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STATISTICS IN BUSINESS.

Lecture

by

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INTRODUCTORY REMARKS

by

Major General B. F. Cheatham, Quartermaster General.

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Gentlemen.

I will not delay you this morning because the speaker has a great deal to say to you. I will not attempt to make the usual speech of introduction. I simply want to introduce to you a distinguished author, an unselfish public servant, and a patriotic American - Colonel Leonard P. Ayres.

STATISTICS IN BUSINESS.

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Gentlemen:

Many of you might well assume that in being here this morning as students of Industry with special reference to National Defense, and thinking, from time to time, about statistical phases of that subject, you were doing something rather new and unusual. In one sense you are, this phase is certainly new in our scheme of National Defense, perhaps so far as any Army is concerned, but in the broader sense what you are doing in a statistical way represents exactly the oldest, the most well defined by experience of all statistical procedure.

About one hundred and fifty years ago a German named Achenwall who was in the employ of the Prussian Government pointed out that there ought to be a new science, this should deal with things the State might well take into account, "things worthy of note by the State". He went a bit further and wrote that we might readily interpret these things as "state wisdom". Of course they dealt with National Defense, resources in time of emergency, stock taking - counting up to find out what the State could actually depend upon in time of need. Other authors followed what he originated and very soon all those words based upon "states" were shortened into the word "statistics" - those parts of knowledge gathered and used for the welfare of the whole social body, the

whole state. So what you are doing is not only statistics but statistics in its most ancient form.

I would next point out that very shortly there developed a real distinction in statistics. The word is used in two ways, singular and plural, and has two distinct meanings. Statistics "is" a science of methods relating to social welfare and prosperity of the state, in the main. Statistics "are" those codified bits of knowledge and information constituting the knowledge of the scientist. When we say "statistics is" we are pointing out that after the knowledge has been gathered, the description made, there are various ways of treating the information. We may draw from the facts wise and valuable deductions and inferences.

The statistician is the explainer, he gathers the evidence and explains what the facts mean. The good explainer is the good statistician - and conversely. The man who cannot explain his figures, no matter how erudite he may be, how much accurate and technical knowledge he may possess, is not a thorough or necessarily a good statistician. A good explainer of the evidence is the good statistician.

In business we have two kinds of statistics, first, the statistics of the efficiency of an organization, internal statistics, how well is the firm, company or corporation organized, how efficiently does it operate, and secondly, external statistics of business operations mostly based on two things, both relating to prices - how much does it cost to purchase the required raw materials,

how much can you get for the finished product, for how much can you sell it. The external may be the most important in business fundamentals resting on prices.

I point that out because it is perfectly clear that we cannot transfer from civilian life, in time of emergency, the operation or much of the experience of business statistics. When an emergency comes, the War Department does not deal primarily with costs and profits but it deals with immediate needs in procurement. It has to have what it wants, no matter what the cost is, it is not concerned with the profit and, abstractly at least, would prefer that there would be no profit.

In time of an emergency the whole point of view is changed. What statistics becomes in time of war at the central offices of the Government is rather a pulling out of the great mass of incidental material, those essential facts that may be used by the people in positions of top control to guide their policies. When the late war broke, the Chief of Staff, the Secretary of War, and their associates were, in the early months of the war, literally swamped with statistical data. I violate no confidence in saying that the then Secretary of War has since told me of his utter despair of being able to sift out vital information and thereby ascertain what was actually taking place. It was literally true that bushels of paper came to his desk every day and contained in that was information about the progress of our military effort. On the whole it was as valuable as if there had not been a single figure; it was so enormous, so multitudinous, so ample that no

one could find out what the exact status of affairs was. The duty I held at that time was that of sifting out the essential data from the incidental, then pointing out what the essential data meant.

I am not going to try to talk about statistical methods. That would be futile. I want to point out two or three essential characteristics of statistical effort as connected with National Defense in time of emergency. The first is that the only thing you can look forward to with positive certainity in this matter is that there will be unexpected complications in industry as related to war, that they will come you can be certain, and their nature you cannot be sure about.

Let me illustrate. When the recent war broke out the Food Administration, under guidance of Mr. Hoover, issued to the people almost at the beginning of the war a plea that they should stop eating meat and substitute fish. The fish available at that season was codfish. Very shortly after this request was issued the office reeeived great numbers of complaints that patriotically minded people who were attempting to follow their request were unable to buy codfish. Why had the outbreak of war stopped the codfish coming from the New England Coast? The fish are caught by hand lines off the Grand Banks. The only line you can catch codfish with is an invisible line, and linen is required for that line. All linen had been requisitioned for airplanes - so people could not eat codfish. I may say that no man could possibly have foreseen that type of contingency.

Shortly after the war began we received notice here in Washington from makers of artillery that they could not go on with the production of artillery then under way. Inquiry brought to light the fact that the relining of the furnaces required additional supplies of bauxite. There was no supply on hand, and bauxite comes from very deep pits. The custom of the industry had been to work the hoists in those pits by the condemned elevator cable obtained from New York City. Under the laws of the State of New York if there was one broken strand in a cable of a passenger elevator, that cable had to be removed and a new one substituted therefor. Only exceptionally long cables would do for the pits. The Army had stepped in and requisitioned all condemned cable fn this country for mining harbors - so artillery stopped coming through. No one could have foreseen that situation in advance. There was no substitute supply for that trade had run for years from apartment house or office building cable.

At another time during the war the output of the artillery was checked. That was toward the end of the war. The reason was that as operations grew to an enormous extent in France it was necessary to use on the railroad lines all locomotives that could be shipped over there. As they were hard to transport, the authorities naturally requisitioned the ships having the largest hatchways. These turned out to be the ships of the Bethlehem Steel Company, running to Cuba and bringing in iron ore. We must have iron ore from Cuba in connection with our ore to make artillery. Because we had to have locomotives in France, artillery production

was stopped once more.

The very first war-time order for field shoes for the soldiers that was placed requested more chrome leather than there was at that time in the world.

These are typical illustrations. No one can foresee such situations but you may be entirely confident that in any future emergency, as in every past emergency, there will be industrial complications. They call for quick, incisive, intelligent diagnosis and the statistician at the central point of control must be ready when these things happen to chase down the change in "cause and effect" and find out what and where the stoppage is. It may not pertain to any one industry and only some one who can chase down the evidence is going to find out quickly and accurately the cause therefor.

From that type of experience I think you may draw the conclusion that in statistical work organized to deal with the sort of thing you gentlemen are studying we must organize by procurement grouping rather than by commodity. The crux of the problem in time of war is to procure those things that are essential. They come under certain procurement groups in the organization of the National Government and primarily in the military arms of the Service. The organization of this information, for reasons of its essential, industrial complexity such as I have illustrated, must, I think, be primarily segregated in connection with those procurement groups - not only the major but also the minor ones. I believe the organization in the past emergency

was right. The Statistical work was organized in coordination with the Army Procurement divisions, a Chief Statistical Officer for Quartermaster material, an Ordnance officer for Ordnance, etc. That builds up a much better organization than to have an officer for cotton, one for wool, steel, leather, and so on. I believe that should be put down as a guiding rule and possibly even as a principle in the building of any organization.

To meet an unexpected emergency by the war game of mapping out what may be expected to happen is, I suspect, of only restricted possible utility. I believe the only way you can really meet an emergency, when the time arrives, is to have a common organization and enable people to deal with that organization, but when you have that organization you must make it possible for them to be readily, effectively useful and accessible. I believe that means you must retain in connection with your statistical work, whether at the top or further down the line, opportunities for close contact with the top control of whatever part of the organization you are dealing with. Statistics to be effective must not filter thru intermediate steps in military or other procedure.

There was a special order in effect during the late emergency that the contact of the Chief Statistical Officer in the War Department with the Chief of Staff and the Secretary of War was to be direct and not through military channels. That, I think, was the only order of the sort that was in effect. In intent, it was right because the statistical work is, so to speak, staff work, staff function. It is the source of information for the people who

do the thinking, planning and formulating of policies and must be located where it is immediately and directly accessible. I am not talking about giving to a statistical group itself additional authority, power or responsibilities, but I am talking about opening the channel of accessibility of contact. That is fundamentally sound.

I wish to speak about the whole problem, of the more complicated method of statistical procedure that has come into effect. An enormous development in statistical technique has taken place. It is very difficult for the non-statistically educated person to read the statistics of today. What shall we do about it? How valuable is it; how much of the real and complicated statistical technique is essential? The answer is "Some". The primary answer is "Do not use the difficult process when you can use the simple one".

During the early part of the War there was located at Fort Monroe, Virginia, a training school for artillery officers. The colonel in charge decided to give the cadets an examination, one of the old-fashioned army type. One of the questions was how to ascertain the height of a tower by means of a aneroid barometer. One of the cadets wrote, "I would lower the barometer from the top of the tower tied to a string, and then would measure the string". The colonel, having a keen sense of justice as well as humor, realized he was right. One should never seek the more complicated solution of a problem. There are times when the less complicated way will not do it, however.

What I am endeavoring to point out is that one must always have within a statistical organization of a major unit one or more men trained in theoretical statistics. Let me illustrate why. Early in the war one of the very great problems in the transportation of troops and supplies arose from the fact that the computations as to the turn-around of transports never formed a trustworthy guide as to actual operations. The first thing the Chief of Staff requested me to work on was that puzzle - why the computed turn-around of ships was always wrong as compared to practice, the take over of men and supplies always being below the reasonable expectations. I saw as soon as I had access to those figures what was wrong.

The principle was this. So many ships were going on several voyages, ships of different speeds. The problem was to find the average turn-around. Let us suppose there are two towns, thirty miles apart, one downhill from the other, and an automobile runs between these two towns going faster in one direction than in the other. The speed is sixty miles one way and thirty miles the opposite. What is the average speed? ~~Thirty~~ 45 miles. But is it? In traveling one direction the machine goes thirty miles in thirty minutes, in the other it goes thirty in sixty minutes. Both answers are good arithmetically, one in forty-five and one in forty. The fact is you have to compute the answer in the way that gives the slower speed. All the work of the computation of the turn-around of the ships had to be scrapped and new ones made based

on the right computation. The Chief of Staff called me before the War Council and asked me to explain the figures. I said, "Sir, we are doing it by the method we call the method of effective average". He asked me to explain further and I gave him the scientific terms as an explanation. Somebody had to know about that phase. It is known as the "harmonic means" and is so seldom used in practical affairs that the average statistician does not know ~~but,~~ but somewhere in your organization you have to have some one that is familiar with it in order to operate effectively and efficiently.

When I was on duty at the General Headquarters at Chaumont I received orders to report for duty with the Supreme War Council. Arriving there I found that they had gathered from all the Allied Armies the most gifted Ordnance and Artillery officers and were holding there awaiting the possible arrival of a Big Bertha dud from the German artillery. These officers were to study the dud with a view to finding out what it revealed for use of the artillery on the Allied lines. They asked me to compute "what the chances were that there was going to be a dud". These were valuable officers, having a nice time but certainly not helping win the war. I asked them to show me some debris of Big Bertha shells and after examination I ascertained they had two fuzes. I asked the officers, "Can any among you tell me whether these fuzes came from the same factory or different factories in Germany? Are they generally independent fuzes in origin, or are they two fuzes of the same sort?" They were

purely independent, coming from different factories. I then asked the approximate possibility of a dud from one of the same type of fuzes in an ordinary shell. They had that data in good shape, and after they told me I could solve the problem in one-half a minute. A shell with one fuze of the given type was so liable that it produced one dud in twenty, it you put in two fuzes you would assume there would be one in forty. That would betrue if the fuzes came from the same factory but if they were independent it would not be one in forty but one in four hundred. After I had figured this out the Ordnance and Artillery gentlemen were speedily dispatched to their commands.

If I had sufficient time I would talk on the essential uses of diagrams. As a general summary, however, first you may besure that when an emergency comes statistics will be essential. Experience indicates, secondly, that they should be organized by procurement rather than commodity groupings and divisions. Experience also clearly indicates that in emergencies a statistical organization must be located in the division so as to have direct access to the top control. The only way to prepare for the emergency is to have a good organization and good men. Among these men have some theoretical statisticians. Finally, diagrams must be used.

Gentlemen, I am very glad to be with you and only wish we had more time.