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Problem Solving and Decision Making

A problem with heat during the summer in a DHL warehouse

Abstract

When we want to define a complex problem, we need to first consider the characteristics that define it, then analyse those characteristics, and then conclude. When attempting to define a complex problem, it is imperative that we never lose sight of the fact that it is distinct from a complicated problem. Although at first glance the two categories of issues may appear to be rather comparable to one another, there are several crucial distinctions between them.

Complicated problems are difficult to resolve, but they are not difficult to characterise. Constructing a vehicle is a challenging endeavour (there are a lot of components that need to be put together). However, the ultimate problem or

objective is simple to articulate. We intend to relocate with the assistance of an automobile.

Due to the complexity of the issue, it is frequently challenging to articulate what the problem entails and, as a result, what must be resolved. There might be several interface problems inside the game, some of which are more evident than others. It may also be challenging for the individuals or groups working on a project to get a consensus on the relative significance of the interaction difficulties that arise.

In most cases, it is possible to break a difficult problem down into its component elements. Using an automobile as an illustration, we can say that it is complicated because it has several different parts that all have their own purpose and that we are able to disassemble and reassemble without much difficulty. When referring to a difficult problem, people will frequently say that it exists in a "closed system." This indicates that you can describe the beginning of the system as well as its conclusion.

It is frequently difficult to specify where the system begins and ends, as well as what is influenced by the system and what, in turn, is impacted by the system. Open systems, on the other hand, are rife with the potential for posing complex challenges. Non-linearity is a hallmark of complex issues. Not only is it challenging to dissect a complex problem into its component elements, but it's also tough to grasp how those components engage in conversation with one another or with outside influences.

A challenging issue, but one that may be anticipated. To continue with the analogy of putting together a car, the process of doing so is not simple, but we are aware of how the automobile's components should interact with one another, and we can anticipate what will occur. This is something that may be accomplished via experience; specifically, through drawing on our own prior experiences as well as the experiences of other people.

When dealing with a complex issue, it might be difficult to anticipate what the next step will be. Just because something occurred in a prior iteration of a project does not indicate that it will take the same form in the current iteration. This may occur for a variety of reasons, including but not limited to variations in culture or geography, the utilisation of innovative technology, political conflicts, the lack of sufficient background data, or the stability of a team.

The most significant challenge associated with predictability is the occurrence of unexpected consequences. The way we approach an issue might on occasion give rise to more complicated difficulties, which in turn induce greater instability in the problem itself.

Covid-19 is the perfect example of a complex challenge, mainly since it cannot be predicted. More than a year has passed since governments from around the world began to respond to a beast that is in a state of constant motion, including new variants, issues with vaccines, socio-political issues, struggling economies, and the unintended consequences of decisions made regarding how to best manage the pandemic. There aren't many ways to make that much more complicated.

It is not hard to find solutions to intricate issues since the issues can be simply characterised, separated into its component pieces, and the outcomes can be anticipated with relative ease.

When the effect of external elements such as political, economic, social, technical, environmental, and legal considerations are considered, complex problems can be handled. Following a comprehensive PESTLE study, we will be able to select the appropriate individuals to tackle the problem. This, in conjunction with an adequate budget and access to the outcomes of other initiatives that are analogous, will result in the problem being solved.

Approximately 2,000 people die in the UK every year due to heat-related causes. Exposure to high indoor temperatures is suspected as a major contributor to this elevated risk. The economic cost is substantial, in addition to the human cost. Costs associated with heat-related deaths are expected to rise from their current annual total of £10-50m due to climate change to between £25-150m by 2050 and between £40-350m by 2080, according to the first UK Climate Change Risk Assessment (CCRA) published by the Department for Environment, Food, and Rural Affairs (Defra) in 2012. If we use the government's own standards, we must call this a "high magnitude" danger.

Overheating causes a variety of negative outcomes, one of which is an increase in mortality. Although the costs to the economy and society of illness, insufficient thermal comfort, and lower productivity and well-being are of paramount importance, there is essentially no reliable data on these effects in the United Kingdom.

Heat-related illnesses, such as heatstroke, don't cause as much harm as the worsening of pre-existing problems like heart or lung disease do.

Considering that most of the world's population resides in significantly warmer climates, the fact that overheating is an issue in a temperate nation like Britain may seem surprising. One explanation for this is that people across the world have evolved to cope with a wide range of climates. Another issue is that British homes and other structures were not built with air conditioning in mind.

Case study

DHL Welham Green warehouse is a Marks and Spencer warehouse managed by DHL Supply Chain UK. It was opened at the beginning of 2019, and since then it has been expanding, as has the volume of processed goods and people working in the warehouse.

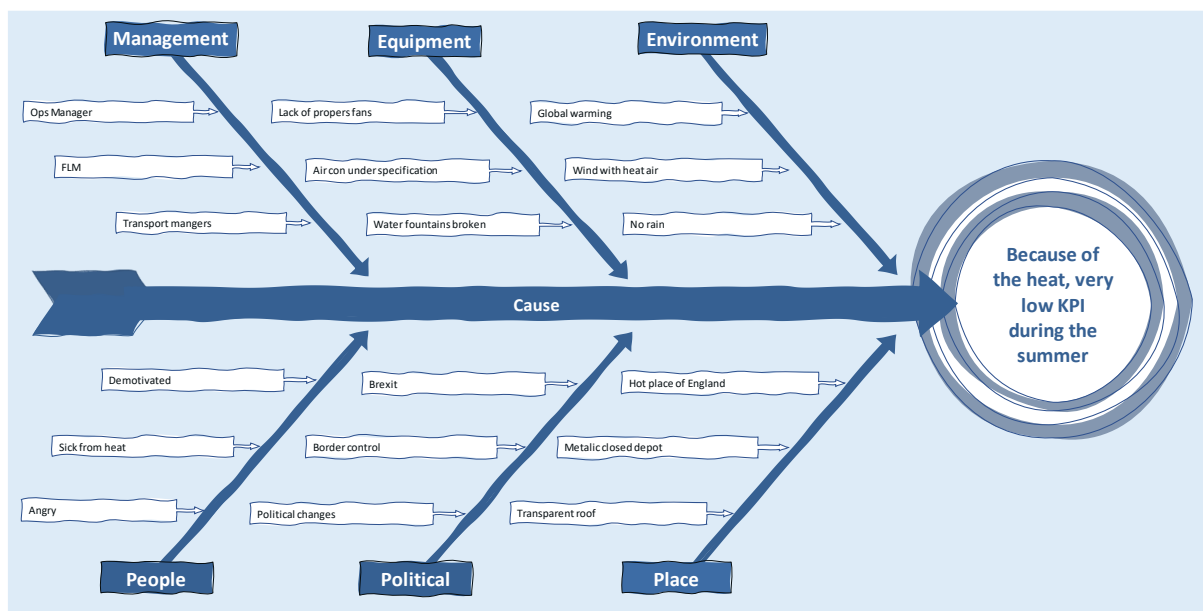
In the first year of operation, a problem was noticed during the summer, excessive heat in the warehouse, especially on the top floor. Because this floor was almost empty, the warehouse was new, there were few people, this problem was ignored, no one from the management anticipating future problems. In the following years, this problem became a complex one, becoming very serious this year.

The warehouse was designed for substantially lower average summer temperatures, with a glass roof for maximum brightness, but which accentuates the summer heat impact. In addition, the air conditioner was built for significantly lower summer temperatures. Furthermore, the rows of shelves were planned for maximum capacity rather than effective ventilation. The use of industrial fans for additional ventilation was attempted, however the impact was negligible.

Simultaneously, in the previous two years, a project has been ongoing in the warehouse to improve the efficiency of product picking volume, which involves the employment of robots (Locus assisted picked robots). They are utilised mostly on the top level (the floor with the most heat difficulties), creating additional heat, particularly when under load or charging.

Another issue noted was that the water fountains on the floors (3 on each floor) do not operate at full capacity, providing water at room temperature.

An attempt was made to ship more water-cooled fans from other DHL warehouses where they were not needed, but managers did not foresee the current political issues. These are in European warehouses and due to Brexit and the current political scenario, the delivery time is significantly delayed due to new border crossing restrictions. Employees are very weary because of the thermal discomfort, they do not operate at their optimum ability, they quit the office, and they are unmotivated. All of this reduces picking performance, resulting in product delivery delays.



To solve this complex problem, I have a few suggestions for potential solutions, which I will evaluate, and then, based on which ones are most likely to succeed, I will select the most promising ones and incorporate them into a strategy for future growth.

- The heat-insulating ceiling will be installed in place of the transparent one. It is possible to replace it gradually over the night without disrupting the routine work of the warehouse and it just costs a small initial investment.

Plus	Minus	Implications
Reduces heat = +7	Requires additional work hours = -2	Investment = -2
Sound dampens outside noise = +3	Reduces natural light = -2	It affects the night shift schedule = -2
Total = +10	Total = -4	Total = -4
Total = +2		

- Investing in a newer, more energy-efficient model for the air conditioner. It involves a significant financial commitment, a significant amount of effort, and it disrupts the typical work routine at the warehouse.

Plus	Minus	Implications
Reduces heat = +10	Requires additional work hours = -5	Investment = -6
Ventilate the warehouse = +3	Requires installation specialists = -4	It affects the work schedule = -2
Total = +13	Total = -9	Total = -8
Total = -4		

- Orders for the water cooling fans that are coming from Europe will be placed earlier than usual so that they may make it to the warehouse on time. At the same time, actions will be taken to put them away for safekeeping in the future so that they can be utilized whenever there is a requirement for doing so. The timetable will not be disrupted by the small amount of investment.

Plus	Minus	Implications
Reduces heat = +8	Needs shipping from Europe = -4	Investment = -1
Ventilate the warehouse = +4	Requires installation specialists = -2	They will remain in storage for later use = +10
Total = +12	Total = -4	Total = +9

Total = +17

- Rearranging the rows of goods to make ventilation more effective and achieve a balance between increasing the volume and maintaining adequate ventilation. Even a very little expenditure might throw off the typical work routine.

Plus	Minus	Implications
Reduces heat = +4	Requires additional work hours = -1	Investment = -1
Ventilate the warehouse =+5	Requires installation specialists = -1	It affects the work schedule = -1
Total = +9	Total = -2	Total = -2
Total = -5		

- The water fountains will be replaced with newer, more energy-efficient models that are linked to a system that supplies flowing water. The average investment that no longer has to be amortized over time because it is no longer necessary to supply water reserves because it is no longer necessary to supply water reserves. As a result, there will be no disruption to the work schedule.

Plus	Minus	Implications
It increases the comfort of employees = +8		Investment = -5
	Requires installation specialists = -4	The investment is amortized over time = +7
Total = +8	Total = -4	Total = +2
Total = +6		

- During this time of the heat wave, staff will have additional breaks. Because of this, the work schedule is disrupted, which may result in delivery delays.

Plus	Minus	Implications
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Motivate employees = +8	Requires additional work hours = -3	It affects the delivery process = -5
		It affects the work schedule = -5
Total = +8	Total = -3	Total = -13
Total = -8		

- The robots will only be used on the lower floors of the building while the heatwave is in effect. It has the potential to disrupt the work schedule, although its effect on cooling is minimal.

Plus	Minus	Implications
Reduces heat = +2	Needs support from Locus = -5	Investment = -3
Reduces crowding in aisles = +3	It needs specialists = -4	It affects the work schedule = -2
Total = +5	Total = -9	Total = -5
Total = -9		

All the warehouse workers were questioned about the measurements and the PMI analyses provided at a brainstorming session with business and employee representatives. As a result of these discussions, a strategy was developed and was to be presented to the customer (Marks & Spencer) in time for the next heatwave.

In the next weeks, Operations Managers will take the required procedures to transport water-cooled fans from Europe, which will arrive in time for usage next summer, while also taking the necessary steps to keep them in storage all year. The shelf aisles will be reconfigured in tandem with the modification in the transparent ceiling. This will be done gradually so as not to disrupt the work schedule while also ensuring that they are ready on time. Managers will work with employee representatives to ensure that these changes are implemented properly. The

warehouse administrator will supervise the efficient operation of the water fountain replacement procedure. Although additional breaks are not a practical solution, workers representatives negotiated an agreement with management representatives. Allow an additional 15 minutes rest on days when the outdoor temperature surpasses 29 degrees Celsius. The Site Manager will negotiate with Marks and Spencer to obtain them.

After applying the ADKAR model to this strategy, it is determined that it is a success.

Awareness	Desire	Knowledge	Ability	Reinforcement		Change
Yes	Yes	Yes	Yes	Yes		

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