QUALITY CONTROL OF OPTICAL FIBER DISRUPTION WITH BIG DATA USING THE SIX SIGMA METHOD

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Abstract: In its implementation, fiber optic is a cable that has fiber material that uses light as a transmission medium in sending data. The speed in data management becomes faster; there is the easy maintenance of tools. Handling this fiber optic disturbance, the company has complex data in big data wherein its management good processing is needed so that data redundancy does not occur. Still, accuracy and speed in data management are very important in big data management. Quality improvement for the company is the most important thing; even to achieve good quality, the company will do things that can support that quality; with the quality of the company being able to have long sustainability, a six sigma approach is carried out so that it can support quality improvements that the company can make.

Keywords: Big Data; Fiber Optic; Six Sigma

Abstrak : implementasinya fiber optic merupakan kabel yang memiliki bahan serat yang menggunakan cahaya sebagai media transmisi dalam mengikirimkan data sehingga kecepatan dalam pengelolaan data menjadi lebih cepat, terdapat kemudahan perawatan tools. Penanganan terhadap gangguan fiber optic ini perusahaan memiliki data yang kompleks dalam suatu bigdata dimana dalam pengelolaannya dibutuhkan suatu pengolahan yang baik agar tidak terjadi redudansi data, akan tetapi ketepatan dan kecepatan dalam pengelolaan data menjadi hal yang sangat penting dalam pengelolaan big data. Peningkatan kualitas bagi perusahaan menjadi hal yang paling penting, bahkan untuk mencapai kualitas yang baik perusahaan akan melakukan hal yang dapat menunjang kepada kualitas tersebut, dengan kualitas perusahaan dapat memiliki *sustainable* yang lama maka dilakukan pendekatan six sigma sehingga dapat mendukung perbaikan kualitas yang dapat dilakukan oleh perusahaan.

Kata kunci : Big data; Fiber Optik; six Sigma

INTRODUCTION

For the company, business customers have a very important case to more first, and mayor because determine to sustain to manage company has process business to do company achieve the target is a satisfied customer.

Fiber Optic interference is a concentration company to increase satisfaction among customers. In the implementation, handling customers has 3x24 hours to close the disruption.

Fiber optic cable is a material used as a light transmission medium in sending data[1]. One benefit of fiber optic is speed transmission data, where Optical fiber consists of an outer protective jacket (coating), cladding/tube, and an inner core.
The ability of optical fiber is what makes a massive change in the telecommunications sector due to the transmission of very large information, small fiber volume and resistance to external interference, and resistance to damage that may occur so that maintenance costs are low [2]
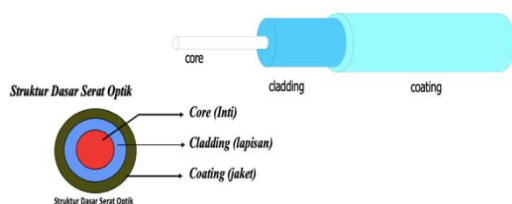
Picture1.structure and type Fiber Optic

There are types of fiber optic cables used.
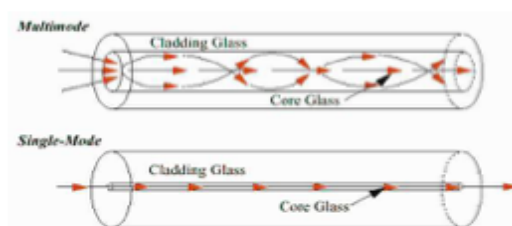
Picture 2. multi-mode and single-mode

The single mood is a type of fiber optic cable that only allows one mode of light to spread through the core at a time, with a smaller core size than multi-mode, 9 microns using the 1300 or 1550nm wavelength.
Its implementation is a multi-mode type of fiber optic that allows hundreds of modes of light to be scattered through the fiber simultaneously [4]. A characteristic of big data technology is to have volume, high speed, and complexity [5].

The concept of big data includes data sets with sizes beyond the capabilities of software tools commonly used to store, manage and process data through the 3V model, namely [6]: Volume: incoming data flow and cumulative data volume. Velocity: represents the data rate used to support the interaction and generated by the interaction Variety: denotes various data formats and data structures that are incompatible and inconsistent [7].

In Six Sigma, there is a cycle of 5 DMAIC phases (Define, Measure, Analysis, Improve, and Control) which is a process that is carried out continuously to improve toward the Six Sigma target. DMAIC is carried out systematically based on facts and knowledge in the field. [8]
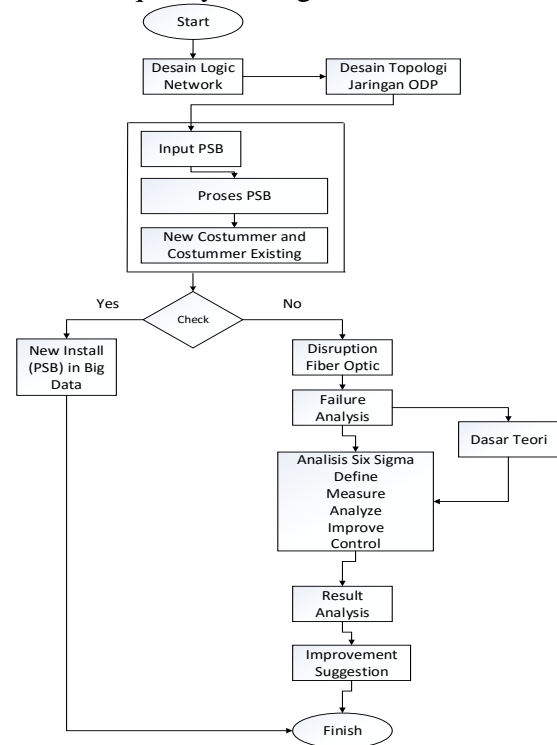to solve problems and process improvement efforts through the DMIAC (Define, Measure, Analysis, Improve, Control) stages [9]

An analysis is the third stage of six Sigma; the main purpose of the Analysis stage is to reduce the main sources of variation. Identify and determine the source of quality problems using analysis of cause-and-effect diagrams or fishbone diagrams. This diagram outlines ways to make the product better and achieve results. [10]

Table 1. Characteristic Fiber Optic [3]

No	Fiber	Characteristic
1.	Core	a. Made of very high-quality quartz b. It is the main part of the optical fiber because light propagation occurs in this section. c. It has a diameter of 10 m ~ 50 m. the size of the core greatly affects the characteristics of the optical fiber
2.	Cladding	a. Made of glass with a lower refractive index than the core b. Is the sheath of the core c. The refractive index relationship between the core and the cladding will affect light propagation in the core (affect the magnitude of the critical angle).
3.	Coating	a. Made of plastic b. Serves to protect optical fiber from damage

METHOD

Define is the first step to take in approaching Six Sigma. This step is an important identification problem in the ongoing process, so in this step, the company identification problem about quality disruption and fiber optic was resolved and not resolved. The second step is proportion defect to determine the significance become to the disruption of fiber optic. Step third measure is an effort to follow up from the definition, do have two goal prime is to get data for validation so that the opportunity occurs. Step fourth is analysis; in this step have detailed step is increased to understand the process and identify the root cause. In this step,

use approach six Sigma by applying statistic tools. Step fifth is an improvement to the made solution, to set action improvement (action plan) to increase quality six Sigma.
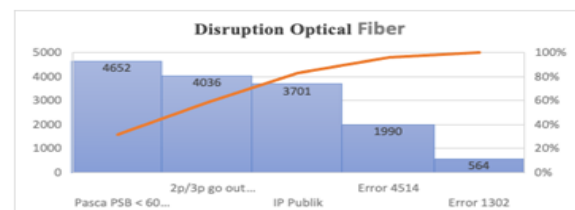

Gambar 3 Metode Penelitian

Table 1. Type Disruption

No	Type disruption	Device malfunction	Setting	connection	Total
1	2p/3p go out today	730	758	2548	4036
2	Error	235	45	254	534
3	PSB	689	735	566	1990
4	Technical	2371	178	1152	3701
5	Not connection	889	754	3009	4652

Picture 4. Pareto Diagram Disruption Optical Fiber Big Data

RESULT AND DISCUSSION

Step define have five type disruption is : disruption 2p/3p go out totally, disruption error 1302, disruption error 1302, disruption error 4514, disruption IP public and disruption pasca PSB <60 days.

Table 2 can be known in one year have disruption 2p/3p go out 4036 disruption, disruption Error 1302 have 3564 disruptions, disruption Error 4514 have 2990 disruption, disruption IP Public has 4701 disruption and disruption Pasca PSB < 60 days is 4652 disruption. For total disruption 19943 from totally disruption in PSB 569613 customer.

Step measure is processed data pasang baru (PSB) in one year calculated every month. Step analysis which conducted is calculated big data company by counting central limit control chart p :

$$p = \frac{\Sigma pi}{\Sigma ni} = \frac{Sum\ disruption}{PSB} \quad (1)$$

$$p = \frac{19943}{569613} = 0{,}0350$$

Count proportion(p) every time PSB use equation :

$$p1 = \frac{pi}{ni} = \frac{1725}{56685} = 0{,}030$$

$$p2 = \frac{pi}{ni} = \frac{1652}{13693} = 0{,}120$$

count control limit with define grad UCL (*Upper Control Limit*) dan LCL (*lower Control Limit*)

$$UCL = \frac{P + 3\sqrt{P(1-P)}}{ni} \quad (2)$$

$$\frac{0{,}030 + 3\sqrt{0{,}030(1-0{,}030)}}{56685}$$

$$= 2{,}78223901$$

$$LCL = \frac{P - 3\sqrt{P(1-P)}}{ni} \quad (3)$$

$$\frac{0{,}030 - 3\sqrt{0{,}030(1-0{,}030)}}{56685} = 2{,}726360$$

Table 2. Data PSB

No	2p/3p go out totally	Error 1302	Error 4514	IP Public	Pascal PSB < 60 days	Total disruption	Total PSB
1	337	345	256	442	345	1725	56685
2	345	376	174	425	342	1662	13693
3	346	456	376	353	543	2074	45168
4	457	245	253	324	432	1711	12936
5	254	342	167	467	421	1651	83153
6	365	236	245	388	442	1676	65981
7	349	178	242	431	375	1575	54782
8	367	473	256	432	322	1850	56621
9	276	213	279	345	332	1445	56570
10	329	343	289	378	320	1659	32562
11	325	233	252	367	343	1520	45891
12	286	124	201	349	435	1395	45571
	4036	3564	2990	4701	4652	19943	569613

Table 3.Count Control Limit

No	Sum PSB	Sum Disruption	Proportion (P)	UCL	LCL
1	56685	1725	0,03043133	2,78223901	2,72636099
2	13693	1662	0,12137589	5,4474252	5,0237748
3	45168	2074	0,04591746	3,40655409	3,30384591
4	12936	1711	0,13226654	5,67190826	5,19289174
5	83153	1651	0,01985497	2,25160386	2,22199614
6	65981	1676	0,02540125	2,54436245	2,50163755
7	54782	1575	0,02875032	2,70497691	2,65362309
8	56621	1850	0,03267339	2,88164625	2,81955375
9	56570	1445	0,02554357	2,5514409	2,5083591
10	32562	1659	0,05094896	3,58517012	3,46542988
11	45891	1520	0,03312196	2,90118116	2,83781884
12	45571	1395	0,03061157	2,79028408	2,73391592
	569613	19943	0,57689722	39,5187923	37,9892077

Based on table 3, make a control chart that has variation be produced in month 6 to 9 in condition unstable its means have any disruption very significant or out of control, in this problem have consequence effort for improvement, so that result variation is in control.
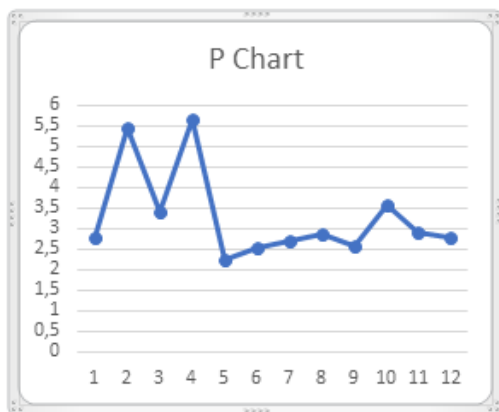
Picture 4. P Chart

Per-million Opportunities (DPMO) converted sigma value based on table sigma count DPU (Defect Per Unit)

$$DPU = \frac{Total\ disruption}{PSB} \quad \frac{1725}{56685} = 0,030$$
$$DPU = \frac{Total\ disruption}{PSB} \quad \frac{1662}{13693} = 0,120$$

Count DPMO (Defect Per Milion Opportunities)

$$DPMO = \frac{Total\ Gangguan}{PSB} \times 1.000.000$$
$$DPMO\ data\ 1 = \frac{1725}{56685} \times 1.000.000$$
$$= 30431,331$$
$$DPMO\ data\ 2 = \frac{1662}{13693} \times 1.000.000 =$$
$$121375,885$$

Table 4 Count level sigma and DPMO

No	PSB	Sum Disruption	PDF	DPM	Nilai Sigma
1	56685	1725	0,0304	30431,331	3,37449187
2	13693	1662	0,1213	121375,885	2,66813635
3	45168	2074	0,0459	45917,4637	3,18579689
4	12936	1711	0,1322	132266,543	2,61574083
5	83153	1651	0,0198	19854,9661	3,55675361
6	65981	1676	0,0254	25401,2519	3,45314426
7	54782	1575	0,0287	28750,3194	3,39948575
8	56621	1850	0,0326	32673,3897	3,34287831
9	56570	1445	0,0255	25543,5743	3,45074701
10	32562	1659	0,0509	50948,9589	3,13572136
11	45891	1520	0,0331	33121,9629	3,33676953
12	45571	1395	0,0306	30611,5731	3,37188044
	569613	19943	0,57689722	576897,22	1,3060379

Based on table 4, the company has level sigma 1,306 or condition level 2 sigma with probability disruption 576897 for one million PSB or 38,85% Defect Per Million Opportunities (DPMO). In this case, of course, to harm the company if not maintenance proses in PSB to push disruption so that level sigma.

Table 5. Recommendation increase Level Sigma

| No	Sum PSB	Sum disruption (2 Sigma)	Recommendation			
			3 Sigma 6,681%	4 Sigma 0,621%	5 Sigma 0,023%	6 Sigma 0,00034%
1	56685	1725	3787,12485	352,01385	13,03755	0,192729
2	13693	1662	914,82933	85,03353	3,14939	0,0465562
3	45168	2074	3017,67408	280,49328	10,38864	0,1535712
4	12936	1711	864,25416	80,33256	2,97528	0,0439824
5	83153	1651	5555,45193	516,38013	19,12519	0,2827202
6	65981	1676	4408,19061	409,74201	15,17563	0,2243354
7	54782	1575	3659,98542	340,19622	12,59986	0,1862588
8	56621	1850	3782,84901	351,61641	13,02283	0,1925114
9	56570	1445	3779,4417	351,2997	13,0111	0,192338
10	32562	1659	2175,46722	202,21002	7,48926	0,1107108
11	45891	1520	3065,97771	284,98311	10,55493	0,1560294
12	45571	1395	3044,59851	282,99591	10,48133	0,1549414
	569613	19943	38055,8445	3537,29673	131,01099	1,9366842
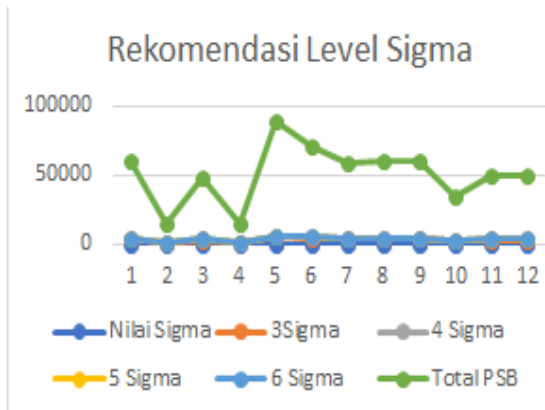
Picture 5. Recommendation Level Sigma

Have recommendation limit tolerance disruption to a target company to increase level status sigma company in level Sigma at the moment is level 2 sigma to level 3 sigma or level 4 sigma or level 5 sigma or 6 sigmas become target company.

Step Improve elements caused by man such as lack of training, the proposed action that must be taken is that the company conducts training at least every six months so that employee skills upgrades are always carried out. In the material element that optical fiber does not contain electricity, it means that in maintenance efforts, being exposed to high voltage electricity can be reduced so that it is still safe in the process. In the machine stage, there is a migration from copper network to fiber optic because optical fiber uses light as its transmission medium to send data so that data management speed becomes faster. In terms of maintenance, there is also convenience. In the method stage, there is an element of complaint in the form of a nuisance ticket that can be submitted by the customer, which the company will then follow up. The next stage is a very influential environment where there is weather that can support the process of resolving network disturbances.

Based on the analysis, the factors that can cause high network disturbances are divided into five main factors: humans, materials, methods, machines, and the environment.

Picture 5. Fish Bon

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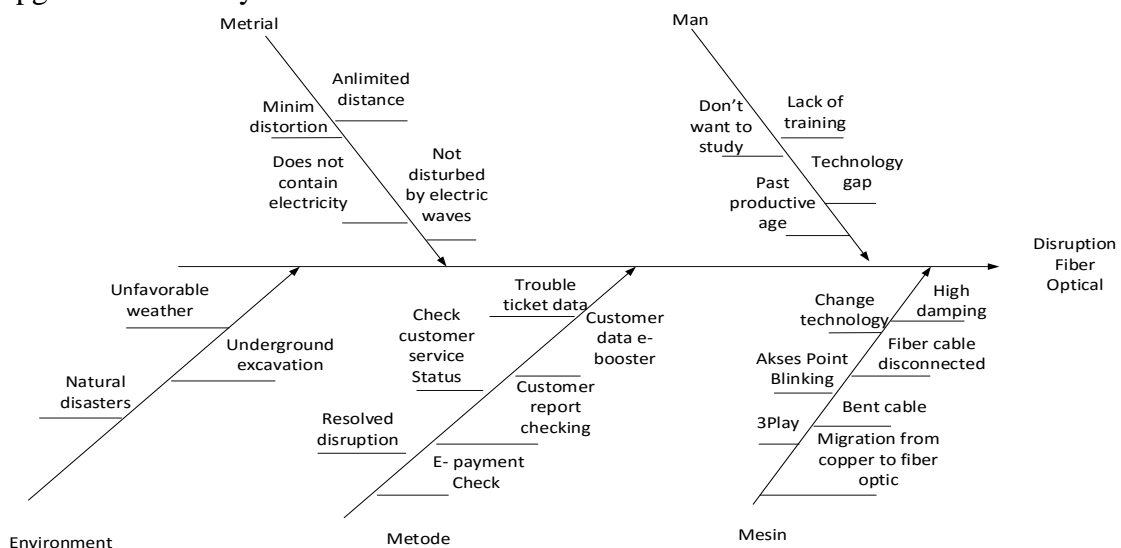
CONCLUSION

In-network disturbances, it is necessary to map the network to anticipate the possibility of network disturbances that take a long time, and the company needs to measure the quality characteristics of the PSB produced to produce a near-perfect process to produce optimal customer satisfaction both in terms of fiber optical quality as well as service quality.

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