# Measuring Engineering
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*"To win in the marketplace you must first win in the workplace"*
-Doug Conant

**Introduction**
The Software Engineering process can be assessed and measured in a number of ways in terms of measurable data, employee performance, quality of work and completeness of work etc.
Sometimes CEOs, managers and even external companies are hired to measure their employee performance to ensure that work is being completed to the highest quality and productivity is always on the rise and never plateaus. This work used to be done by the in line managers and supervisors but in the past few years employee performance and productivity has become increasingly measured using software and pre-installed programs on employee machines raising ethical concerns and a heated debate on whether this Artificial Intelligence can really measure an employee like a human can and the ultimate question – *Which is better, AI or Human measuring?*

**Ways in which the Software Engineering Process can be measured and assessed in terms of the measurable data:**

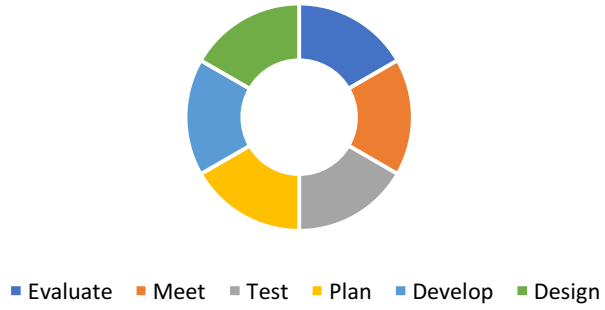
Normally the Software Engineering process can be measured and assessed in terms of measurable data. This process involves the employee to record how complete they are on current objectives or using a To-Do list. The latest general consensus between companies and employees is that every feature of a company or process is measurable and all add value to the company in some way, so if you aren't going to measure the process then don't do the process. There are many ways in which a Software Development team can get feedback about their product including simply asking the users of a program how they're finding it, we see this almost every day a website or program asks us for

feedback and some like Apple ask to send data about your usage to their data centres automatically. But why is this so important? In order to produce the Programs we love and use every day there is hundreds of thousands of hours of development involved mostly of big teams all working together to increase Bug Tracking, Automated tests, Unit tests, Bug detection and Stability of the program. For example, a Beta program may only be implemented on Unix Systems first as a test and so as to not invest too much money in it, however as popularity and testing grows on the program there evolves a need for the program to be spread across the market to Windows Systems also. This cannot happen as easily as the average person thinks and involves extensive work and measuring of employees work to find out such things as how many lines of code they write per hour, how long they spend actually working, the amount of bugs detected in the program and also development teams designed to test the robustness of a program and intentionally try to break it to test security and reliability.

Many companies keep their source code on GitHub and allow their developers to pull and push online to see who is submitting what code, what they changed on the code, to track bugs in the code and even allow their projects to be open source and allow the public to find bugs and create their own versions and 'Mods' which can be a good way to figure out what the public think about the project. If a bug is found how long did it take to be solved? How many bugs aren't resolved yet? How much code is a particular employee actually contributing to the project? How much of their code has to be rewritten by someone else to improve security or prevent bugs?

These questions all have to be answered by a project manager at some point to decide the effectiveness and contribution of their employees. The stability and productiveness of a development team directly relates to the feedback of customers and users of the software. It's important that in the long run the customers feedback is always reflected into the software i.e. there's no point creating the greatest software in the world for you but nobody else likes it, it will never take off.

In the last few years an umbrella term has been thrown around called Agile Development. IT involves a different type of programming that is less likely to cause errors, increase performance and allow cross knowledge of departments. It comprises of these main points; The code is never pushed and then tested it is always tested first, Developers work in pairs working on the same code and bounce knowledge between them and also allow a second opinion, a common codebase is shared between the team to allow everyone on the team to see everyone's work using GitHub etc. Continuous integration occurs where any developer can integrate any code at any time there is no distinct weekly code deadline, all programmers must adhere to the same coding standard across the board to ensure they can all understand eachother's code and last but not least their work environment is open to ensure that developers on frontend can interact and share things with backend developers, Unit testers and anyone else involved in the project. All of these processes involved in the Agile Development process all run concurrently and throughout the project as a whole.




**Measuring workers to assess and enhance performance**

Why do companies assess employee performance?

The primary concern for most companies is to enhance their employees performance. A relatively old method project managers employ is to create extremely high expectations of their employees which encourages employees to push towards this and not sit back and relax e.g. A Salesman is given a target of €50,000 every month of the year but November and December are the extremely busy months, if his target is not increased he will hit his target too early in the month and not put in effort for the rest of the month, decreasing company profits, productivity and performance.

Generally to increase productivity an employee should be aware of the companies long and short term goals, what drives the company and learn to act on these to increase their overall performance for example is the companies goal to expand, increase profits, boost productivity or increase customer base. If an employee can realise that their work is affecting the company in a good way will be much happier in their job and will enhance their own performance due to the realisation that their work is not going to waste. The importance of measuring employees is reflected in a 2017 survey by Gallop that revealed that 70 percent of employees in the U.S are disengaged from their workday due to their phones, social media, and their personal lives. The only one of these that cannot be directly fixed in the office is employees personal lives.
(Universal Class, n.d.)

Sometimes employees require deadlines to work towards such as by Objectives, for example, having completed the company training by Friday etc. Other deadlines could be designed quantitatively such as having made 10 sales by Friday evening. Another option to measure employee performance can be derived from their co-workers. Although this approach has many complications it can be very useful in small departments where each workers performance directly affects their co-workers work. This works by using software to send an email at the end of each day asking each employee anonymously on a survey how their co-workers were today and if they helped them or not. This type of analytics can raise many ethical concerns also such as should you really be asking other employees to essentially tell on their co-workers for low performance, also shouldn't the in-line manager be watching this and not need employees to anonymously tell on co-workers.

There is also another method of employee measuring in the office that is time management.
A worker can update staff when the complete a certain objective, or be told they need to make a sale every 30 mins etc. Their quality of work can then be

put against their time management, so it means they won't want to complete their work the quickest they'll want to complete their work the quickest with the highest quality which means their productivity is increased.

**An overview of computational platforms available to perform this assessment**

This brings me to talk about the availabilities for companies to measure their employees. There is an enormous array of services available for this exact purpose and include interactive To-Do lists such as ToDoist, Basecamp and iDoneThis. These allow basic measuring of employee data such as how many lines of code they wrote or how many bugs they found, but the employee may not be telling the truth unless it's backed up by their work. There also exists Intercom, an Irish company specialising in customer feedback and sending out grouped messages to consumers about products or at specific times including live chat with customers and to engage customers and ultimately increase companies sales.

There are also a group of applications such as DeskTime, NotWorking and WorkIQ, which allow managers and companies to track their employees engagement and productivity while using company computers, such as tracking the time spent on Categorized applications like Social Media as unproductive, others as neutral and work related applications as productive. This type of software has even been integrated for contractors so that companies can bill them for their actual hours worked and not their time spent in the office.

Other applications such as Slack and Trello allow team communication to be visualised and organised in real time on a workflow in the cloud to allow any team member to access from anywhere. It is an effective way of keeping up to date on a task and to ensure each team member is carrying their weight. The last of these applications that I would introduce to an office if I were the manager would be TinyPulse, it sends a survey to each staff member to find out the office vibe, their feelings on projects and work in general, what the company could improve on or what they excel in. These applications allow the company to get real informed data from their employees directly without

having to rely on automated systems to relay everything, they are used to help the business grow.

**Algorithmic approaches available**

These applications bring me to the point that relying on these automated systems to help in your business can be a good thing but allowing them to take over and to make decisions in the company is another issue. It may seem like a smart way to operate your business but it impacts employee rights and evolves into many different ethical issues. This process is known as people analytics and can be sued to decide whether to hire or fire someone, its redesigning the modern workplace. This would rely on a vast amount of data about a person such as their name, nationality, race, work ethic, performance, their email traffic, their presence on social media and from applications discussed above that would tell the people analytics software all of the information necessary in order to hire or fire someone.

However, this may seem brilliant and a step forward in the ever-changing modern world but is this really representational of a person, who's to say that a person isn't the best worker the company could ever have with a bit of training, or their personality would greatly increase employee morale. This type of software learns certain patterns over time and if the company had a tendency to employ people of a particular race or nationality the software may misinterpret a wrong candidate for the right choice.

This type of analytics also compromises all employee privacy and confidentiality including gaining access to their phones and computers in order to track their app usage, their email history to see how much is work related etc. Some software even requires employees to wear a distinct badge so that tracking software can see where they go within the shop and check their productivity, even to record their customer conversations and their tone of voice. This type of employee privacy is a huge ethical concern and a lot of workers would refuse to partake in such extreme measures.

These measures decrease employee individuality, trying to create a monotonous army of workers that all work the exact same as eachother, act

the same, talk the same in order to represent a company brand. It encourages individuals not to express their individuality, the thing that sets them apart in job interviews etc. Employee creativity is also greatly hampered and they are less likely to think for themselves or work off their own initiative and instead to follow orders.
(Qrius, 2017)

This process of predictive analysis uses entirely computer based algorithms to make human based decisions on behalf of the company, leading to discrimination, punishment based on predictions and past patterns before the worker has done anything wrong. For example a huge multinational bank, Credit Suisse, use this predictive analysis to gauge when a worker is likely to quit their job using past experiences of employee behaviour to make this decision in which they will be told to fire someone before they have even had the chance to say anything. The study of human behaviour requires rational thinking and decision making, computers cannot think rationally so how can these algorithms be employed by huge multinational companies raising no ethical concerns?

**Augment or replace with automated systems**

The potential for Artificial Intelligence has greatly improved over the last few years with new inventions such as Siri, the Google driverless car, the Google glasses, and many industries becoming increasingly automated such as the airline industry. Nowadays pilots don't even fly their own planes the autopilot does, airline check in is done from a computer without any staff present and you can even scan your passport to gain access to customs without having being screened by an officer. Does this improve our quality of life or should be just fear about our jobs being taken over by automated processes?

Thirty years ago there were thousands of bank tellers around the country, today there are hundreds of thousands of ATMs and a handful of bank tellers. Does this say anything about automated systems, the jobs that many have are going to become increasingly automated. But where does this stop? In thirty more years will we be able to inject a chimp into our body that will make us

faster, stronger like an exoskeleton or to regrow a limb like other mammals can do?

Many experts predict that it's not entire jobs that will be automated but the activities performed to be automated to make the employee's job easier, to process more and increase productivity, which will ultimately involve staff being let go to accommodate less work needing to be done. If the U.S automated every activity someone can be paid to do it would save close to 2 trillion dollars annually. Also surprisingly enough the same study found that persons of authority such as CEO's have a huge amount of tasks that can be automated more than the average low skilled worker.
(Chui, et al., 2015)

A great example of a company which was founded on the use of AI to help build company growth without replacing anyone would be Assist. Assist is a tech start-up that works as a live chat for customers and staff to answer frequently asked questions. Assist uses a vast library of previously answered questions in a database that when someone asks a question it pulls the correct answer from the database leaving employee time to answering new questions to increase the size of the database. This method of business is hugely popular and decreases the staff necessary by a massive amount. Imagine all of the call centres around the world that could be replaced with technology like this. Savings millions of dollars per year in salaries of workers and instead spending a few thousand each year to maintain the database.

Although, recently many surveys around the world have found that in a world where every process is becoming more and more digital, such as even ordering in some restaurants from a computer tablet instead of a real human interaction of a waiter/waitress coming and taking your order, the world is craving this interaction. The world wants and finds a need for human interaction so much that this lack of interaction is turning many people away from companies. E.g. this lack of interaction is so widely hated that many people will refuse to call their bank and will rather go into a branch to get their query answered instead of taking twice as long for a machine to get you to the

person you need to talk to. Ireland's very own revenue system is among one of the most hated companies to deal with majorly due to the fact that it's next to impossible to find a person to answer your question rather than dealing with a machine which is a generalised service instead of a personalised one.
(Gaskell, 2016)

**Ethics concerns associated with this kind of analytics**

There are a huge number of ethical concerns in this process for employees, these analytics are subjective and by that each employee must be treated the exact same in every aspect prior to being assessed and evaluated. The same criteria must be used for everyone, if different ways to rate your employees are used in different departments the accurate rates of each employee can differ greatly and can be unfair and unethical.

If the person who is rating the employees e.g. a manager etc. has any feelings towards the employee in question albeit, friends, partner, co-worker or even a dislike towards them, this decision needs to be based purely from their work and not these feelings which will affect decision making. This is an advantage of using machines or an external company to monitor activity as they have no prejudice towards any employees and only ever see an employee as their name or their employee number and their work done. This can be an advantage or disadvantage as the person could be a great worker but brings the wrong type of atmosphere to the office and doesn't communicate with others to develop the project but on paper it could look like they contribute a lot.

For example, if you were a company recruiter and your friend wanted a job and you had the power to give him the job but you know he would be completely unsuitable for it you need to have some ethical concerns and remove the friendship factor and ask yourself would you hire your friend for the role if they weren't your friend.

The ethics surrounding these analytics depend entirely on human behaviour not on machines. The human concerns involve sometimes unfair or prejudiced decisions and would involve another set of data analytics to find someone who doesn't have any prejudice toward any employees involved to allow them to conduct the process. Sometimes the right answer could be to use computers to find the best candidate along with the human based decision so they can see who should get the job.

Ethics in modern companies has become a huge part of their code of conduct and behavioural rules, companies generally like employees to behave in a mannerly way, to dress appropriately, to have integrity, accountability for their work, string teamwork and commitment. However, how can companies expect all of this when in return they are invading their worker's rights to privacy and confidentiality by accessing their belongings to track their productivity and how long they spend actually working. If a company expects integrity, honesty and commitment then shouldn't the employee expect the same in return, trust in their work.
(McQuerrey, n.d.)

**Conclusion**

While the rise of Artificial intelligence is on the rise at the moment and not looking like it's going to slow down any time soon it brings about both enthusiasm and fear from two separate types of people. At the moment the measuring of employees performance is our only worry as machines cannot think like a human, making rational decisions and having human-like behaviour. For the moment the way Artificial Intelligence is being used generally in the workplace is tolerable as it is being used as a secondary measure and as a second opinion on what the rational thinking of a human thinks what is right.

In the Software Engineering process the ability to gather measurable data from the employee by using things such as their code added, their contributions, their knowledge of the system, their bug tracking and resolved problems from GitHub using the API to interrogate and find out details about the project and

contributors to add to a graph etc. However, for the average person in a 9-5 office job doing many different things all day it is very hard to accurately measure data using applications unless by objective or quantitative approaches and in my opinion should be left to personal judgement based from a manager/supervisor who can see the situation from the inside and evaluate the work that each worker contributes to the projects.

For someone applying to a job and to have their personal information being taken and used by the new prospective company in order to decide to hire them or not I think is greatly unfair as factors such as race, nationality, age, disabilities will play a big factor when automated systems begin to notice a pattern in employees who have been hired and haven't. I don't agree with this situation at all, as well as being judged purely on paper and not by your behaviour, knowledge and individuality as well as creativity is a huge disadvantage to the average person applying for a job, who may not have the degree on paper but will probably make the best fit for the office.

Companies are focusing too much emphasis on getting an employee pool of the exact same people to represent them with no individuality, just workers who have the right attitude and all act the same as eachother in order to predict their behaviours and less on what they could contribute to the company.

Obviously in today's society the ability to measure the productivity of your employees is a huge advantage knowing who does well at which tasks can lead to streamlining your business and let the people that are the best at each task perform them, which in turn reduces errors such as bugs and also allows them to be fixed easier.

The measuring of employees has a huge amount of pros as well as a lot of cons, it's hard to choose which outweighs the other, although if you ask the younger and older generations which way they'd choose I'm sure the results would differ greatly, and maybe we are just being awkward that this is the way society is going and one day we will all be measured on everything we do and graded against one another.

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