00:00

[Music]

00:04

amazon is the world's biggest retailer

00:06

and its ceo jeff bezos is the world's

00:08

richest man

00:09

for one very good reason his company is

00:11

better than anyone else

00:13

ever at giving people what they want

00:15

quickly amazon acquired its undisputed

00:17

status as the heavyweight champion of

00:18

the retail universe

00:19

thanks largely to its lightning fast

00:21

delivery times the astonishing feat of

00:23

ferrying hundreds of millions of items

00:25

from guitar strings to saucepans to car

00:27

parts directly to your door

00:29

inside 24 hours is nothing short of a

00:31

modern logistical miracle

00:33

so how does amazon do it a super smart

00:36

army of slave robots for one

00:38

ingenious if occasionally unscrupulous

00:40

management practices are part of the

00:41

answer too

00:42

and the modern day voodoo of deep

00:44

learning ai all of which are made flesh

00:46

in the most advanced stock rooms the

00:48

world has ever seen

00:49

so join us today as we button up our

00:51

hybris jacket and journey inside

00:53

amazon's smart warehouses

00:55

in the year to september 2020 with the

00:57

global economy and the teeth of

00:59

coronavirus and the bleakest employment

01:01

outlook in history

01:02

amazon reported global revenues of

01:03

little under 350 billion dollars

01:06

that's roughly double what it earned in

01:08

2017 by the way

01:10

only three short years earlier not bad

01:12

for a company which only started trading

01:14

in 1994.

01:15

amazon has built its empire on a

01:17

platform of sheer unbeatable convenience

01:19

for the end user

01:20

you the customer need a product so you

01:23

open the app or have a quiet word with

01:24

alexa and next day

01:26

hey presto it's sitting on your doorstep

01:28

moving products from a to b

01:29

quickly is not easy compared with other

01:31

modern technology giants which barely

01:33

need to exist in the real world

01:34

think of netflix google or facebook

01:36

amazon needs to shift an astonishingly

01:38

vast amount of sheer bulk

01:40

safely precisely and quickly all day

01:43

every day so how does it do it last year

01:46

a senior amazon executive described

01:48

amazon's warehouses rather poetically

01:50

as a symphony of humans and machines

01:52

working together

01:53

how does this symphony actually work

01:55

let's take it from the top

01:56

before you've even logged onto its

01:58

website amazon has a fairly good idea of

02:00

what you're going to buy

02:01

this is all down to the semi-occult 21st

02:04

century abracadabra that is deep

02:05

learning ai

02:06

which amazon has been leveraging to

02:08

incredible effect since around 2015.

02:10

put simply an algorithm makes some

02:12

assumptions about you

02:13

based on your age location socioeconomic

02:16

background and purchase history

02:17

it will then hours days or even weeks

02:20

before you actually log on ensure that

02:22

your local warehouse is stocked with

02:23

appropriate quantities of stock you're

02:25

likely to consider buying

02:26

this might be a certain style of racy

02:28

swimsuit that the algorithm anticipates

02:30

will be the hot new must-have come

02:32

springtime

02:32

it might be the paperback novel for a

02:34

soon-to-go viral tv adaptation

02:36

in january 2020 for instance amazon's

02:39

algorithm correctly anticipated high

02:41

incoming demands for face masks

02:42

and well we all know what happened there

02:44

so amazon's smart warehouses

02:46

also known as fulfillment centers not to

02:48

be confused with their post

02:50

office style sortation centers very

02:51

often know what you want

02:53

even before you do or at least they know

02:55

the very second you click

02:56

buy now in the case of those wine

02:58

inspired late night impulse buys

03:00

once you've clicked our symphony begins

03:02

in earnest

03:03

you may have read headlines in recent

03:05

years suggesting amazon workers walk as

03:07

many as 12 miles per shift

03:09

darting about between shelves

03:10

frantically picking up items

03:12

that's no longer quite true amazon's

03:14

modern fulfillment centers are largely

03:15

patrolled by an army of squat roomba

03:17

like robots that pick up whole shelves

03:19

also known as pods and bring them to a

03:21

human picker situated at a stationary

03:23

workstation

03:24

amazon's enlistment of this whirring

03:26

battalion began in 2012 when the company

03:29

purchased robotics company kiva systems

03:31

the market leader in warehouse

03:32

automation for an eye-watering 775

03:35

million dollars cash

03:37

the company's flagship model commonly

03:38

referred to as kiva

03:40

is around 30 centimeters high and

03:41

capable of lifting 450 kilograms in

03:44

weight

03:44

whilst traveling at around 3 miles per

03:46

hour the substitution of these squat

03:48

orange automatons in place of dashing

03:50

human workers makes a colossal

03:52

difference to amazon's bottom line

03:53

it's been estimated that amazon's

03:55

warehouses can now hold 50

03:57

more stock and retrieve that stock three

03:59

times faster

04:00

this reduces the overall cost of

04:02

fulfillment by some 40

04:04

cheaper quicker warehouses mean products

04:06

that are more affordable for the end

04:07

user

04:08

and crucially products that are much

04:09

more likely to be on the van driving

04:11

down your street the following day

04:13

amazon isn't about to stop there in a

04:15

move that could be described as either

04:16

ruthless or inspired

04:18

upon purchasing kiva jeff bezos changed

04:20

the name of the company to amazon

04:22

robotics

04:22

and told all previous kiva customers

04:24

household names like gap

04:26

walgreens and staples they'd no longer

04:28

be allowed to buy new kiva technology

04:30

this of course gives amazon an

04:32

incalculable competitive advantage

04:34

since rolling out the kiva robot across

04:36

its fulfillment centers by 2018 they had

04:39

100 000 of them by now that

04:41

has comfortably surpassed two hundred

04:42

thousand amazon robotics has been

04:44

refining the design still further

04:46

the new iteration of kiva known as

04:48

pegasus is 10 centimeters shorter

04:50

meaning more can be stopped on top and

04:52

uses half the parts so it's cheaper to

04:54

manufacture and maintain

04:55

amazon says pegasus can lift a hefty 600

04:58

kilograms and can be customized with a

05:00

conveyor belt to work in the sortation

05:01

centers

05:02

where amazon reports errors in delivery

05:05

have been halved

05:06

thanks to pegasus naturally amazon isn't

05:08

quitting there last summer it announced

05:11

a newer thinner robot still

05:12

called xanthus and coming to a

05:14

fulfillment center near you

05:16

so how do these pimped out room bars get

05:17

around without knocking into each other

05:19

all the time

05:19

cloud-based software operating what can

05:21

fairly be described as an ai run air

05:23

traffic control network

05:24

coordinates the route of every single

05:26

robot this is

05:28

all about optimization what's the

05:29

quickest route to get to a product that

05:31

won't interfere with other robots on

05:32

their own runs

05:33

what's the optimum speed acceleration

05:35

and deceleration as many as 800 robots

05:38

can be deployed at any one time on the

05:39

warehouse floor although in practice the

05:41

numbers tend to be kept lower to avoid

05:43

traffic jams

05:44

when their batteries run low the robots

05:46

are instructed to find the nearest

05:47

charging station

05:48

since robots took over the warehouses

05:50

changes have been implemented to

05:52

improve their working conditions

05:53

skylights for instance are now covered

05:55

up so the robot's sensors aren't

05:56

confused by glare

05:58

air conditioning units that blow

05:59

downwards in areas where humans work

06:01

now blow sideways so as not to topple

06:03

delicate items from the tops of moving

06:05

shelves

06:05

to navigate a camera on the robot's

06:07

undercarriage reads qr codes embedded in

06:09

the floor

06:10

and individual sensors help the robot

06:12

slow or swerve to avoid obstacles in

06:14

their paths

06:15

compared with these scurrying warehouse

06:17

servants some other robots working at

06:19

amazon look almost

06:20

humdrum and conventional the so-called

06:22

robo-stow robotic arm for instance

06:24

wouldn't look out of place in an

06:25

old-school car factory

06:27

except it can lift a hefty 1200

06:29

kilograms and manipulate shipping

06:31

pellets to within a tenth of a

06:32

millimeter accuracy

06:34

there's also the labeling robots

06:35

nicknamed slam machines by human

06:37

co-workers for their relentlessly

06:38

percussive racket

06:39

these can label up to one package every

06:41

second and for a hint of what will

06:43

happen in the coming years

06:44

amazon recently purchased canvas

06:46

technologies a firm specializing in

06:48

autonomous robotic carts

06:50

just picture the most sci-fi drinks

06:52

trolley you can imagine

06:53

robots of course are only part of the

06:54

story inside amazon's smart warehouses

06:57

even the company's most fervent

06:58

futurists admit the notion of complete

07:00

automation is a decade away

07:02

and even then probably won't happen so

07:04

what of the human side

07:05

amazon's management techniques in

07:07

concept with all that automation

07:08

have made the business astonishingly

07:10

lean and mean by historic standards

07:12

in 2016 it was estimated that by

07:15

bringing everything in-house

07:16

as opposed to all the duplication

07:18

inherent in a standard high street or

07:20

shopping mall

07:20

amazon requires only half the employees

07:22

a traditional retailer mine

07:24

per 10 million dollars in sales what are

07:26

all these humans

07:27

hundreds of thousands across the world

07:29

actually doing that well since kiva and

07:31

its robotic airs took over

07:32

there's much less rushing around than

07:34

they used to be but there's still plenty

07:36

of tasks requiring dexterity and problem

07:38

solving

07:38

the two most common roles still done by

07:40

humans are stowing and picking

07:42

when goods arrive at the fulfillment

07:43

centers they're stowed by humans onto

07:45

shelves or pods to be collected later by

07:48

the robots

07:48

the pickers then pick the specific item

07:50

from the shelves when the robots come by

07:52

then send it on to be packed workers on

07:54

the picking side are encouraged to work

07:56

fast in order to maintain their

07:58

so-called rate if workers rate falls

08:00

below expectations

08:01

employees can be disciplined and

08:03

ultimately sacked according to one

08:05

ex-employee this rate can be challenging

08:07

to fulfill

08:08

120 items per hour when they started at

08:10

the company rising as high as 280 items

08:13

per hour just three years later

08:15

errors are also punished according to

08:17

the same ex employee

08:18

workers were once permitted one error

08:20

per 1 000 items but now they're only

08:22

allowed one per 2

08:23

200. the rates only get more challenging

08:26

during prime day when sales on amazon

08:28

skyrocket

08:29

one way amazon encourages workers to

08:31

make rates is through gamification or

08:34

making the whole thing into a game

08:35

so instead of a plain old-fashioned

08:37

graph telling workers where their

08:38

productivity stands in relation to the

08:40

rate

08:41

workers instead play and compete on

08:43

in-house games with names like

08:44

picks in space mission racer or castle

08:47

crafter

08:48

so essentially the faster and more

08:50

accurately employees pick stock the

08:52

faster their little pixelated car moves

08:54

around the track

08:55

other incentive schemes such as in-house

08:57

currency swag bucks

08:58

reward hard work with amazon branded

09:00

merch such as water bottles or t-shirts

09:02

amazon has regularly found itself in the

09:04

firing line for its intense working

09:06

practices

09:07

according to reports as many as 14 000

09:10

serious injuries occurred at amazon

09:11

sites in 2019

09:13

a per employee rate of nearly double the

09:15

industry standard

09:16

deaths are infrequent but not unheard of

09:19

in the uk alone during the three years

09:20

to 2018

09:22

ambulances were called to amazon

09:23

warehouses 600 times

09:25

for its part amazon is keen to stress it

09:28

invests tens of millions of dollars into

09:30

workers safety awareness programs but

09:32

there's no denying injuries spike around

09:34

prime day

09:35

so are amazon's ultra efficient

09:36

warehouse is ultimately a force for good

09:38

while kovid 19 laid waste to vast

09:41

swathes of the conventional retail

09:42

landscape

09:43

this year amazon has been processing up

09:45

to 40 more orders than expected

09:47

in the month leading up to march 23

09:49

alone toilet paper sales increased 186

09:52

percent

09:53

sales of cough medicine skyrocketed 862

09:56

and children's vitamins went up 287

09:59

plainly in a world where going to the

10:01

shops can be a risky business

10:02

amazon is fulfilling a need and as such

10:05

ever greater numbers of people are

10:06

relying on it

10:07

will the robots steal our jobs then the

10:09

outlook is unclear

10:10

but within amazon it's plain to see that

10:12

humans are still needed for many aspects

10:14

of the work

10:15

and even if robots can one day stow or

10:17

pick as fast as humans

10:18

dealing with many crises like leaking

10:20

paint pots on a fast-moving conveyor

10:22

belt or identifying ripe bananas on site

10:24

will still need the human touch for some

10:26

time to come whatever the future brings

10:28

amazon's new 40 million robotics lab

10:31

just outside boston for instance or its

10:33

tantalizing patent for airship like

10:35

floating fulfillment centers

10:37

one thing can be guaranteed as long as

10:39

we're all buying

10:40

amazon will keep on delivering

10:48