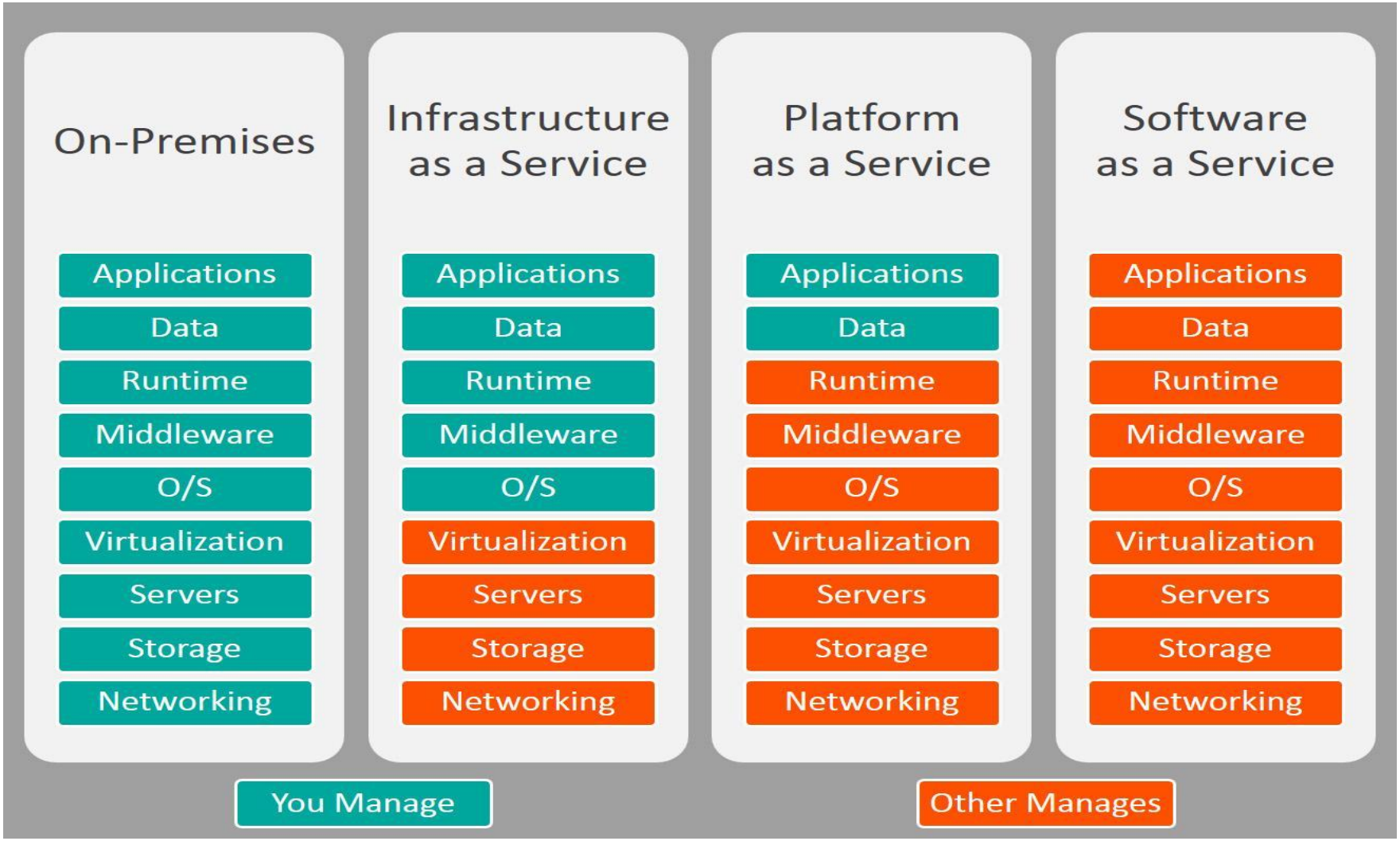
EXAMPLES OF CLOUD-BASED SAAS

- Outlook.com & Gmail
- Office 365, Google Docs
- Box & Dropbox
- Salesforce
- WebEx, GoToMeeting, and Zoom video conferencing

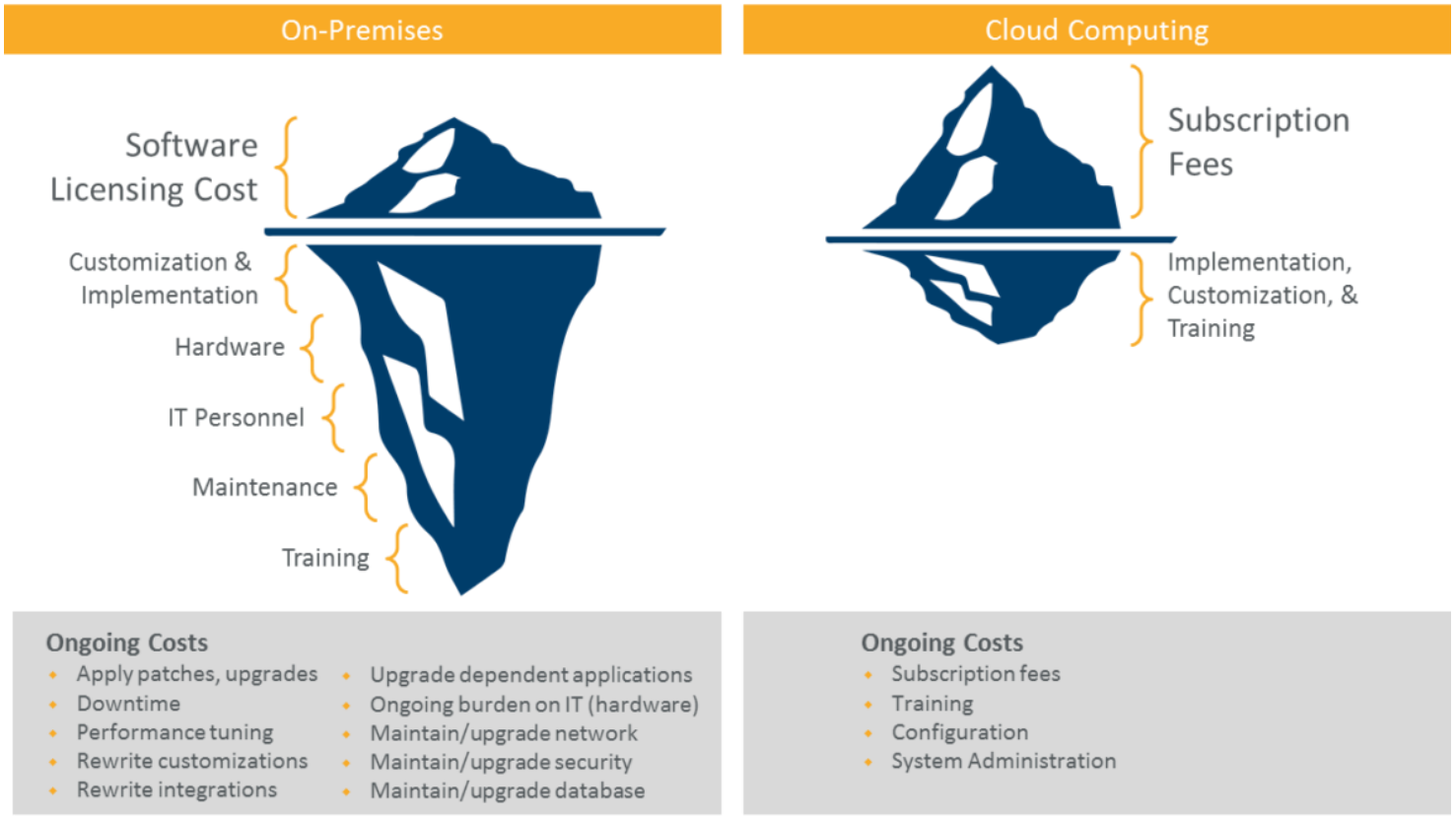
CLOUD & SAAS

- **Cloud** is web hosting, supercharged. The biggest players are Amazon (AWS), Google (Cloud), and Microsoft (Azure) and most vendors build their software on one of them.
- **Software as a Service (SaaS)** is a pricing model where you pay for access (subscription) to the software, hosted and managed by a vendor.
- Often times, we interchange SaaS and Cloud. A Cloud-hosted product is often called SaaS and a SaaS product is often hosted on the Cloud.
- Most vendors are moving to the cloud (and moving their pricing models to subscription).

ON-PREMISE & SAAS



Another way of looking at it



BIGGEST BENEFITS TO THE CLOUD

Performance	Scalability	Availability & Connectivity
• Powerful servers crunching your data.	• Add more users, easily increase server capacity.	• From any Internet-connected device, anytime.

PERFORMANCE, SCALABILITY, AND AVAILABILITY

These are hard problems. They are not the core competency of your department and may not be of your IT department.

When you buy SaaS solutions, you're outsourcing Performance, Scalability and Availability so your agency can focus on your customer service and customer experience.

→ Less Staff Time Required / Spent on Software Issues

TIPS TO FIND A GREAT SAAS VENDOR

- Talk to existing customers (by reference and back channel). Ask about if the software:
  - Loads in seconds (Performance)
  - Has remained fast over time (Scalability)
  - Is always accessible and online (Availability)

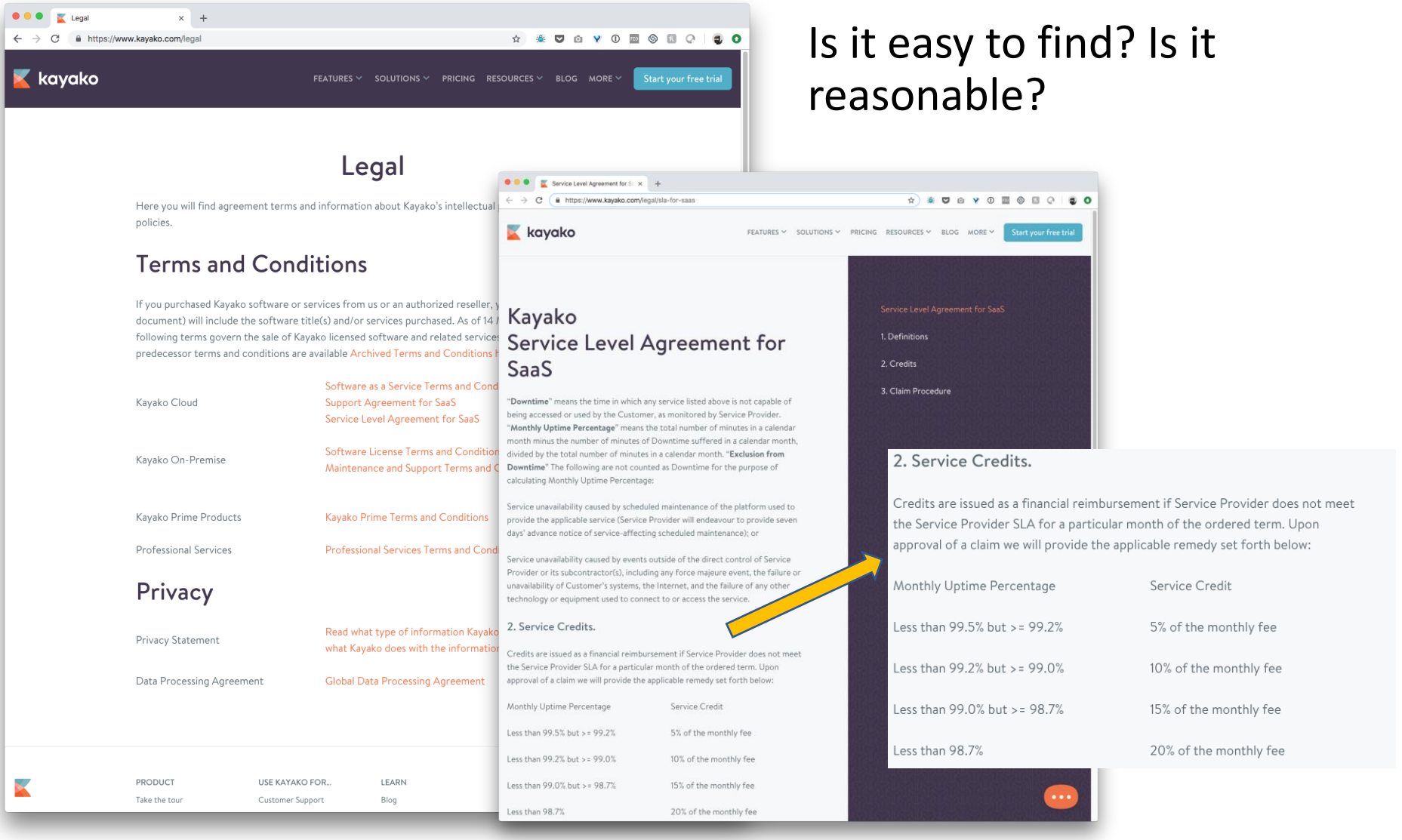
- Ask the vendor for **two** product roadmaps; a short-term and a long-term. Do you like what you see?

- Who is the last customer that switched away from their service? Why?

- Who is their most recent customer that was deployed? (And go talk to that Customer directly).

- How is support managed? Is there a ZenDesk portal or online forum? Is there a phone number to call and when is that phone staffed? What is the expected response time (SLA) for support to reply?

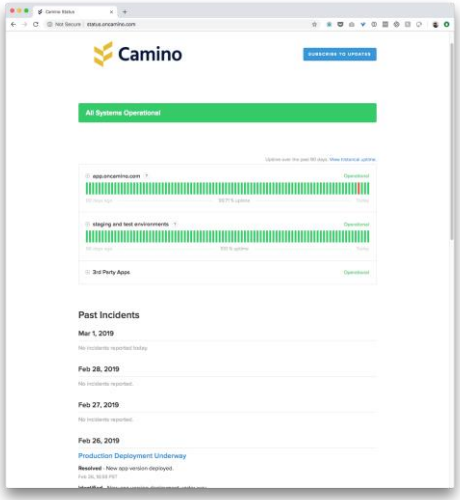
SERVICE LEVEL AGREEMENTS (SLA)



Is it easy to find? Is it reasonable?

SERVICE LEVEL AGREEMENT (SLA) CONTINUED

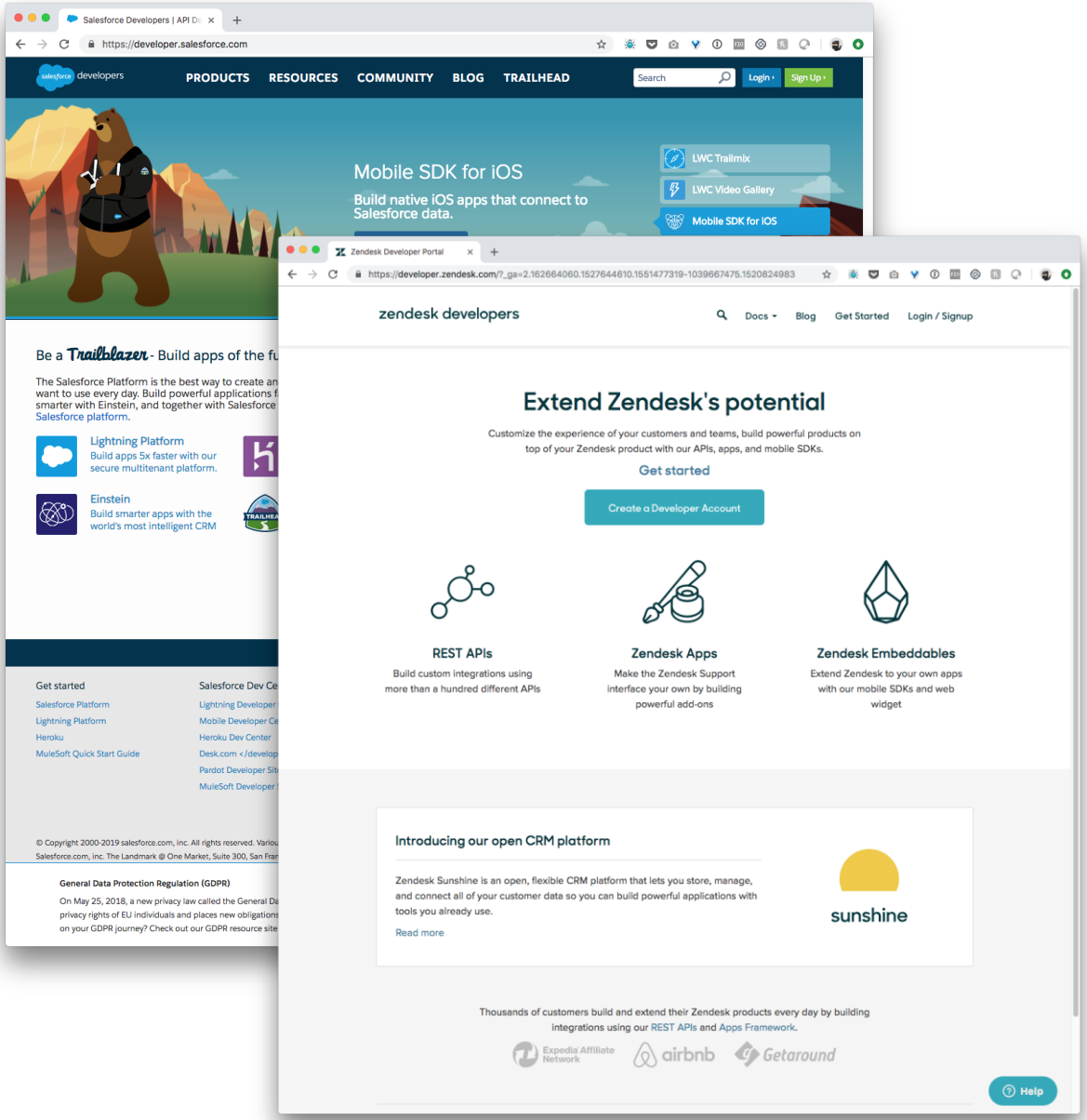
- Ask a vendor for their uptime and status.
- Be suspect if it's 100% and concerned if it's under 99.5%.
- How do they notify you of new software releases?



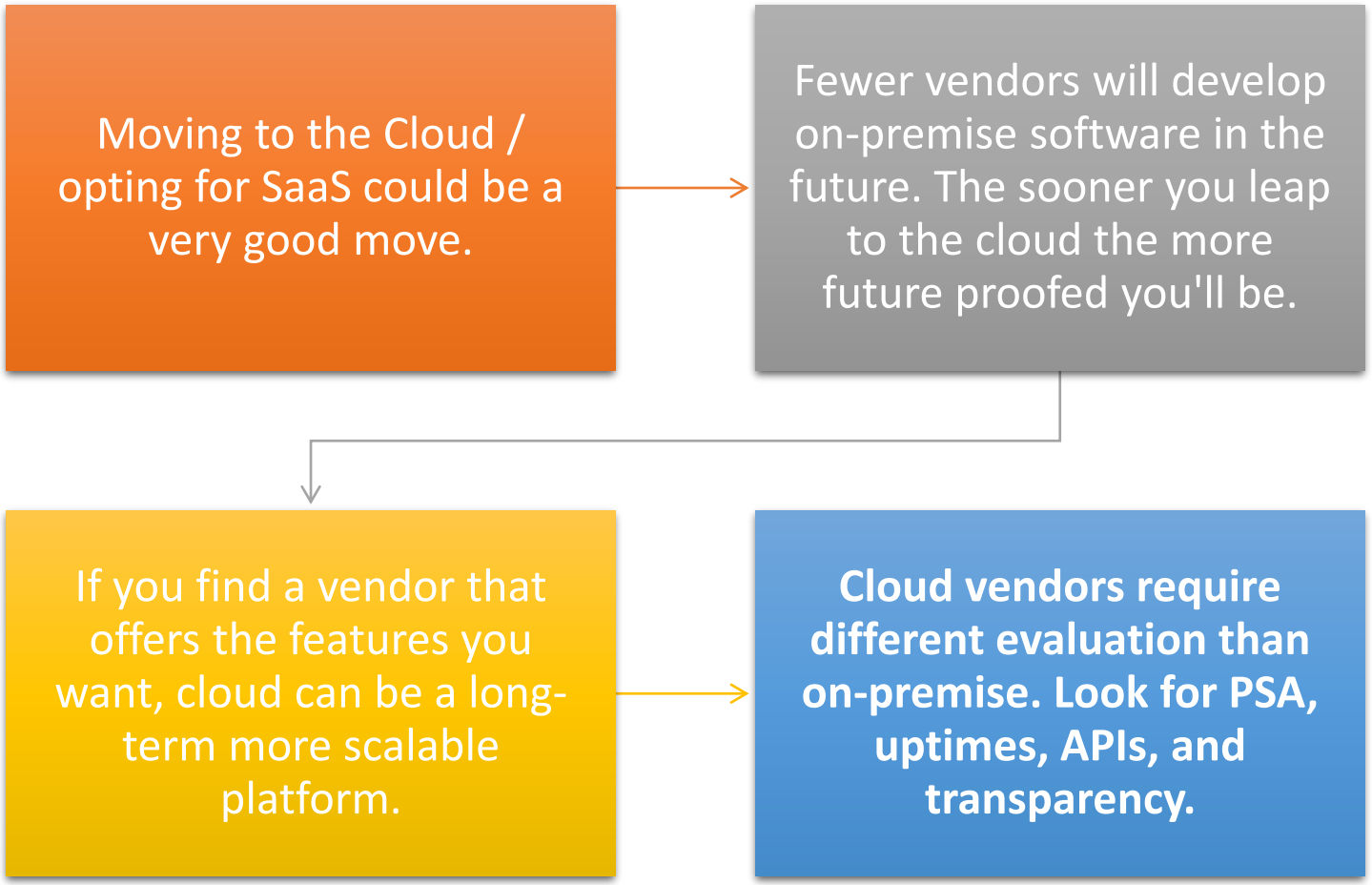
IS IT EASY TO INTEGRATE WITH OTHER SYSTEMS?

An inherent benefit to Cloud applications is that they are more accessible and (should) come with an API to increase flexibility and extensibility.

It should be easy to have data flow between applications.



SO WHAT'S THE POINT?

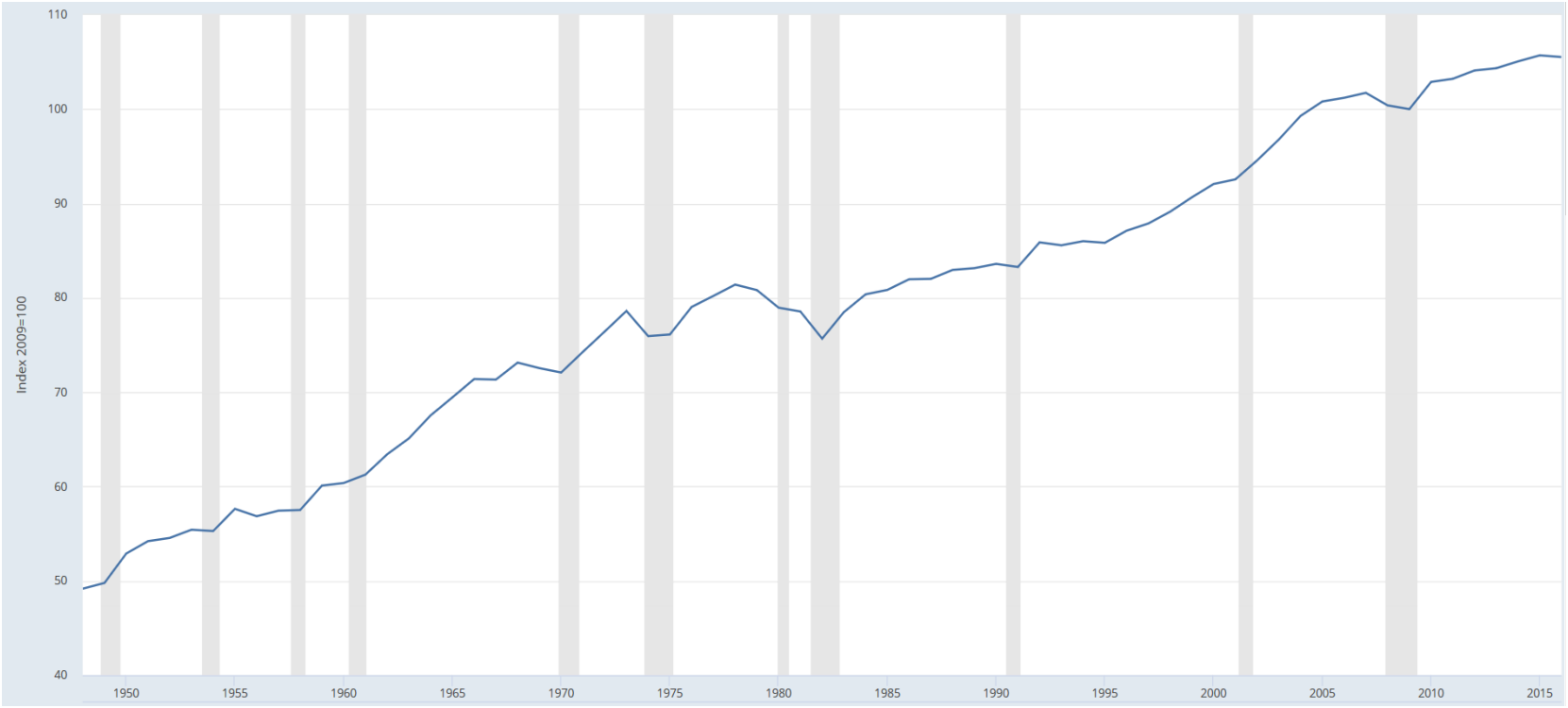


Building Department Productivity and Technology

STATISTICAL ANALYSIS

By Paul Krugman:

"Productivity is not everything, but in the long run, it is almost everything."



IMPORTANCE OF PRODUCTIVITY

Direct impact on budgets and financial aspects.

Customers are served faster and better.

When staff is productive, they feel a sense of service, accomplishment and purpose in their employment.

A building department will thrive and the overall quality and performance of work produced will improve.

The role of the building official is to remove obstacles to productivity such as reducing bureaucracy and organizational drag.

"Unfortunately, they're very good at what they do."

OUTLINE

- Present the data that was used in the analysis.
- Develop a measure of productivity.
- Examine the impact of technology on productivity.
- Determine if economies to scale are present in building departments .

DATA DESCRIPTION

Survey by CALBO Innovative Practices Committee (IPC)

Permits: Number of permits the jurisdictions issued.

Staff: Overall number of staff members in the building department.

If the jurisdiction uses online permitting, online inspections requests or electronic plan check.

Additional data was needed:

Staff: The number of building department employees dedicated to permit issuance, plan review and inspections, and excluding other employees such as ones tasked with code enforcements.

PCStaff and InspStaff: The number of plan check and inspections staff

Consult: The percentage of work performed by consultants.

SysYear: Year permitting system was deployed.

FIRST DATA SET

	Population	Permits	Staff	Online Permitting	Electronic Plan Check	Online Inspections
Mean	92,735.71	4,238.51	15.30	0.49	0.42	0.35
Standard Error	16,898.61	651.82	2.45	0.08	0.08	0.07
Median	69,395.00	3,200.00	11.00			
Mode	#N/A	3,200.00	9.00			
Std. Deviation	104,170.04	4,070.59	16.08	0.51	0.50	0.48
Kurtosis	9.45	6.06	7.37	(2.10)	(1.98)	(1.65)
Skewness	2.93	2.22	2.50	0.05	0.34	0.66
Range	495,121.00	20,043.00	79.00	1.00	1.00	1.00
Minimum	113.00	457.00	2.00			
Maximum	495,234.00	20,500.00	81.00	1.00	1.00	1.00
Sum	3,523,957.00	165,302.00	658.00	21.00	18.00	15.00
Count	38.00	39.00	43.00	43.00	43.00	43.00

SECOND DATA SET

	Population	Permits	Staff	PCStaff	InspStaff	Consult	SysYear
Mean	103,044.71	4,681.18	17.24	4.71	7.24	0.30	2005.25
Standard Error	31,532.34	874.68	4.03	1.27	1.64	0.07	2.02
Median	68,085.50	3,500.00	11.00	3.50	6.00	0.20	2003.00
Mode	#N/A	3,200.00	9.00	1.00	1.00	0.10	1999.00
Std. Deviation	117,983.22	3,606.38	16.61	5.23	6.76	0.27	8.10
Kurtosis	7.81	1.05	6.74	10.09	6.48	(1.00)	(1.40)
Skewness	2.61	1.23	2.39	2.93	2.21	0.63	0.18
Range	466,239.00	12,608.00	69.00	22.00	28.00	0.80	25.00
Minimum	3,891.00	457.00	2.00	1.00	1.00		1992.00
Maximum	470,130.00	13,065.00	71.00	23.00	29.00	0.80	2017.00
Sum	1,442,626.00	79,580.00	293.00	80.00	123.00	5.06	32,084.00
Count	14.00	17.00	17.00	17.00	17.00	17.00	16.00

PRODUCTIVITY ANALYSIS

- The output of a Building department primarily consists of permits processed through plan check, permit issuance and inspections.
- A “Regression analysis” was performed on the survey data to arrive at Building department efficiency through implementation of technology.
- Productivity and efficiency are some of the primary reasons for implementing technology in a Building department. Efficiency is producing at the lowest possible cost for a given level of output.
- The types of service offered and the business practices of each agency vary greatly and a direct comparison is not always possible.

MEASURE OF PRODUCTIVITY

PPS: Permits Per Staff Member

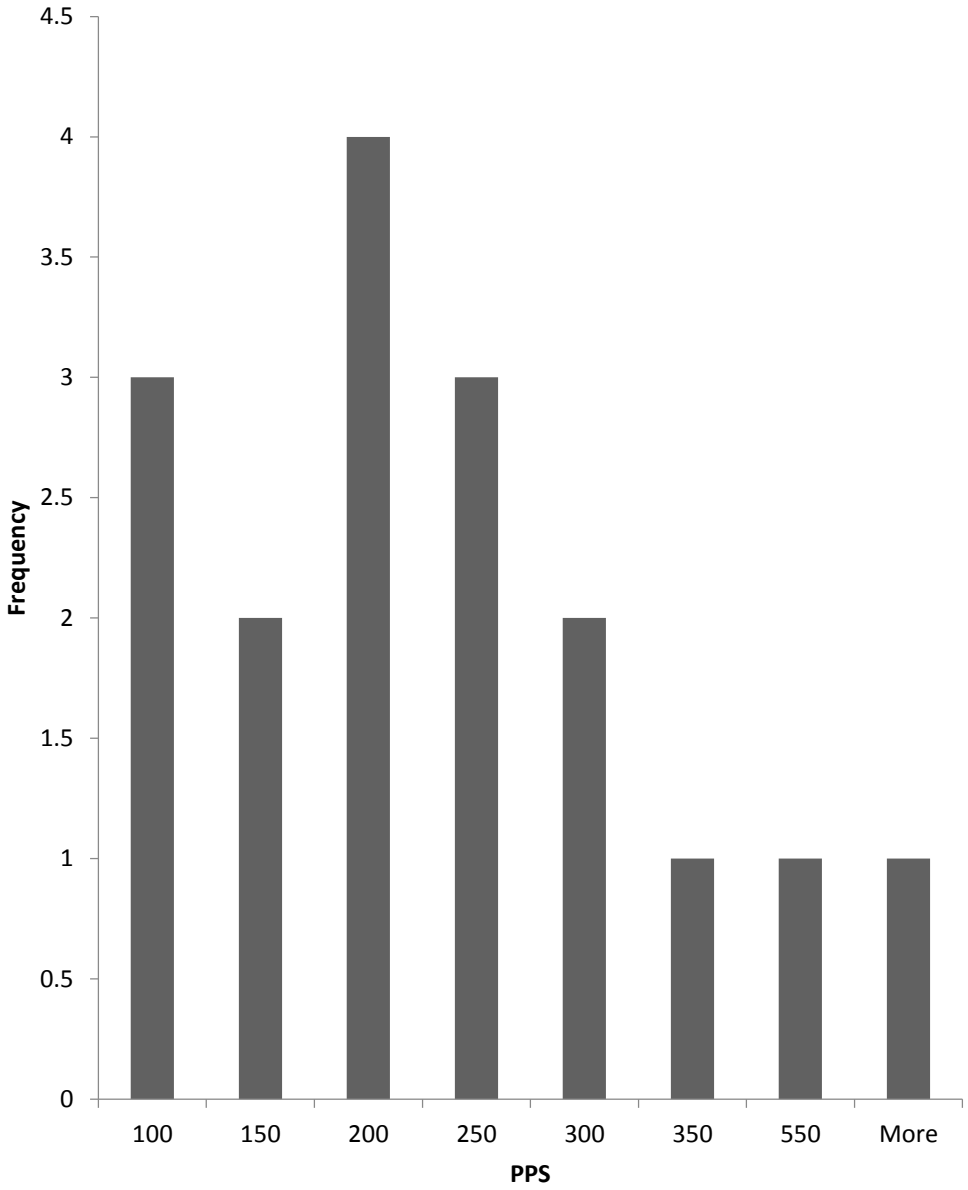
$$\frac{Output}{Input} = \frac{Permits\ Processed}{Building\ Staff}$$

Adjust for consultants:

$$\frac{Permits\ Processed}{Building\ Staff}$$

$$\times (1 - \%\ consult)$$

PPS HISTOGRAM



PPS DESCRIPTIVE STATISTICS

Average jurisdiction processes 235 permits per staff member (PPS) per year

Median is 185.

Standard deviation is 191.

The value of the standard deviation indicates that there is a high degree of variations among jurisdictions in terms of staffing.

The permit processing operation and complexity varies by jurisdiction. The PPS does not capture nor take into account the inner workings of a department, which can be a source of the variation in the data.

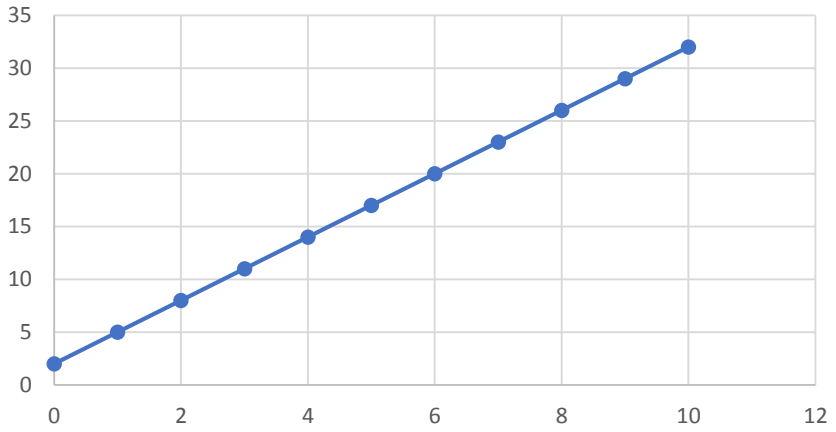
INSPECTOR TO PLAN CHECKER STAFFING RATIO

Inspector to Plan Checker Ratio	
Mean	1.907852
Standard Error	0.412503
Median	1.6
Mode	1
Standard Deviation	1.700792
Sample Variance	2.892694
Kurtosis	11.44944
Skewness	3.164165
Range	7.5
Minimum	0.5
Maximum	8
Sum	32.43349
Count	17

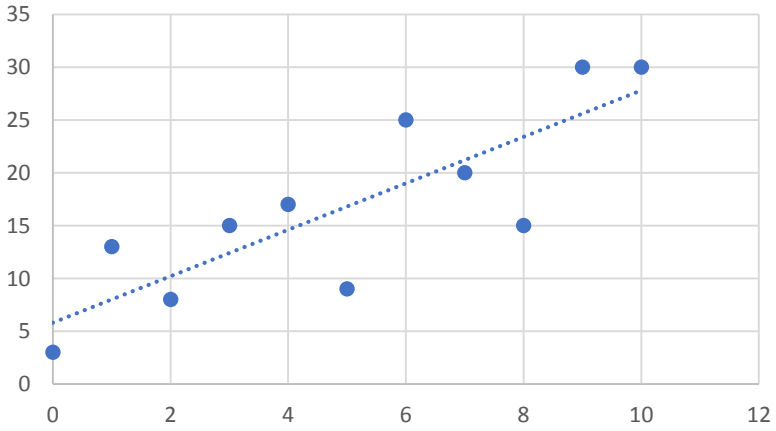
What is Regression Analysis?

$$Y = a + bX$$

X	Y
0	2
1	5
2	8
3	11
4	14
5	17
6	20
7	23
8	26
9	29
10	32



X	Y
0	3
1	13
2	8
3	15
4	17
5	9
6	25
7	20
8	15
9	30
10	30



$$Y = a + bX$$

Equation Being Estimated

$$\text{PPS} = a + \text{b x online Permits} + \text{c x Electronic PC} + \text{d x Online Inspections}$$

IS THERE A LINK BETWEEN PRODUCTIVITY AND TECHNOLOGY

SUMMARY OUTPUT			
Regression Statistics			
Multiple R	0.673158612		
R Square	0.453142517		
Adjusted R Square	0.326944636		
Standard Error	156.7454433		
Observations	17		
ANOVA			
	df	SS	MS
Regression	3	264663.3798	88221.1266
Residual	13	319398.7421	24569.13401
Total	16	584062.1219	
	Coefficients	Standard Error	t Stat
Intercept	433.7930004	86.06064059	5.040550447
Online Permitting	-240.0608672	85.7143187	-2.800709039
Electronic Plan Check	-40.36563839	83.60626686	-0.482806372
Online Inspections	-35.6917523	83.07089572	-0.429654116

WHY? POSSIBLE EXPLANATIONS?

A possible explanation could lie in the difficulty many jurisdictions have in finding the technology that effectively matches their requirements.

Jurisdictions may not be utilizing the technology to its fullest extent.

New technology might be one that needs additional staff to maintain it.

High staff turnover and having to learn the usage of the technology again by new staff.

A jurisdiction may maintain the same level of staffing upon technology implementations or now utilizing staff to improve the quality of service provided.

Additional information and data might be needed to increase the robustness of the results.


CONSOLIDATED BLIVET LLC
WEEKLY PRODUCTIVITY
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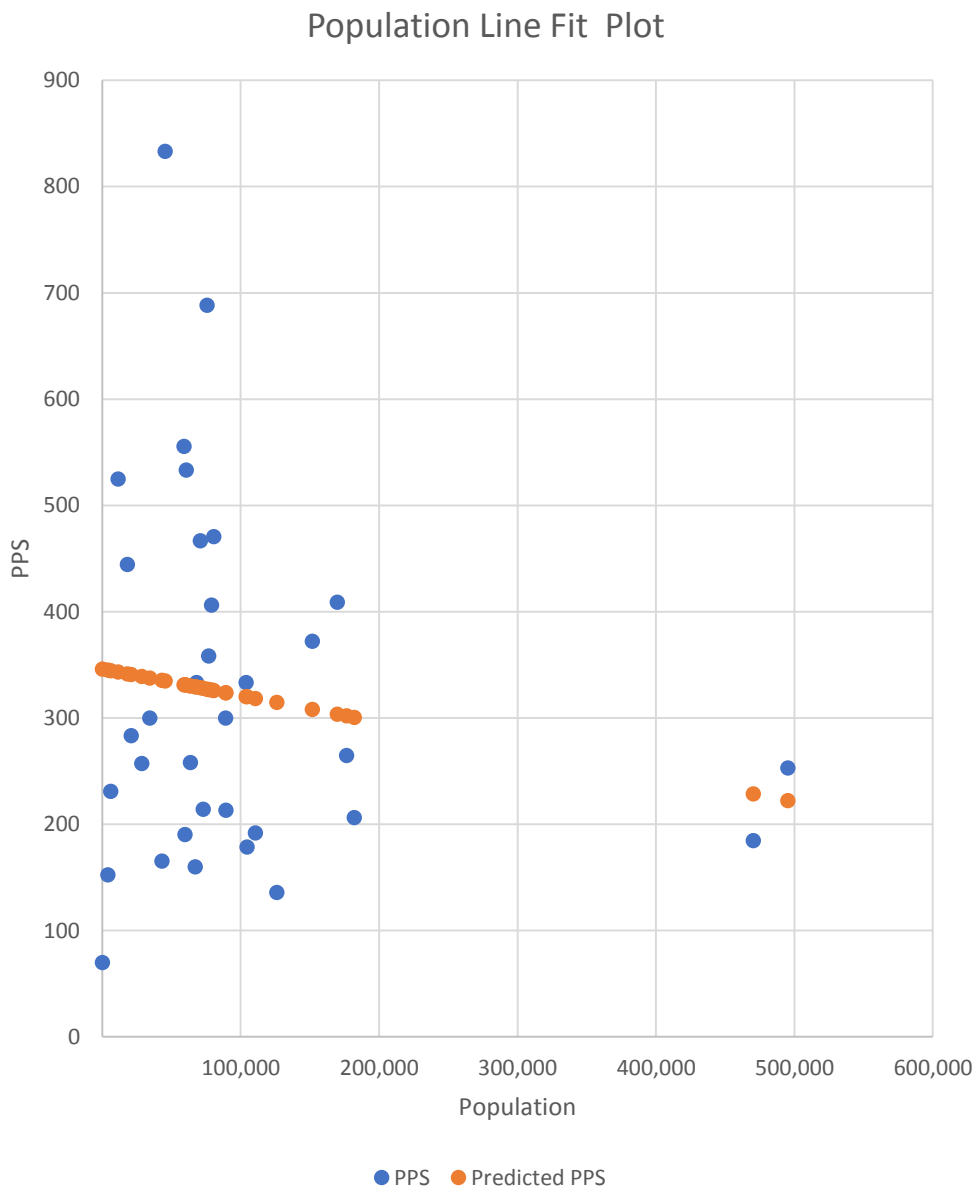
FACEBOOK CRASHED FOR TWO HOURS...

PRODUCTIVITY AND ECONOMIES OF SCALE

Are larger jurisdictions more productive? Do cities with a larger population have a higher PPS?



ANALYSIS RESULT FOR ECONOMIES OF SCALE

SUMMARY OUTPUT				
Regression Statistics				
Multiple R	0.063877			
R Square	0.00408			
Adjusted R Square	-0.02358			
Standard Error	189.548			
Observations	38			
ANOVA				
	df	SS	MS	F
Regression	1	5299.154	5299.154	0.147492
Residual	36	1293423	35928.43	
Total	37	1298723		
	Coefficients	Standard Error	t Stat	P-value
Intercept	298.5663	41.41315	7.209457	1.75E-08
Population	-0.00011	0.000299	-0.38405	0.703203

SUMMARY

- Mean PPS is 235, Median is 185.
- High degree of variation in data.
- Technology does not seem to have a positive impact on productivity.
- No Economies to Scale.
- Consider Six-Sigma approach.
- Future analysis will rely on a larger data set which can possibly change the results of the analysis on technology and refine other measures

ON LINE TOOL

http://codetools.tracksoftinc.com/default.aspx

Example :

$$Number\ of\ Staff\ members$$

$$= \frac{2000\ permits}{185} = 10.8$$

Conclusion

CONCLUSIONS

- Innovative Practices and Technology must always be used together to get the greatest efficiencies and to provide the best service.

- Keep in mind that old antiquated practices can defeat the best technology available.

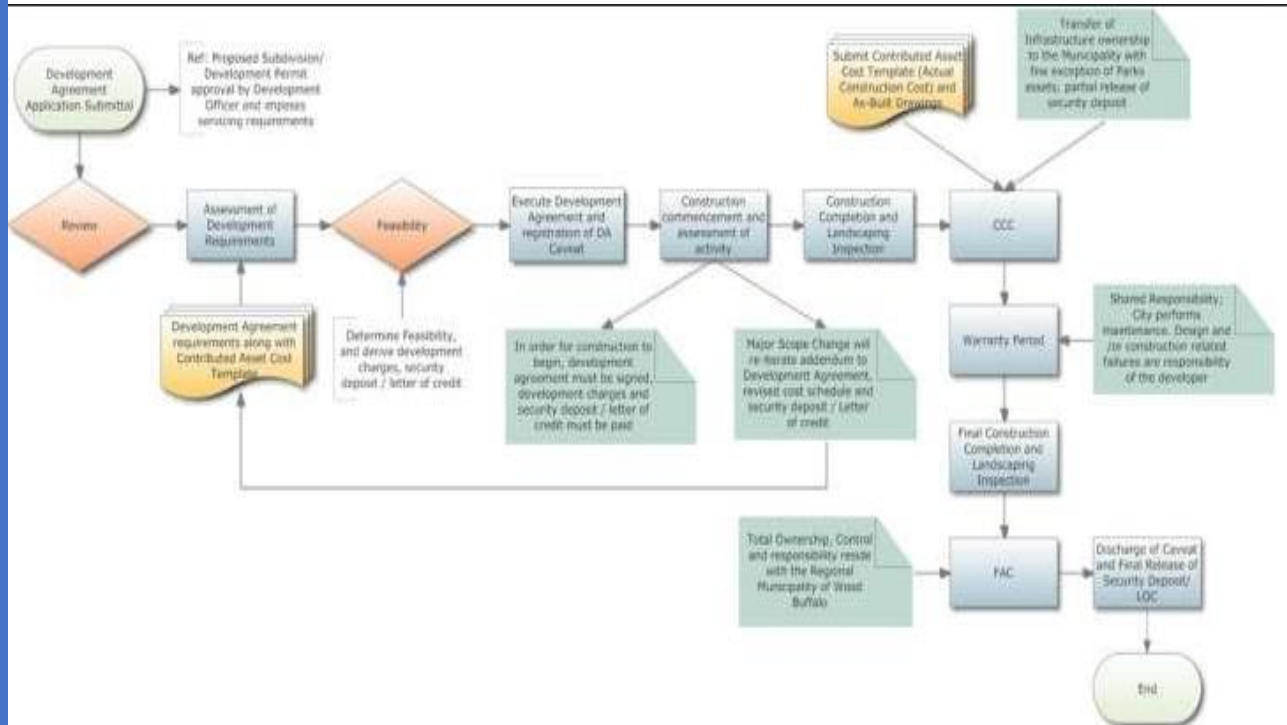
CONCLUSIONS

- Developing innovative practices can be as simple as reviewing your agencies policies and procedures and insuring that they are necessary, current, and relevant. This can be time consuming and tedious but can yield the greatest improvements especially if old requirements that are no longer relevant and are still in use.

Cavemen had a hard time
putting up their building permits.

CONCLUSIONS

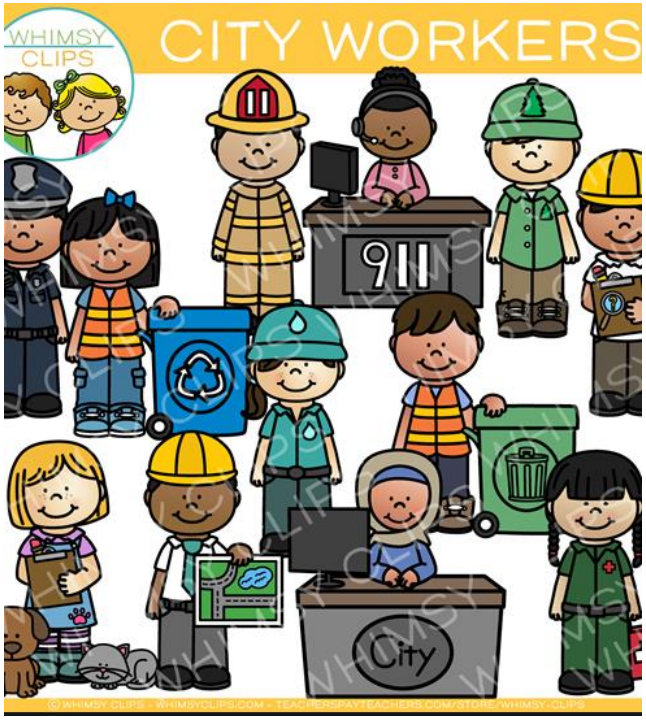
- Using new technology is not the goal, if you are using new technology for the sake of using new technology. What ever technologies and practices you use they must bring value to the table. What is the point of electronic plan check if you require the applicant to still come to the counter and deliver the drawings in electronic format and then come and pick them up?
- When considering the use of new technologies remember you will need to change your current processes to take full advantage of what ever technologies you are considering.
- Determine your needs in advance “What do you need to accomplish?”, “How should you accomplish it?”, “Who will it Serve?”, “Who will use it?”



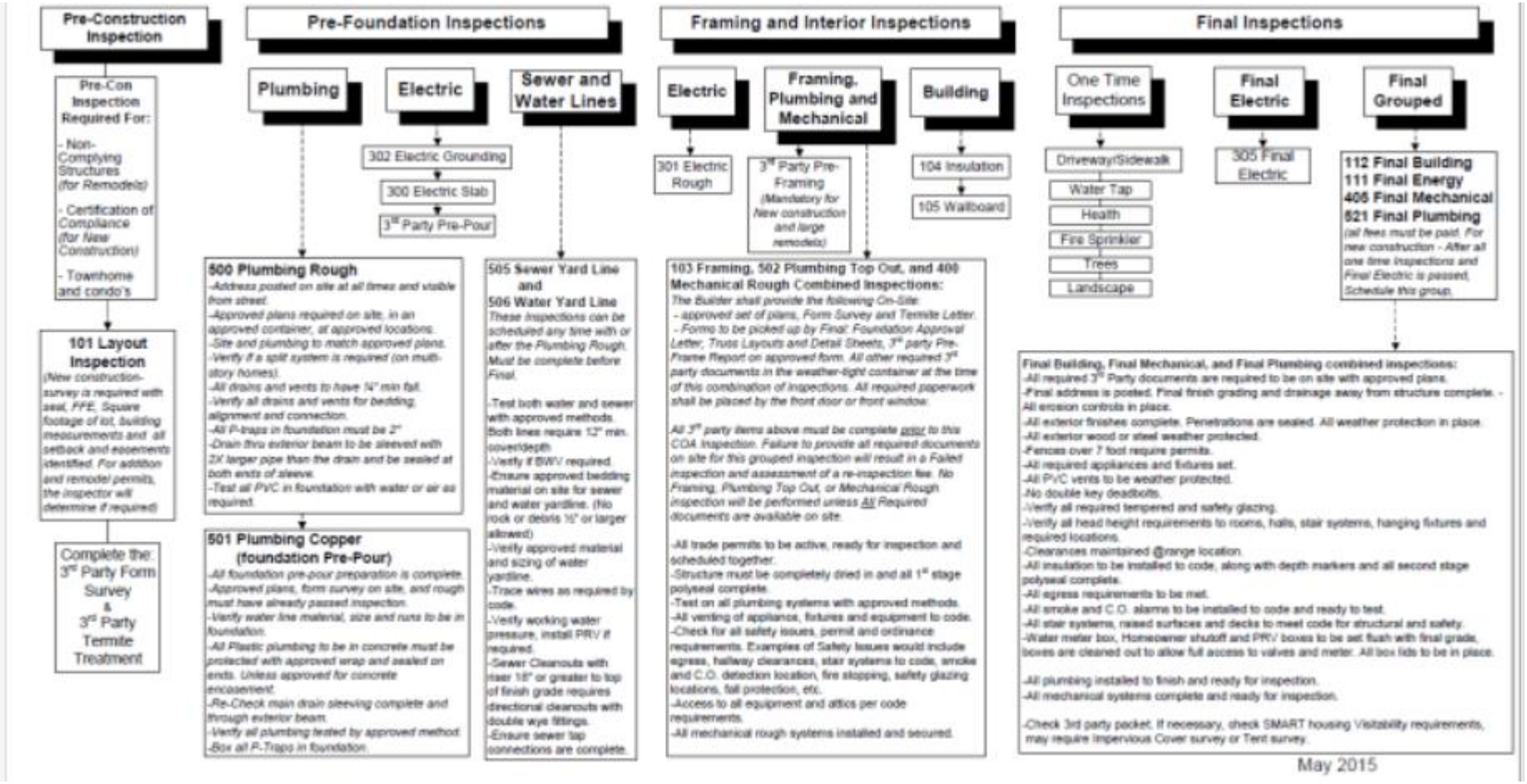
Points to Ponder

- Not all uses of technology will reduce labor cost or save labor time. So don't sell your governing body on these points. A good example is you may opt to put a little more information in to your permit system but in so doing you have now provided the information that is frequently asked by real estate agents and now they can access it them selves and directly without your staff doing the work now providing better service than before.

- Scanning in and retaining not only plot plans but construction plans can use time but allows you to offer superior service in the future when questions come up in regards to projects original size and configuration, this also may help other divisions within your agency in the future, Police Department, Fire Department, and Code enforcement to name a few.



- Fully developing a plan of how you do business, what steps are included, who does those steps and how, will set you on a path to getting software which helps you get your work done regardless of the platform or type of solution you choose.



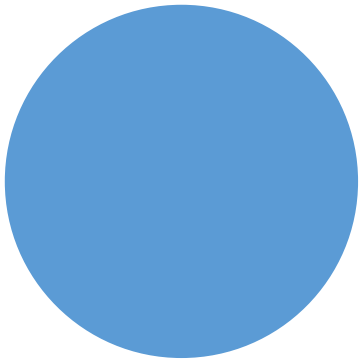
- If you fail to fully plan what you need and how to get there you will be at the mercy of a salesman that has the latest and greatest software on earth and it does everything you need.
- If you don’t know what you need how does he?

Next Step

This committee understands how difficult and complicated this topic is and we hear from our members all of the time how to get good software that works for us.

- Well, the Committee is working on a guide that will be published for your use, and is envisioned as a 35 to 40 page document covering this topic to try and give a best practices over view of how to do this.
- If there is sufficient interest in this topic, the Board may elect to create a series of classes from CALBO to assist in how to get the best software solutions for your organization.
- Your input to the Board or the Committee will determine how we move forward and what offerings are made to the membership in the future.

- Thank you for your interest in this topic.




Questions