

PUBLIC WORKS IN INDIA:

BEING

A Letter

TO THE RIGHT HONOURABLE

RICHARD VERNON SMITH, M.P.

President of the Board of Control,

ILLUSTRATIVE OF THE NECESSITY OF IRRIGATION AND INTERNAL
NAVIGATION BEING LARGELY PROMOTED IN INDIA,
TO DEVELOP THE RESOURCES OF THAT COUNTRY,
AND PREVENT THE FAILURE OF THE RAILWAYS.

BY

JOHN BOURNE, ESQ.

WITH AN APPENDIX AND A MAP,
SHOWING THE NAVIGABLE RIVERS AND THE COMPLETED LINES OF RAILWAY.

Dedicated

TO

COLONEL WILLIAM HENRY SYKES, F.R.S., &c. &c. &c.

CHAIRMAN OF THE HON. EAST INDIA COMPANY.

LONDON:

LONGMAN, BROWN, GREEN, LONGMANS, & ROBERTS.

1856.

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TO

COLONEL WILLIAM HENRY SYKES, F.R.S.,

&c. &c. &c.

CHAIRMAN OF THE HON. EAST INDIA COMPANY.

DEAR SIR,

I beg leave to dedicate the following pages to you, first, because you have long supported the measure they advocate of opening up the internal commerce of India by establishing steam navigation upon the rivers; and second, because the official position you at present occupy naturally points you out as the person to whom any work, written in the hope of benefiting India, should be inscribed. I trust that your chairmanship will be signalised by the realisation of a measure of such lasting importance as the establishment of a wide and effectual system of navigation upon the rivers of

India would assuredly be ; for, as you have uniformly supported this measure during many years, there is only justice in the hope that it will be during your tenure of office that it will be carried into practical operation.

I am, dear Sir,

Faithfully yours,

J. BOURNE.

TO THE RIGHT HONOURABLE

RICHARD VERNON SMITH, M.P.

&c. &c. &c.

RIGHT HONOURABLE SIR,

As the momentous subject of public works in India is at present attracting much interest in this country, and as I have given to that part of the general question which more particularly refers to internal communications my constant attention for the last ten years, I beg leave to be permitted to lay before you the results of my observation and reflection on that subject, in the hope that they will be found not altogether unworthy of consideration. I am induced to adventure these remarks from the cordial interest in the welfare of India which was manifested by your recent speech in Parliament on Indian affairs, much of which, as Sir Erskine Perry justly remarks, "must have gone home to the hearts of all who took an interest in the welfare or progress of India." I will not here repeat the terms of admiration in which that speech is everywhere spoken of, and especially as regards its main point of distinction,—the transparency and sincerity of purpose which mark it from end to end. How grateful the contrast between such singleness of spirit and the shams and equivocations by which, in such statements as the one you had to make, the truth is often wilfully concealed or perverted!

I presume that all projects for adding to the prosperity of India must have regard, in the first instance, to the improvement of the revenue, not merely because that question is a most momentous one in itself, but because the revenue is the index of the prosperity and material comfort of the people. The improvement of the finances of a country consists, of course, of two parts, of which one has regard to the diminution of expenditure, the other to increase of income. With any proposal for the diminution of expenditure in India I have no present concern, nor do I consider myself qualified to discuss that question. The remarks I have to offer have reference solely to the means of increasing income.

Now, it is obvious to every one that the first condition of obtaining revenue from a people is to enable them to pay it. Variations in the mode of levying the payment will signify little if the people have not the means of paying the sum required. Taxes are not to be wrung out of a starving multitude even with the aid of torture, now proved, after many denials, to have been resorted to habitually in India for that purpose. If, however, we open up to the people means of enriching themselves that were heretofore unavailable, we enable them to support a pressure of taxation without repining that they would otherwise be unable to bear. If we enable them to turn their labour and ingenuity to better account than formerly, or, in other words, if with the same amount of labour and ingenuity we enable them to produce much more wealth than before, we not merely solve the problem of the revenue,—long nearly stationary and for some time past exceeded by the expenditure,—but at the same time we acquire an as-

surance of the comfort and material prosperity of the people such as we could not otherwise obtain.

I am of course aware that there are many improvements necessary to be carried out in India — improvements in the police, improvements in the means of education, and many others which it would be out of place here to mention. But every one now admits that all *moral* improvement must have *material* improvement for its basis. A population is not likely to make much progress either in knowledge or in virtue that is dying of starvation; but the physical wants once duly satisfied, the moral wants will kindle and aspire. Material improvement in fact must be the antecedent of all extended and substantial improvement; so that the question of the material improvement of a suffering people comprehends the question of improvement of every other kind. We come back, therefore, to the position that the achievement of enabling the natives of India, with the same expenditure of labour and thought, to enrich themselves more than heretofore is the great genesis of national amelioration; and there can be no doubt that if we succeed in resolving this problem, we shall not merely set the revenue upon a satisfactory basis, but shall open the door to other improvements which will follow as a matter of course.

Now the means for improving the revenue are identical with the means of increasing the productiveness of the country, and the means of increasing the productiveness of India are happily neither unknown nor untested. They consist, in the first place, in collecting and distributing water for the purpose of irrigation, whereby the fertility of the soil will, with a given amount of labour, in many cases be increased *fourfold*;

and, in the second place, in affording for the surplus productions of the soil, thus brought into existence, a cheap means of conveyance, in order that they may reach a remunerative market. In these two simple expedients, judiciously and extensively carried out, we have a certain and sufficing remedy for the present depressed condition of India, and the secret for reconciling a large assessment with a thriving and contented population. Some parts of India are well suited for the production of cotton; other parts are well suited for the production of rice. But such is the difficulty of internal locomotion, that each district cannot be employed for the growth of those commodities for which it is naturally best adapted. Those articles which are required in any locality have, as a general rule, to be grown there, though their production is to some extent an artificial process, involving increased expense and an inferior result. It is much as if England were to grow sugar-cane in hothouses. Cheapness of communication, however, by enabling the productions of one district to flow easily into another, ensures the appropriation of each locality to those purposes for which it is best adapted by nature, and obviates that waste of national effort which must otherwise ensue.

It is, of course, obvious that any extensive system of irrigation and improved communication in India involves the construction of public works; and it is an essential part of the question to inquire what will be the expense of these works, and what return they will yield upon the capital invested in them. Here, fortunately, we have the data afforded by actual experience for arriving at a sound conclusion. The irrigation works constructed by the Government in the Madras presidency — which may be taken as a type of the general

character of the irrigation works suitable for India — have so much added to the revenue of the locality in which they are situated, as to have brought back to the Government a return equivalent to a dividend of 70 per cent. per annum upon the capital invested in them. This is the average result of the whole of the works since the time of their commencement, as appears from official returns. And in all other parts of India in which irrigation works have been established a very large return has in every instance been derived from them. The question of the remunerative character of these works may therefore be considered to have been completely established after adequate experiment; and it is as conclusively ascertained as any fact can be within the whole range of our experience, that irrigation works in India, if carried into effect with ordinary economy and intelligence, will not merely add to the prosperity of the district in which they are situated, but will yield a large return upon the capital embarked in them. The benefit to the population, indeed, afforded by any public work is, within certain limits, measurable by the returns it yields, or is capable of yielding, upon the capital expended upon it. And it may be set down as a general law, that every species of public work in India, the use of which is not either gratuitous or purposely cheapened unduly for the promotion of public objects, will confer benefits upon the population, which will be large in the proportion of the returns upon the capital embarked in its construction. Any ordinary public work conducted on commercial principles, if it yields a large return upon the capital, will also yield a large benefit to the population. It is only out of the benefits conferred upon the population that the profits on the capital can be paid; and since in

no case the whole of these benefits can go as profit upon capital, which would leave the public without any motive to use the improvement, the total amount of the advantage must be divided in a certain ratio between the persons who use the public work and the capitalists who construct it. I will not stop here to adduce proof of what the proportion of benefit which goes to each party usually is in the case of works of irrigation in India. It is well known that the advantage to the persons who use the water of public works, constructed for purposes of irrigation, is much greater than the advantage which accrues to the persons by whom the water is supplied, as indeed may readily be conceived, if it be the fact that, by a small annual payment for irrigation, the productiveness of a given tract of country will be increased fourfold.

It is computed that the cost of raising water from wells for purposes of irrigation, as is done over a large part of India where irrigation works do not exist, is about 1*l.* sterling for 5000 cubic yards; whereas, in some of the irrigation works constructed by the Government in the presidency of Madras, about 300,000 cubic yards of water can, it is reckoned, be conducted to the land for the same sum; or, in other words, the cost of water is reduced to $\frac{1}{80}$ th of its present cost, as raised from wells, by the establishment of suitable works of irrigation. Whether these figures be accepted as perfectly accurate or not, it is at least certain that in India, as in all tropical countries, water is essential to fertility; that this water can be supplied at a vastly cheaper rate by conducting the water over the land on a large scale, in suitable channels, than by the laborious operation of raising it from wells, as is now widely practised; and that a large proportion of the saving thus

effected goes as profit to the cultivator, while a part of it goes to reimburse the capitalist by whom the necessary works have been constructed. It is, of course, the interest of persons establishing works of irrigation that the water they supply shall be used as widely as possible. The cost of their works would remain the same whether the water were used or not; and the water must be used very widely to enable their works to become very profitable. To induce the general employment of the water, however, the proprietors of the irrigation works must be prepared to supply it at a cheap rate; and the maximum of profit on the works can only consist with the realisation, by the cultivator, of a very large measure of advantage. The same remark applies to any enterprise proposing to establish improved means of internal communication. Any commercial undertaking for this purpose in India can only be profitable if, by materially cheapening transport, it largely contributes to the public advantage; and so uniform is this relation, that the amount of public advantage is in a great degree measurable by the amount of profit which the undertaking yields. If, therefore, it is found that an enterprise for improving internal communication, which is not established for gratuitous use, but is conducted on the ordinary commercial principles which regulate such undertakings, is not productive of profit, but, on the contrary, does not return its expenses, the inevitable inference is that the capital expended upon such a work is not rendering material benefit to the people, and will not enable them to add to their wealth, or support with less difficulty the public burdens; in short, the result shows that the work is not of that kind which the circumstances of the locality require.

Now, I do not by any means maintain that under no cir-

cumstances should public works be undertaken or promoted by the Government in India, even though such works are not reproductive in a financial point of view. There may be, and no doubt are, cases in which it becomes proper to construct a public work from political or other considerations, though with the knowledge that it will not add to the revenue or augment the wealth and comfort of the people. The electric telegraph appears to me to be a work answering to this description ; and I can imagine that it would be a proper thing for the Government to construct electric telegraphs, even though it was known that they would not return the expense incurred. Such a work is in fact an instrument for facilitating the government of India ; and if the cost of such a new instrument is not great, and the facilities it renders are very important, it will no doubt be proper to incur the expense for the sake of the benefit. Here, however, as in all other cases, the propriety or otherwise of undertaking such a work depends upon the issue of the comparison between the amount of the cost and the amount of the benefit. If the cost be very large and the benefit be not of corresponding magnitude, it is clearly inadvisable to undertake a work promising such inadequate results, when so many other undertakings fraught with such momentous benefits to India are suffered to lie neglected. The Government, it is clear, cannot undertake or promote everything ; and the whole question at present pressing on the attention of persons interested in the welfare of India is this : What species of public works shall be undertaken first ? Whether shall they be works which will confessedly directly promote the prosperity of the people, and immediately improve the revenue, thus laying the foundation of a capacity to proceed to larger efforts ; or shall they be

works which do not materially promote the present prosperity of the people, or add to the revenue, and of which the benefits are only collateral, contingent, and contested, or at best remote? This is the question now pending between the railway works, which have been undertaken in India, and the various other important works, such as those of irrigation and navigation, which await execution in that country.

With all the arguments which can be used in favour of the construction of railways in India I have long been familiar; and since the first institution of those undertakings I have been more or less connected with them. In 1846, when Mr. Macdonald Stephenson returned from India, after having formed the design of the East Indian Railway, he put into my hands the whole of the data he had collected illustrative of the probable traffic; and from these documents, with some other information which I found it necessary to obtain, I determined the amount of traffic upon the line which the railway was to follow, and also the average rate which the railway might hope to obtain for the conveyance of merchandise, and which I showed could not be more than one penny per ton per mile. These determinations were adopted by the railway company as the basis of the undertaking; but another deduction which I made at the same time, and which the railway company did not put so prominently forward, was, that the portion of the railway at that time proposed for execution, leading from Calcutta to Burdwan, could not possibly be worked except at a heavy loss, and that it was highly inadvisable to proceed with so unpromising a project. The railway company for some time oscillated between the line to Burdwan and the line to Rajmahal. This last line had been proposed or supported by Mr. W. P. Andrew, well known

from his various works on Indian railways; but, by desire of the East India Company, the company Mr. Andrew had formed to carry out his design was incorporated with the East Indian Railway Company, and either project was now therefore available for the combined railway company to pursue. The Rajmahal line, however, did not appear to me to be an eligible one either; and the arguments which at that time I used against it I still consider conclusive. Mr. Andrew's view was, that it was proper to use the Ganges as far as possible in forming a line of improved communication between the north-west provinces and the sea, seeing that the river already existed, was suitable for navigation by steam, and could be made available without expense. But inasmuch as at Rajmahal the line of communication through the Bhagarutty river became defective from a scarcity of water, it was advisable to construct a railway from Rajmahal to Calcutta, to supersede this defective part of the line. My answer to this argument was, that if goods were once launched upon the Ganges in the north-west provinces for conveyance to Calcutta, they would not be unladen at Rajmahal, subject as they would thereby be to increased expense and to the risks of damage and peculation, when they might avoid these disadvantages by proceeding through the circuitous but accustomed route by the Sunderbunds to Calcutta,—the main inconvenience by this route being that the voyage would occupy a somewhat longer time. I added, that if it were judged expedient to improve this part of the communication, it would be more effectually done by the construction of the canal from Rajmahal to Calcutta which had been proposed by General M'Leod and Colonel Forbes than by the construction of a railway, inasmuch as by the construction of a canal the boats

could be brought from the Ganges to Calcutta without being unladen at all.

Twenty-five years ago, my father, who was at that time interested in a line of steam-vessels plying between London and Dublin, finding that vessels of that size were much injured and incommoded by the inadequate depth and other faults of Dublin harbour, proposed the formation of a ship-canal from Kingstown to Dublin, whereby the risks of Dublin bar would have been avoided. The canal could have been formed easily by cutting off a portion of the sea-shore by means of a sea-wall; and the effect of this improvement would have been that vessels could have entered Dublin at all times of the tide without risk, and have proceeded at once to unload their cargoes. About the same time the railway connecting Kingstown and Dublin was projected, professedly with the same objects; and ships were to unload their cargoes at Kingstown, which cargoes were to be taken up to Dublin by the railway. After much contention between the two projects, as is usually the case on such occasions, the railway was the undertaking which obtained Government support, and was finally made. And what has been the result? *Not one single ship has ever unloaded merchandise in Kingstown harbour*, and therefore not one ton of such merchandise has ever been carried by the railway. So far, therefore, as the alleviation of the defects of Dublin harbour is concerned the railway has been a complete failure; for the Dublin bar and the other defects of the navigation have to be encountered in precisely the same manner as if the railway had never existed. The railway, indeed, has been profitable to its proprietors; for, as it has made Kingstown almost a suburb of Dublin, the passenger-traffic on it is considerable; and as the

proprietors of the railway had at an early period purchased large tracts of land in the neighbourhood of Kingstown, which were afterwards built upon, they either directly or indirectly derived a large advantage from the undertaking. To secure such advantages to private persons, however, is hardly an object towards which a Government ought to contribute; and the grounds on which the assistance from the Government was accorded, viz. that the undertaking was one which would relieve the deficiencies of the port of Dublin, have turned out to be a complete delusion. A similar delusion existed among the advocates of the Blackwall Railway, the Greenock and Glasgow Railway, and other lines which were intended to supersede water-communication; and in every case it has been found that merchants are indisposed to unload their ships at a distance from the place of consignment; and that a bad water-communication will carry more cheaply than a good railway. With these facts before me, the conclusion at which I arrived was, that the merchandise shipped upon the Ganges would continue to follow its accustomed route through the Sunderbunds to Calcutta, even if the Rajmahal line were made. I subsequently ascertained, by personal examination of the head of the Bhagarutty branch of the Ganges where it leaves the main stream at the commencement of the delta, that it would be a simple operation to deepen this branch throughout, not by excavating the bed, but by causing a larger part of the main stream of the Ganges to pass into it. I made a plan of the expedients necessary to carry out this improvement at the time I was in India, now nearly nine years ago. This plan was shown to some of the officials at the India House, but it did not attract the least attention.

Seeing, then, that there is no case on record in which it has been found that a railway can compete with a navigable river in the cheap conveyance of merchandise, and that the Bhagarutty, by an improvement which must at no distant time be accomplished, would be rendered navigable for boats of large burden throughout the year, I have always discouraged the construction of a railway connecting Rajmahal with Calcutta. I have not a much more favourable opinion of any line proposing to pass up the valley of the Ganges. The works of such a line must be expensive, and will be more liable to inundation than if placed more remote from the river; and the various tributaries of the Ganges will have to be bridged at their broadest part. Then the line is considerably longer than it would otherwise require to be. The Bhagarutty and Ganges, constituting the line of water-communication between Calcutta and Mirzapore, form two sides of a triangle, of which the grand trunk road connecting Calcutta with Mirzapore forms the base; and the line of railway for connecting Calcutta with Mirzapore, as originally proposed by the East Indian Railway Company, was to run contiguous to the grand trunk road throughout its entire length. As the route by the railway would thus be very much shorter than the route by the river, a compensating element was obtained to some extent for the greater cheapness of water-communication; but this advantage is lost when the railway pursues the circuits of the river, at the same time that greater expense of construction and greater risk of damage to the works from floods are entailed. No doubt the country is more fully developed and more populous on the banks of the river than it is in the districts through which the railway was originally to pass; and this would certainly be

an argument for the adoption of its present circuitous track *if there were no river there*. But surely it is a waste of power, looking to the exigent want of public improvements in other parts of India, to spend many millions sterling in the construction of a duplicate line of communication, when there is already available a means of communication which, whatever be its defects, is yet in the habit of transmitting from the interior to the coast two millions of tons of commodities every year, and is capable of transmitting many times that quantity if occasion should require. No railway in the world has a traffic upon it at all equal to this; and yet on the very margin of this river a railway is being constructed, costing many millions sterling, although it is well known, from the uniform experience of similar cases in all parts of the world, that the river will be able to carry more cheaply than the railway! I know that it is maintained that the construction of this line of railway has been suggested partly by political considerations. It was maintained by myself, among others, when the East Indian Railway was first projected, that the existence of a railway connecting the seat of government and the military resources of the country with the frontier beyond Delhi, would enable our forces to be precipitated upon the frontier with such rapidity as to confound the machinations of our opponents. But the political posture of affairs has changed very much since the railway was first projected. Our frontier is no longer near Delhi, for we have since acquired possession of the Punjaub, to all parts of which easy access is afforded from the sea by the Indus and its great tributaries, and the appropriate watch-tower of the frontier is no longer Calcutta but Bombay. It has been ascertained, moreover, since

the railway was first proposed, that the Ganges and other rivers of India are far more susceptible of navigation by steam than was at that time imagined. This I first ascertained by my personal investigations in India; and it became obvious to me, that although vessels of the ordinary construction would not be widely available upon the rivers of India, yet that there would be no difficulty in the introduction of vessels of light draft of water, and otherwise suited to the shallowness of the rivers, by means of which all the more important rivers might be navigated throughout the year for a great part of their length. The political benefits, therefore, of a railway up the valley of the Ganges, resolve themselves into the benefits of a speed of conveyance for troops and stores of twenty or thirty miles an hour over a speed of eight or ten miles an hour, which a steamer would be able to maintain. Seeing that there is now the electric telegraph throughout India, which gives the power of transmitting requisitions for troops or stores instantly from place to place, thereby enabling them to be carried to their destination in steamers maintaining a speed of ten miles an hour, in as short a time as without the telegraph they could be conveyed by railways at a speed of twenty miles an hour, the question is, whether the rate of speed attainable by the employment of steam-vessels on the rivers is not sufficient for all political purposes; or whether the realisation of a somewhat higher speed will confer such benefits as warrant, in the present impoverished state of India, the expenditure of many millions sterling to attain them? A railway must rest its pretensions to Government support either upon the commercial benefits it confers upon the population, or upon the political advantages it yields to the Government. As a railway is

a very expensive instrument, the political advantages it holds out must be very large and very unequivocal to warrant its construction upon that ground; and I maintain that there is no railway in India, either made or projected, which can support any such pretension. No doubt this is a pretension which any scheme, however futile and unsound, can assert, and it is one, moreover, which is likely to be asserted by all such schemes with an energy of vociferation that is in proportion to their futility and unsoundness. There is an instinctive necessity on the part of the supporters of such projects to take refuge in a fog, and the assertion of political merit is a claim that is sufficiently vague and turbid to afford the degree of mystification required. When, however, we examine closely these large pretensions, we will in most cases find how hollow and spectral they become. They cannot bear the shock of argument, or the light of day, without collapsing into that insignificance from which, but for the haze by which they have been surrounded, they never would have emerged.

The portion of the East Indian Railway originally proposed to be constructed was that portion of the main line leading from Calcutta to Mirzapore, which connected Calcutta with the Burdwan Collieries. For the construction of this portion of the line the East India Company had given a guarantee of interest on a capital of three millions sterling. The line was to be a double line of expensive construction. I recommended that the line should be made single, of cheap but substantial construction, and that it should either be carried all the way to Mirzapore or not be undertaken at all: but this recommendation was not adopted, for one

reason among others, because the guaranteed capital was insufficient for the extension.

Shortly afterwards I went to India as one of the engineers of the railway. The conclusions I had arrived at in England, as to the folly of making a piece of railway leading into a jungle as a demonstration of the advantage of railway works in India, were fully confirmed on my arrival in India; and every one connected with the railway in India appeared to come round to the same opinion. Shortly after my arrival in Calcutta I proceeded to Mirzapore. From that place I addressed a letter to Mr. Stephenson in Calcutta, stating that in my journey along the grand trunk road I found that it was so wide and level, and so suitable for a railway, being carried on an embankment which was consolidated by time and with 150 bridges upon it which had been tested with reference to the inundations, that the best thing that could in my opinion be done was to ask the Government for permission to lay a single line of rails along one side of the road from Calcutta to Mirzapore, and which might be done without disturbing the road traffic, as, by dividing off the railway by a fence, there would be more width left for the road traffic than was actually then used for that purpose. That this suggestion was not carried into effect was no fault of Mr. Stephenson's. He was, and I have no doubt still is, ever ready to adopt any measure which appears calculated to promote the honest and efficient prosecution of the undertaking he has in hand. But the proposal experienced opposition in other quarters where his singleness of purpose did not equally prevail, and in the end it was not adopted. Had it been adopted, the East Indian Railway would have been opened to Mirzapore years ago, and would in my opinion have been

a successful undertaking. As scarcely anything would have had to be provided but the rails and the working stock, the capital on which interest would be payable would have been moderate, and an experiment would have been afforded of the merits of railway works in India which would probably have enlisted public opinion in their favour, and might have led to the extension by private enterprise of such undertakings. And now what is the actual issue? The loss upon the working of the portion of the line already opened is fully greater than what I predicted it would be; and that the undertaking, when extended in the manner now proposed, will prove a very questionable success, it is not difficult to foresee. With the Ganges, in the cheap conveyance of merchandise, it never can successfully compete. It will no doubt, in the vicinity of towns, be used to convey passengers through short distances; but even this is a service which steam-vessels on the river can equally well perform, and it is not the purpose for which the railway is professedly constructed. Nothing can be more lamentable than the want of intelligent management under which this railway company has suffered from its first formation till the present day. Every one feels how important it is to attract English capital to India. Here is a great experiment tried of the actual results of such an investment; and if the speculation be a failure, as up to the present time it confessedly is, and as under existing circumstances it appears likely to continue, will not the effect be to discourage the influx of English capital into India, and hinder the prosecution of many works which would have been of great permanent advantage? The Bombay Railway has been conducted in a similar spirit, and has been attended with a like result. The total re-

ceipts upon the Calcutta line are only 4 per cent. per annum on the cost of construction; and after making a moderate deduction for depreciation and wear and tear, neither of the lines pays its working expenses. Both schemes at present are incumbrances upon the people and the government of India, by whose contributions a large part of the loss caused by the maintenance of these railways must every year be made up. This is a result which I have, to the best of my ability, endeavoured to obviate; and I have reason to believe that the result, bad as it is, would have been worse but for my intervention. I believe that the arguments I have used—not only with Mr. Stephenson, who projected the East Indian Railway, and Mr. Chapman, who projected the Great Indian Peninsular Railway at Bombay, but with all the persons with whom I have come into contact in reference to such questions—have served to dissipate many of the magnificent illusions in which the subject of Indian railways was originally enveloped, and to reduce to a more modest scale of expense the projects which were originally entertained. Both the East Indian and the Great Indian Peninsular Railways were proposed originally as double lines. They are, for the most part, constructed as single lines, as I recommended. I very early pointed out to Mr. Chapman the risks attaching to his proposal of ascending by the Malsej Ghaut to the table land above Bombay, inasmuch as in that line the country was completely undeveloped, whereas, by ascending by the Bhore and Thull Ghauts, he at once got into the current of traffic already existing. The project of the railway is now altered in conformity with these suggestions. A line from Bombay to Poonah, or rather from Callian to Poonah, would, I think, have been a useful line, and if economically can-

structed, would, I believe, have returned its expenses. But I do not believe that the design at present entertained of carrying this line to the opposite coast of the Peninsula of India can be attended with a prosperous result, as such a line comes into competition with the water carriage on the rivers which rise in the Ghauts at the back of Bombay; and all experience shows that rivers can carry merchandise more cheaply than railways. The natural terminus of all lines of communication which profess to carry commodities for exportation is the sea. The sea is also the natural terminus of rivers; and the branches of rivers collect the traffic over a wide area to transmit it to the sea just as they collect the waters. The natural course of procedure in developing the internal communications of a country is, to proceed up the rivers as far as possible, removing out of their beds any obstructions which can be removed at a moderate expense, and at the points where the rivers cease to be navigable, by the shallowest species of boat that can be employed for the purpose: the communication must be continued by a canal, by a roadway, or by a railway. The canal in India has this advantage over the other expedients, — that it may be used for purposes of irrigation also, and its employment does not involve a transshipment of the cargo. Nevertheless, there are situations in which a canal cannot be made without a greater expense being incurred than the case would warrant; and in those situations a roadway should be constructed, which may be changed into a railway so soon as the traffic rises to such a point as to justify the transformation. This, as it appears to me, is the only natural and safe way to introduce improved communications into India on such a scale of extension as to be productive of sensible advantage to the

country, and without incurring the risk of repeating those splendid mistakes of which we have an example in some of the existing railways, and which it would be too expensive an experiment further to multiply.

I was at Mirzapore at the time I made the suggestion that the East Indian Railway should apply for the concession of a width of the grand trunk road on which to lay down the rails. This was in 1847. I returned to Calcutta by a steam-vessel on the river, and was left behind at Rajmahal, but subsequently overtook the steamer when she stopped during the night. During this voyage I ascertained two things: the one, that the steam-vessels on the river were by no means well adapted for encountering the difficulties of a shallow and shifting navigation; and the other was, that the Bhagarutty, which was at that time closed, might be rendered susceptible of navigation throughout the year merely by compelling a larger portion of the main stream of the Ganges to pass down that particular channel. Although, therefore, the navigation of the Ganges was confessedly very defective, and no longer adequate to the wants of the age, it was quite clear that it was susceptible of vast amelioration at small expense; and when the plan which I had proposed for carrying the railway along the road was not accepted by the railway company, and the enterprise was consequently put in abeyance for some years, I took up the question of the navigation of the river, and made a definite proposal to the East India Company with regard to the navigation of the Ganges, the Godavery, and the Indus. This proposal was very favourably entertained by General Galloway, who was at that time chairman of the East India Company, and was adopted by the Court of Directors, subject, however, to a reference to the Governor-General

in Council, which was accordingly made. The Governor-General referred the question to several engineer officers, and among the number to Colonel Baker, who had recently been appointed to the office of superintendent of the works of the East Indian Railway, which had been by that time resumed. Colonel Baker's opinion was on the whole adverse to the undertaking; not so much, I imagine, from any demerits of its own which he imputed, as because it might interfere with the prosecution of the railway works which were then under his superintendence. This impression is derived both from what I remember of the nature of Colonel Baker's objections, which did not appear to me at the time to be very tangible; and from the objections he subsequently brought against the views advanced by Colonel Cotton respecting the primary importance of works of navigation and irrigation spread all over India, in preference to the expensive expedient of railways of the existing magnificent type in a few favoured localities. Colonel Baker, in his Report upon Colonel Cotton's proposals, remarks, "I may be permitted to express my regret that an officer apparently so anxious for the welfare and improvement of India, should have directed the influence due to his abilities and reputation against a system the value of which, after years of controversy, has at length been recognised, but which is not yet so firmly established as to be safe from the risk of further delay and injury by adverse discussion."

It would be easy to retort the feeling of regret here expressed. Here we have an officer in a responsible position, of manifest talents and not deficient in information, arresting the progress of improvement in India, of an ascertained and practical character, for the sake of a magnificent phantom. I do not know who it is that

recognises the value of the railway system as at present carried out in India. Certainly I do not recognise it, and those who do are fast finding the grounds of their admiration dissolved away by inexorable fact. I confess I am curious to learn the grounds on which that system rests its claims to the large and almost exclusive Government support it has already received. No doubt it has a wholesome fear of "adverse discussion;" but is it the interest of the people of India, or can it be the interest of the Indian Government, to extend such large pecuniary assistance to undertakings which are incapable of supporting "adverse discussion?" The railway companies are powerful and rich. They number among their supporters many men of talent and address. They need not, therefore, have any apprehension that any case which they feel disposed to lay before the public will not have all the justice done to it of which it is susceptible. The railway companies are either right when they say that railways are the primary want of India, and should therefore obtain the first and largest share of Government support,—or Colonel Cotton is right when he says that railways of the expensive character hitherto constructed in India are not wanted at all, or, at least, are not the wants which are of the most pressing character; that the primary wants of India are, water for irrigation, whereby the productiveness of the country will be increased; and a cheap system of navigation through the irrigating channels and navigable rivers to the sea, so as to enable the surplus produce to find a remunerative market, bringing other commodities in return. Now, without insisting on the accuracy of every detail that Colonel Cotton has brought forward,—many of which must be considered as intended only for purposes of illustration, and imperfect precision in which

will not affect his main positions,—I do not hesitate to maintain that it is Colonel Cotton who is in the right, and the railway companies who are in the wrong; and this position can, I believe, be maintained against all objectors. If the advocates of the railways feel that they are unable to sustain an argument upon this subject, they certainly abdicate all pretension to further Government assistance. If they think that they *are* able, let them come forward, and I will meet in the fair field of argument any gentleman who thinks himself qualified to support such a discussion. Those who deprecate discussion only proclaim their consciousness that the cause they advocate cannot be defended. The question of the material improvement of India is too momentous a question to be smuggled through without debate. It is a question affecting not merely the people of India, but the people of this country also, who will have to pay the debts of India if she is unable herself to do so, and who year after year are losing the enormous benefits which India, if her resources were developed, is capable of rendering, both as an inexhaustible source of supply for the raw materials we require, and an inexhaustible source of demand for our manufactures. A good cause should not fear argument; a bad cause should not be shielded from it: and the more the subject of Indian improvements is discussed, the more clearly will it appear where the truth lies. *That* is the thing which it behoves us to discover, and which those only who are animated by disingenuous motives will endeavour to conceal.

It will not be understood, from what I have stated, that I include all the railways in India at present constructed, or proposed, in one general condemnation. In some parts of India railways of a cheap construction

would be valuable aids to internal communication, and several of the lines latterly proposed or in progress I know but little about, so that it would be impossible for me either to approve or condemn them. The Madras line, in its original modest dimensions, extending from Madras to Arcot, I thought favourably of, and supported ; and a cheap line from Callian up the Ghauts to Poonah would, I think, have been a reasonable undertaking. The projects of which I think least favourably are the unprofitable and pretentious projects of the East Indian Railway, and Great Indian Peninsular Railway Companies, the one extending from Calcutta to Delhi, in competition with the Ganges, and the other extending from Bombay to Nagpore, in competition with the Godavery, a river which, since the exactions of the zemindars on its banks have been suppressed, will doubtless develop a large traffic.

If the resources of the state are to be spent on such splendid bubbles as these, not only will capital be scared from India, but the new burdens imposed upon the Government will have the inevitable result of compelling the Government *to cut down the salaries of all the officials in India*, as the only means of recovering the finances. If the resources of the country are not improved,—and such undertakings as these cannot improve them,—and if at the same time the Government is called upon to make up every year to the shareholders in the railways the deficient interest which must necessarily accrue in many of these undertakings, it requires no great perspicacity to discover that the Government will be thrown on the expedient of retrenchment as a relief from its financial difficulties ; and retrenchment implies paying to the persons it employs a smaller stipend than before. It is clear, therefore,

that every individual in the Government employment in India has a *direct interest* in putting a stop to this ruinous expenditure, and an interest also in seeing public works undertaken which will be profitable to the shareholders and productive to the revenue. Such works the works of navigation and irrigation proposed by Colonel Cotton are known to be. He advocates them from no hypothetical idea of their importance, but he merely proposes to apply widely over India works of that character which have been found to be productive of results almost magical in the presidency of Madras and wherever else they have been introduced. The first thing to be done, he says, is to place both the Government and the people in easy circumstances : that you will certainly do if you increase the productiveness of India fourfold, as you may do by superior irrigation, or if you increase its productiveness even one-fourth fold. A people can only become rich by its accumulations. The cost of subsistence must first be met before there is any fund available for the payment of taxes or for the increase of wealth ; and as the cost of subsistence may be taken at nearly a constant sum, the means of a nation rise very rapidly with an increase of production. No doubt as a people becomes richer their style of living becomes more expensive, and the whole increase of production arising from public improvements does not therefore go to add to the national accumulations or to swell the revenue. But a large part of the increased production is available for those purposes, and the residue is usefully expended, inasmuch as it adds to the comfort of the people. If after a nation becomes rich it chooses to be extravagant, the worst that can be said is that it misuses its resources ; but if it becomes extravagant while poor, it is

inevitably overtaken by a swift retribution. Now it is maintained by Colonel Cotton, and I think with justice, that railways, of the expensive type of those imported into India, are among the *luxuries* of life. Even in England, with its panting haste and wealthy population, railways of this class have on the whole yielded a very inadequate return; and in a poor and supine country like India the result is likely to be still less auspicious. What India requires is, not superlative refinements of locomotion, maintained at a great expense in a few favoured localities, but improvements of a cheap character spread widely over the surface of the country, which will increase production, facilitate the conveyance of cheap and bulky articles of produce, and enable the people to add to their wealth with the expenditure of the present amount of labour. *These are objects which every officer in the East India Company's service has a direct interest in promoting;* and he has an equal interest in preventing India from being bled to death for the support of transcendental projects of doubtful practical advantage. All men must admit that it is a good thing to navigate the rivers so far as they can be navigated, and wherever there is produce to be conveyed; and by bringing in the aid of steam-vessels of a light draught of water, towing trains of shallow barges, the rivers may be much more advantageously navigated than formerly and at an increased rate of speed. All men must also admit that there cannot be much risk to the Government in promoting works of irrigation such as those in the Madras presidency, which have, on the average, returned to the Government 70 per cent. per annum on the money invested, taking the average of all the years since their construction, while the annual returns are increasing every year.

Colonel Baker defends the construction of railways capable of maintaining a high rate of speed in India, not on the ground that such a speed is necessary or even advantageous, but on the ground that the cost of traction, on a level and substantially constructed railway, is less than on a railway with steeper gradients or lighter rails. Now, in the first place, there is no gradient on the whole line of the East Indian Railway involving material expense in its supercession; and even in the case of lines with steep gradients, the amount of mechanical power consumed in traction will be about the same whether the line is level or somewhat undulating, provided that the declivities are not so steep as to make it necessary to apply the break in descending them; for the increased power necessary for ascending an acclivity will be exactly compensated by the power saved in descending the corresponding declivity, and the total sum of the tractive power will remain unaltered. Nor is it the fact that the traction upon lightly constructed railways is materially greater than it is on expensively constructed railways, provided the dimensions and weight of the carriages are adjusted to the dimensions of the rails, and that a moderate rate of speed is maintained. It is the high rates of speed upon English railways which render necessary heavy rails and an expensive line. To realise high rates of speed very heavy engines are necessary, and the weight and concussions of these engines try the railway so severely at a high rate of speed, that an expensive construction of railway is indispensable not merely to durability, but to safety. If we are content with a low rate of speed, we may employ a light and cheap engine; and an expensive species of line under such circumstances is not required. Colonel Baker states, that the expense

of tractive power upon the American lines, which are lightly constructed, is very much greater than the cost on the English railways, which are constructed in an expensive manner. I doubt the fact to the extent he endeavours to make out. But there is another fact which, in any comparison of these two railway systems, is much more germane to the present question. The American railways, as a general rule, yield a fair return upon the capital invested in them. The English railways, on the contrary, yield in general a very inadequate return, though connecting more populous districts, and supported by a more wealthy population. Surely the only inference to be drawn from these facts is, that the American system, as the better speculation, is the one to be preferred, especially in a country like India, which more resembles the circumstances of America than the circumstances of England, and seeing that there is but a limited amount of capital available for public works.*

My proposal for navigating the rivers of India by means of steam-vessels, of light draught of water, towing trains of shallow barges, was first propounded in 1848; and it received a large measure of discussion during that and the two following years. At first, some incredulity was expressed, whether a design so

* In America the same very natural view which Colonel Baker propounds appears to have been originally adopted, but it had finally to be abandoned after much loss and expense had been incurred. In the annual report of the engineer of the State of New York for 1854, page 7, the following remarks will be found:—

“The engineers of this country began the construction of railroads by following the plans laid down by their European brethren. As the latter had unlimited command of capital, so long as their plans were followed in this country the progress of the railroad system was comparatively slow, because capital could not be obtained, *and roads thus constructed were not remunerative.*”

simple in itself, and promising such a large measure of advantage, could be practically carried out; and it was regarded as a presumption against its feasibility that it had not already been carried into operation. This, of course, is a presumption which is applicable to every measure of improvement not yet accomplished; but the proofs of the feasibility of the design, which I accumulated, at length not merely convinced sceptics, but, what was a more difficult task, silenced objectors. Memorials in favour of the undertaking were presented to the East India Company by various public bodies; by the Chambers of Commerce of Belfast, Dundee, Edinburgh, Leith, Glasgow, Greenock, and Manchester; by the East India and China Association of Liverpool; by the Commercial Association of Manchester; and by the Provost, magistrates, and leading citizens of Aberdeen. The mechanical sufficiency of my proposal was testified to by the most eminent mechanical engineers in this country—by Messrs. Boulton and Watt, Penn, Miller, Fairbairn, Summers, Steele, and many others; by the late chief engineers of Bengal, Madras, and Bombay, and by various nautical men and others familiar with the rivers of India; of whom I will here only mention the late Sir Charles Malcolm, who took a lively interest in the question, and Lieutenant Wood, of the Indian Navy, well known for his familiar acquaintance with the Indus, and for his travels on the Oxus, and in various other parts of the East. Strange to say, Mr. Wood, who was justly regarded by the East India Company as an eminent authority upon such questions, and was, therefore, consulted respecting my proposal, took an unfavourable view, at first, of the species of trains of barges which I had designed for the accomplishment of the navigation, and wrote a pamphlet

setting forth the nature of his objections. But, upon a more mature consideration of the subject, he found that his objections were unfounded; and he therefore wrote to me to say, that he altogether abandoned them. One cause of his change of opinion was, that on the occasion of a visit he had to make to the Continent, he learned that trains of a similar construction, in many respects, to those I had proposed, were in successful use on the Rhone,—a fact of which I had long been cognisant; and he thus found that certain arrangements which he thought would not work well, were found, in actual practice, to work in a perfectly effective manner. Mr. Wood, after this discovery, became an earnest supporter of my design, which he continued to be until he went to Australia some years afterwards.

Colonel Baker, in his remarks upon Colonel Cotton's proposals for Indian improvement, states that he is not sanguine that inland steam navigation in India will ever attain to the speed or cheapness which Colonel Cotton anticipates, seeing that it is no longer in its infancy, and that the inland steam department of the Government, after an experience of twenty years, has not been able to introduce any improvement. But is Colonel Baker prepared to maintain, that because the steam department of the Government in India has not been able to introduce any improvement, that therefore improvement is impossible, or even unlikely? I have yet to learn that the steam department of the Government in India has ever *tried* to introduce any material improvement in the navigation of the rivers; nor do I know who, among its officers, are disposed to incur the responsibility and labour which attach to the establishment of every important measure of improvement, or to whom among them the world is likely to

look for examples of the latest steps of improvement in steam navigation. There is no superfluity of mechanical talent and proficiency in India. The engineers of this country who have that talent and proficiency have never been in India. They have no very distinct conception, therefore, of the nature of the difficulties which have to be overcome in the navigation of the Indian rivers, and are moreover so much engaged in the execution of works of a stereotyped character, that they are little disposed to give their attention to problems involving considerable deviation from their usual practice. Then, again, there are very few persons, if any, in India, who can be supposed to be sufficiently proficient in the resources of mechanical engineering, to be able to initiate and practically carry out important improvements in steam navigation, so that what between the ignorance of the conditions of the problem in this country, and the want of skill for its solution in that, it remains to the present day practically unresolved. Now inertia is a cheap virtue. It is an easy thing to insinuate doubts instead of replying to facts and arguments; and instead of discussing a proposed improvement on its merits, to maintain that the fact of its non-existence in a particular locality is a sufficing presumption against the possibility of its introduction. Such a course, however, is not conducive to the prosperity or successful administration of the affairs of India. The truth is, Colonel Baker seems to be aware that on such questions mankind judge not so much by the weight of evidence as by the weight of authority; and although this is a standard which I do not personally recognise, I am quite willing that the present question of the practicability of navigating the rivers of India by trains of shallow barges, either maintaining a considerable rate of speed, or

capable of carrying merchandise at a much cheaper rate than is possible on railways, should be left to its decision. On the one side of this question, then, we have Colonel Baker, an officer of manifest talent, of responsible official position, and with that evident bias in favour of railways which is probably a natural result of his identification with them, as the superintending Government engineer. On the other side, we have myself; and I do not suppose that I shall be considered to manifest great presumption, if I reckon my authority on such a question as of nearly equal weight. I was connected with the railways before Colonel Baker was; am probably as familiar as he is with the arguments which can be adduced in their favour; and years ago I passed beyond the stage of information now only reached by the existing stereotyped railway advocates. I began with a bias towards the railways too; but I saw, from the first moment that I began to investigate the subject, that railways in India would not answer, or, in other words, would not attract to themselves much traffic, or be of sensible advantage to the commercial wants of the country, unless they were constructed in a very economical manner, instead of being merely a stolid importation of the English system. On proceeding further, I found that there was a road extending from Calcutta to Delhi, which, except in a few spots, where some deviation would be necessary, was suitable for a railway; and I further found that the navigation of the Ganges by steam was susceptible of such vast improvement, that it could be rendered a most important line of internal communication. At the point which Colonel Baker has now reached, I began. The same process of conviction which has acted upon my mind will, I have no doubt, finally act upon his. But look to the

detriment which India suffers in the meanwhile! All really useful public works stopped for the sake of these railway sublimities, which, after all, so far as our present experience goes, or any analogy warrants us to hope, will fail to render to the country that measure of substantial advantage which would be afforded by works of a suitable character.

But the comparison must not stop here, as it refers not merely to the value of railways, but also to the value of improved steam navigation. I do not suppose that I shall be considered as offering any disparagement to Colonel Baker's abilities, if I venture to express a doubt whether he can have the same intimate acquaintance with steam navigation and the capabilities of steam machinery, which my pursuits for the last twenty-five years have enabled me to acquire. I do not imagine that Colonel Baker himself would think so; nor do I imagine that he will maintain that he has given the same attention to the question of navigating the rivers of India by steam, that I have given to it for the last nine years. Upon the whole, therefore, I do not imagine that Colonel Baker would himself be disposed to imply that his antecedents have been more favourable than mine, for enabling him to attain sound convictions upon this subject. Weighed therefore against my opinion, Colonel Baker must be content to see his opinion taken with some deduction from its authority; and while I am quite sensible that, in discussing the claims of this and other proposed improvements for India, he has exhibited much candour and ability, I at the same time feel that his convictions have been strained somewhat out of their natural direction by the predominance of a preconceived idea. No doubt it may be said, that I have preconceived ideas also; and in this objection

there would probably be some weight, if it were not the fact that *I began with much the same ideas that Colonel Baker now entertains* ; so that my preconceptions, if I had any, were precisely in the same direction as those of Colonel Baker. If I have outgrown these ideas, it has only been because I found them to be inconsistent with the larger and more accurate information that I have since acquired ; and, as Colonel Baker gives more of his attention to the navigation of the rivers, his views will, I believe, undergo a similar transformation. I yielded, as every man ought to do, to the evidence of physical fact ; and I cannot suppose that any one of Colonel Baker's talents will refuse to manifest a similar docility.

But it is not on my opinion alone that the pretensions of the undertaking I proposed for improving the internal communications of India, by establishing steam navigation of an efficient character upon the rivers, can be supposed to rest. We have on the same side the opinion of Colonel Cotton, who has given to the subject of the navigation of the rivers of India his constant attention for some years, and who is no less remarkable for his talents as an engineer than for his transparent integrity of character. We have also on the same side the opinions of the late chief engineers of the three Presidencies of India — viz., General Macleod, late chief engineer of Bengal ; General Sim, late chief engineer of Madras ; and Colonel Dickenson, late chief engineer of Bombay. We have also on the same side the opinions of the most eminent mechanical engineers in this country ; and, lastly, we have the example of various trains of barges propelled by steam, and of a construction similar to what I intended, in actual use upon rivers more difficult than those which I proposed to navigate. In America such trains of barges, propelled by steam,

are now used to an *enormous extent*; and they are found to afford most important facilities in promoting the internal communications of the country.* In the face of such an array of evidence, what is the amount of cogency which Colonel Baker would himself be disposed to attribute to the doubts he formerly suggested?

It has often been suspected that many of those persons who have discouraged the establishment of steam navigation upon the rivers of India have been mainly prompted by the secret conviction that it would answer too well. Those persons have almost in every case been connected with the railway works in progress

* In Lardner's "Museum of Science and Art," vol. ii. p. 35, the following account is given of the trains of barges employed on the rivers of America for the conveyance of goods:—

"The other class of steamers used for towing the commerce of the rivers corresponds to the goods trains on railways. No spectacle can be more remarkable than these locomotive machines dragging their enormous load up the Hudson. They may be seen in the midst of this vast stream surrounded by a cluster of twenty or thirty loaded craft of various magnitudes.

"As this *water goods train*—for so it may be called—ascends the Hudson, it drops off its load, vessel by vessel, at the towns which it passes. One or two are left at Newburgh, another at Powkeepsie, two or three more at Hudson, one or two more at Fishkill, and in fine the tug arrives with a residuum of some half a dozen vessels at Albany." In a letter which I received lately from Dr. Lardner, he states that trains of barges of this character are used in America to an *enormous extent*, and that they admirably fulfil their intended object of carrying a large quantity of goods on shallow rivers at a cheap rate. From the want of some such cheap means of conveyance in India, the produce accruing to the Government as payment of rent is often altogether lost; as, if unsaleable on the spot, it cannot be carried to a more favourable market, and in many cases it actually has to be suffered to rot upon the ground. A Department of Public Works for India, if properly constituted, would speedily remedy such evils as this, by providing cheap and remunerative lines of internal communication.

in that country, and the very natural question they have put to themselves is,—"If all this can be accomplished by steam upon the rivers, wherein lies the necessity of railways?" They have, in fact, looked upon the rivers as the natural enemies of the railways, and have resisted accordingly all proposals for their improvement and navigation. This, though a very natural view, is not the less a very narrow one; and it would be easy to show that the only hope of the railways becoming remunerative lies in the establishment of steam navigation upon the rivers, and in the accomplishment of the other expedients of internal improvement which have been advocated by Colonel Cotton. For if railways of an expensive character be among the luxuries of life, they can only be brought into profitable use when supported by a population which has the means of paying for the luxury of rapid locomotion. It is quite indispensable, therefore, even to the attainment of the most moderate success by the existing railways, that the population should be enriched by a profitable exercise of industry, so as to have money to spend on other objects than the mere necessities of existence: and this end will be best attained by increasing as much as possible the productiveness of the soil, and by opening up communications, from the interior to the coast, of the cheapest possible character. It would be a completely visionary expectation to suppose that cheap agricultural produce can ever be transmitted from the interior to the coast by railways. It could not bear the expense of that mode of transmission, and it must therefore either remain unproduced, whereby the poverty of the people will be perpetuated, or a water-conveyance, by means of rivers, or otherwise, to the coast, must be provided. If the people remain in poverty they cannot afford to use the railway.

If they are enriched by being enabled to find a profitable market for their produce, they may then be able, not merely to travel on the railway in considerable numbers, but will become consumers of those expensive manufactures which are able to pay for a high rate of transport, and also of such luxuries as ice, fresh fish, and other perishable articles, which the railways are found to carry in large quantities in European countries, and for which rapidity of transmission is important.* Even the railway companies, therefore, have the same interest as the Government and people of India in the establishment of improved means of water-communication by the rivers and canals throughout the interior of India, as the wealth thus created will tell powerfully upon the railway traffic, and is in fact the only source from which that traffic can be sustained. If it would be useful to the railway companies to prevent the improved navigation of the rivers, it would be more useful to stop their navigation altogether. But what would be the result of such a measure, supposing it to be possible of accom-

* In America it has been found, on an average of four years, that the value of the goods carried by the railways of the State of New York was 227.41 dollars per ton, whereas the average value of the goods carried by canal in the same State and during the same period was 48.68 dollars per ton. (See "Annual Report of the Engineer of the State of New York for 1854," p. 83.) It appears from this, that to afford traffic for a railway, the more expensive commodities of life must be in consumption, which can only be the case when the population is in easy circumstances; and in India the population can be in easy circumstances only when there is a profitable cultivation of the land. In the Appendix will be found an extract from the Report of the New York State Engineer for 1854, in refutation of the prevalent idea that transport by water and by railway are antagonistic; the whole tenor of the experience gained in America being to the effect that the two systems are necessary to the well-being of one another.

plishment? Much of the agricultural produce which now goes to enrich the people and to support the revenue would not be raised at all. If the sugar we now receive from India, and the manufactures we export thither, could only be transmitted by a railway connecting the two countries, what would be the amount of the commodities interchanged? And if the expense of railway conveyance through long distances cannot be borne by articles of the value of sugar and manufactures, still less can it be borne by the rough agricultural produce of the country, which at present constitutes the bulk of the river traffic. The alternative lies not between the railway and the river carrying such articles, but between their conveyance by the river and their not being produced at all; and every hindrance to production saps the prosperity of a railway just in the proportion in which it operates to the public loss and detriment.

The necessity of cheap water-communication to the prosperity of expensive lines of railway is amply illustrated by the example of England. It is our cheap means of communication by sea with all parts of the world which enables our costly railways to return their expenses, as will be obvious, if for a moment we consider what the consequences would be if that cheap water-communication were arrested. If we suppose a belt of country 1000 miles broad to be carried all round this island, so that we could receive neither wheat, timber, nor any other article from abroad, nor transmit a single ton of coal, iron, or any other article to foreign countries without having to encounter the expense of 1000 miles of land-transport, what would be the effect on the national prosperity, and, not least, upon our railways? The whole population, stricken

with poverty, would at once lower their expenditure. The railways would carry fewer passengers and fewer goods, and the interest of the money invested in them could no longer be paid. If, then, the railways of this country would suffer severely from any such hindrance to that cheap water-communication with the rest of the world, by which, in point of fact, they are fed and sustained, shall we artificially cause a similar hindrance to the water-communications of India with the view of aiding the success of railways in that country ; or, what is the same thing, shall we refuse to aid the development of those cheap water communications ? No greater calamity could befall the railways of India, or of any other country, than the abolition or diminished efficiency of those cheap modes of water-communication which enable cheap articles to be conveyed through long distances at a small expense ; for in this power of cheap internal locomotion, rivalling that of the ocean, lies one of the main roots of that national prosperity with which railways must alike flourish and decline.

I have the honour to be,

Right Honourable Sir,

Your most obedient, humble servant,

JOHN BOURNE.

APPENDIX A.

From Indian River Navigation, by John Bourne, 1849.

THE GANGES.

IN the Ganges, as in most of the rivers of tropical countries, there is a yearly inundation, during which there is an abundant depth of water for purposes of navigation; but in the dry season the depth of the channel in many parts between Allahabad and Calcutta does not exceed 3 feet 6 inches, and sometimes it is even less than this. The river begins to fall in October, and continues falling through November, December, January, February, March, April, and May: during April and May, and sometimes half of June, the river is at its lowest, and after that it begins to rise from the melting of the snows in the Himalaya and the rains which fall in Bengal. In the dry season the average passage by steamer from Calcutta to Allahabad is 24 days, and from Allahabad to Calcutta 15 days; and during this season the average velocity of the current does not exceed $2\frac{1}{2}$ or 3 miles an hour; whereas during the rains, although the current is then much stronger, the average passage upwards is 20 days and down 8 days. This disparity is mainly due to the circumstance of the Bhaugiruttee branch of the Ganges, through which the navigation is pursued during the rains, being too shallow during the dry season to enable the steamers to use it; and they have consequently at such times to pursue a circuitous course through the Sunderbunds and up the Goraee river, by which the length of the voyage is increased from 787 miles to 1147 miles. The minimum depth of water in the Bhaugiruttee is 2 feet, and that

river therefore will be always accessible to steamers drawing only one foot of water. The breadth of the Bhaugiruttee varies from 200 to 450 yards.

The main stream of the Ganges may be navigated by the improved vessel as high as Gurmucktesir, near Meerut. The Gogra, a large tributary of the Ganges, taking its rise in the Himalaya and running past Oude, could also be navigated by boats on the same plan, but of smaller dimensions, than those intended for the Ganges; and the Gunduck, a river also falling into the Ganges and taking its rise in the Dhawalagiri mountain in Thibet, could also be navigated by the same means. The Goomty river, rising in the Himalaya, passing the important cities of Lucknow and Juanpoor, and falling into the Ganges below Benares, might, notwithstanding its sinuous course, be ascended by small steamers, such as those proper for the Gogra and Gunduck, to a considerable height; and the Soane river, which falls into the Ganges above Patna, could also be navigated by steamers of the proposed configuration. By thus opening up the tributary rivers of the Ganges, so far as can be profitably done, it may reasonably be expected that the traffic on the main stream would be itself increased; but the existing traffic upon the main Ganges has been already ascertained to be upwards of a million tons a year; so that it constitutes a larger amount than steamers could hope to monopolise for many years to come. The Chumbul river could be navigated, by the improved steamers, past Gwalior to Kotah, in latitude 25° , during all seasons of the year; and during the rains boats can ascend to the foot of the Vindhya mountains, on the northern bank of the Nerbudda.

THE GODAVERY.

This is a river which, rising near Bombay, and flowing eastward through the heart of the cotton districts of the Deccan, empties itself into the Bay of Bengal at Coringa, to the north of Madras. Although capable of affording a commodious outlet for the cotton and other produce of Berar, and with a sufficient depth of water to enable navigation to be carried on throughout

the year, the Godavery is nevertheless, up to the present time, without any system of navigation such as is possessed by the Ganges and other rivers. This anomaly is to be imputed partly to the circumstance that the jungle in many of the districts through which the river flows, comes so close to the water's edge, and is so impervious and entangled, as to prevent the boats from being tracked upwards against the stream; and partly to the exactions of the officers of the Nizam, who, however, would have no power over English vessels. In 1816, Messrs. Palmer and Co., of Calcutta, formed the design of establishing a navigation upon the Godavery and Wurdah of 400 miles in length, and with this object they removed certain obstructions out of the bed of the river; but political events occurred which prevented the project from being carried into practical effect. As the river approaches the Rajamundry frontier, it has to pass through the Papkoonda mountains, where it is contracted from a mile and a half to a furlong in breadth, and consequently runs with great velocity, but there are no falls to obstruct the navigation. In various parts of the channel between Berar and the sea the depth during the dry season does not exceed 18 inches; nevertheless, as such a depth is sufficient for a steam-vessel of the kind proposed, there is no difficulty in the establishment of an efficient system of Steam Navigation upon this river. Captain R. H. Fenwick, after a personal survey of the locality, says, "That the navigation of the Wurdah, from Wonee to Kalisir, and of the Godavery, from Elgurb near Neermul to the coast, is practicable, there remains no longer any doubt;" and H. Chamier, Esq., the Secretary of the Madras Government, writing to G. A. Bushby, Esq., Secretary to the Government of India, in August 1840, suggests the propriety of a steamer being put upon the Godavery, to facilitate the transport of troops to Nagpore. Mr. Secretary Chamier writes as follows:—"Captain Fenwick, in par. 10. of his letter, states that he considers the Godavery and Wurdah rivers navigable for mercantile purposes, and offering a more advantageous mode of conveying cotton from Berar and the Nagpore territories to the eastern coast, than on carts and bullocks by land."

Mr. Chamier therefore adds: — “ It appears, therefore, probable that steamers like those on the Ganges might ascend the Godavery to a considerable distance, and afford great and important advantages, not only to trade, but especially for the conveyance of troops and stores for Nagpore and Jubbulpore.”

The distance of Nagpore from Woonee, in a direct line, is about 70 miles, which is somewhat less than the distance from Nagpore to Chandah. The distance of Oomrowty from Woonee is about 100 miles; but the Wurdah river ascends to within 20 miles of Oomrowty, and would be navigable by a smaller species of boat up to the vicinity of Natchengong, 30 miles below Oomrowty, where a fall in the river occurs, and over which boats cannot pass except in the height of the rains.

There can be no doubt, in my apprehension, that the larger part of the cotton of Berar would descend the Godavery, if an efficient Steam Navigation were established upon that river, which would carry the article from the place of its production to the sea at a moderate rate of freight; and the quantity of cotton grown would probably increase with the new facilities given to its conveyance, while at the same time the price of the article would be diminished to the English manufacturer. It is obvious, too, that since it is about the time of the monsoon rains that the cotton has to be transported, those rains, instead of impeding, would extend and facilitate communication if the rivers be made the highways; and the rivers would be most available for active service precisely at the time when the roads are closed by the floods.

Besides cotton, a steamer upon the Godavery would carry downwards silk, linen, shell lac, turmeric, grain, goor, oil, hemp, tobacco, bees' wax, &c.; and upwards, cotton and woollen cloths, salt, saltpetre, spices, iron wares, and metals, &c. The quantity of these articles which would be available as cargo for a steamer it is impossible at present to specify, but there can be no doubt that at least one steamer would find full and profitable employment. And when it is remembered that the Godavery, if navigated by steam, would become the highway to the heart of the Deccan, and must transmit the accumulated

produce of extensive districts, it will be obvious that the traffic, though of uncertain amount, cannot but be large; while the very fact of opening the river to Steam Navigation would not only divert the existing trade into a more eligible channel, but also materially increase its amount.

N. R. R. A. D. A.
THE NERBUDDA

The Nerbudda river, falling into the sea near Broach, to the north of Bombay, constitutes the northern boundary of the Deccan, and runs through a country which, though naturally productive, has been but little opened to commerce. The Tapti, which pursues a course parallel to that of the Nerbudda, falls into the sea at Surat, nearer Bombay. The districts of Broach and Surat are both known to furnish cotton of a superior quality; and by the establishment of an efficient system of navigation upon the rivers, the production of cotton would be largely increased. The navigation of the Nerbudda, however, is rendered difficult by rocks and falls, which obstruct the channel, and also by the strength of the current; but the magnitude of these difficulties appears to have been much exaggerated by loose and groundless generalisations; and it appears that the river could, at no great expense, be rendered navigable from near Jubbulpore to the sea — a distance of between 400 and 500 miles in a direct line — by boats of considerable burden. In a Letter from the Honourable Court of Directors of the East India Company (Marine Department), dated March 8. 1840, it is stated, "On reference to Capt. Ouseley's report, we find it asserted that, with the exception of the Dahree falls, there is no place from Bharagurha, near Jubbulpore, to the mouth that might not be rendered passable for such boats as are now used, — 30 to 40 feet long, and 8 to 10 feet wide. All rapids could, with trifling expense, be rendered navigable. Sir J. Malcolm cites Matthews' opinion in favour of the same object between Hernphal and Mokree; and we think that, whilst the native surveyor's opinion remains

substantially uncontradicted, it ought to be further investigated."

The Dahree falls are 40 feet high; and they could only be surmounted by an inclined plane, or by locks. An inclined plane of timber would be an inexpensive structure, as the finest teak timber grows in abundance upon the river banks.

From the sea to 11 miles above Tulluckwarra, a distance of 110 miles, there is no impediment to the navigation. There the Mokree falls, which are 6 feet high, occur, but they can be avoided by a side channel. The river, however, is obstructed by occasional rocks and rapids; but, by an inconsiderable amount of blasting, these impediments could be speedily removed. At the Hernphal, or Deer's Leap, the channel is contracted to a width of 40 yards, and the current is very rapid. At the Sarsa Darah falls there is a side channel available, by which the falls may be avoided. The Dahree falls of 40 feet, and perhaps, also, the Mundhar falls, of 10 feet high, would have to be overcome by inclined planes, upon which the vessels would ascend, after the fashion of a patent slip, or in the manner followed on some of the American canals.

It will be obvious from this recital that the Nerbudda presents difficulties in the navigation such as do not exist in the Godavery or the Ganges, arising mainly from the rocky nature of its bed; but this very peculiarity makes the Nerbudda an improveable river, inasmuch as any amelioration consequent upon the removal of rocks, or the deepening or widening of the channel, would be permanent and decisive. Of the importance of opening the Nerbudda to navigation no doubt can exist; and the practicability of accomplishing the necessary improvements at a moderate expenditure appears, from the reports of various engineer officers who have surveyed or sailed down the river, to be equally certain. To what point a steamer of adequate power could ascend the river in its present condition appears doubtful; but the most judicious course would probably be for the steamer to ascend the river as far as is practicable with safety, and for the obstructions to be cleared away progressively, from the mouth of the river upwards, the steamer

ascending higher every successive trip, in proportion as the obstructions were removed. The lower part of the Tapti is freer from impediments than the lower part of the Nerbudda; and a steamer of the kind proposed could ascend to Talneir, in longitude 75° , — the minimum depth of the water up to that point being 2 feet over the fords.

Supposing the Nerbudda to be opened to steam navigation, the commerce of Central India would be attracted towards it, as affording the readiest outlet for the productions of all the countries lying between the Godavery and the Jumna. Cotton, hemp, oil, seeds, sugar, rice, shell lac, hides, horns, and coal, would be brought down the stream; and British manufactures from Bombay, salt and salt fish, and articles from the Persian Gulf, would be carried upwards. The soil upon the banks of the Nerbudda, moreover, is known to be of a kind favourable to the growth of indigo, which, indeed, grows wild in those districts to a great extent; and the opening of the river would probably have the effect of inducing the cultivation of this and other valuable crops. The opium of Malwa, on the northern bank of the Nerbudda, is the best produced in India; and the same remark applies to the Malwa tobacco, which is much prized. From Broach there is upwards of seven millions of pounds of cotton annually exported at present; and the opening of the Nerbudda and Tapti to steam navigation would probably have the effect of increasing largely the export of cotton, and correspondingly augmenting the import of British manufactures.

THE INDUS AND ITS TRIBUTARIES.

In former times the Indus was the great highway of commerce between India and Central Asia; but upon the dismemberment of the empire of the Great Mogul the river fell under the power of a multitude of petty chiefs, whose exactions gradually extinguished the traffic. One consequence of this revolution was, that Cabool, Bokhara, and Persia, instead of being supplied from India with manufactured goods, as had previously

been the case, received most of their supplies from Russia, which, from the facilities of conveyance afforded by the Volga, running into the Caspian Sea, was enabled to come into the markets of the East upon eligible terms. These advantages possessed by Russia have, it is understood, been latterly augmented by the establishment of steam-vessels upon the Volga and the Caspian; and the Russians are now supplanting the English manufacturers in the Punjaub, and even threatening to do so in the north-west provinces of Bengal. The Indus, though a large river, is but ill adapted to navigation by steam, being in many places shallow and full of shifting sand-banks, among which it is impossible to discover the most eligible channel; and although the river is too deep to be easily fordable, it is at the same time so full of shoals as to present nearly the same difficulties to navigation as if the depth nowhere exceeded 2 or 3 feet. Practically, *the river is unimproveable*, and the same remark applies to all its tributary streams; so that the Indus is not only unfitted for the reception, with advantage, of adequate steam-vessels of the ordinary kind, but is incapable of being made better. By means of steamers, however, of the kind now proposed, the Indus may be navigated from the sea to Attock with a remunerative cargo; the Jailum to Oin, the Chenaub to Aknur, the Ravee to Lahore, and the Sutlej to Ropur, above Loodheana; and the voyage may in general be pursued day and night, since a vessel drawing only 1 or 2 feet water is not so likely to get upon a bank; and since, even should such an accident occur, efficient means are available for carrying her over it. The fall of the Indus, from Attock to the sea, being about 1 foot in the mile, the velocity of the current is necessarily greater than in the Ganges, but there would also be fewer stoppages; so that, with a velocity through the water of 15 miles an hour, an effective velocity of 10 miles an hour in ascending the stream might probably be realised. With this velocity the voyage from the sea to Attock would only occupy 94 hours; from the sea to Oin 92 hours; from the sea to Aknur 93 hours; from the sea to Lahore 101 hours; and from the sea to Ropur, on the Sutlej, 103 hours. Ropur is distant

little more than 100 miles from Kurnaul, upon the Jumna, to which point it has latterly been proposed to carry a canal from the Sutlej for purposes of irrigation; and if this canal were made large enough to be suitable for navigation also, it would then be practicable to go from Calcutta to the Punjaub by inland water conveyance, and India would become an island. A canal of large dimensions, conducting water from the Sutlej to the Jumna, would not only have the effect of deepening the Jumna by *restoring a volume of water* exceeding that at present withdrawn for irrigation, but, by replenishing the Gagur, Sursooty, and other rivers now nearly dried up, fertility would be again given to the region of Hurreana, whereby, under suitable arrangements, the expense of the work would be abundantly defrayed.

There appears little doubt that it would be practicable to ascend the Indus by steam considerably higher than Attock*; but there would be but little advantage in doing so, as at Attock the current of trade would pass westward into Cabool. The Jui Shir, or Cabool river, has, it is stated, been already ascended by a steamer as high as Jelalabad, although the river, in passing round the end of the Khyber mountains, runs with great violence; but an efficient vessel would be able to stem the current at all seasons, and, by carrying merchandise by this route into Cabool, the necessity would be obviated of having to convey it through the Khyber Pass, on the road from Peshawur to Jelalabad. The point in Cabool at which the steamer had to stop would of course become a *dépôt* for British goods, which would from thence be conveyed through the Pass between Hindoo Koosh and Koh-i-Baba, at Bamian, into most of the bazaars of Central Asia.

The imports of Cabool are indigo, cotton, sugar, calicoes, muslins, and shawls; and the exports are horses, the madder of Ghuznee and Candahar, and fresh and dried fruits. The chief carriers of the trade are the Lohanee merchants, a pastoral race

* From Kalabagh to Attock the Indus runs with great rapidity, and special arrangements would be necessary to overcome the velocity of the current.

of Afghans who occupy the country eastward from Ghuznee to the Indus. The Lohanee caravan usually reaches Cabool about the beginning of June; and after the merchants have disposed of their goods they prosecute their journey onward to Bokhara. The imports which Bokhara receives from India are the same as those received by Cabool. About 2000 camel-loads of goods reach Cabool from India yearly, and about half this quantity is transmitted to Turkestan.

The imports into Bokhara from Russia are, white cloths, muslins, chintzes, broadcloths, velvets, brocade, nankeen, gold thread, cochineal, refined sugar, honey, furs, locks, iron, iron pots, wire, copper and brass, leather, paper, needles, inferior cutlery and jewellery, hardware, and a variety of other small articles. English broadcloth is much prized in Bokhara, but none reaches that country, except through Russia or Persia; from which countries, although its transmission is subject to heavy imposts, it can be brought at a cheaper rate than from India, in consequence of the expense of the land-carriage through Afghanistan, which, however, the opening of the Indus would in a great measure supersede.

Besides the Russian and Indian trade, Bokhara carries on a considerable traffic with China, by way of Cashgar and Yarkund. The imports to Bokhara from China are, China ware, musk, bullion, and tea. Of the latter article there are 950 horse-loads, or 200,000 pounds, transmitted annually, although the difficulties of the roads, and the long land-carriage through Thibet, necessarily much enhance the price. A horse-load of 250 pounds costs 60 tillas in Yarkund, and sells for 100 tillas in Bokhara. It is entirely green tea which is carried to Turkestan, and the best comes from a place in China called Turkht, and is packed in small boxes of Banca tin, from whence it is called Banca tea. The sugar-candy of China is also imported into Turkestan, but being a comparatively cumbersome article, it cannot be carried by the same route as the tea, but is conveyed from China to Bombay, from thence up the Persian Gulf, and on by land to Teheran: from thence a large quantity is carried across the Caspian to the Bay of Balkan,

from whence it is carried to Khiva, and a small quantity is also carried by way of Meshed. It is obvious, that if the Indus were available for commerce it would afford a much easier route for the produce of China to Khiva and Bokhara, than either the route through Thibet, or the route through Persia; and many of the commodities which find their way into Central Asia through circuitous routes, would necessarily take the route of the Indus, so soon as that channel of communication was properly opened up.

The principal exports of Bokhara are silk, wool, and lamb-skins. The silk is chiefly produced on the banks of the Oxus, where the mulberry grows in the most luxuriant manner, and nearly all the inhabitants are engaged in rearing the silk-worm during the summer months. The lamb-skins of Bokhara are renowned throughout the East, and are only procured at Karahool, a small district lying between Bokhara and the Oxus. These skins are chiefly carried to Persia; but the risks of the transport are great, in consequence of the unsettled condition of the tribes between the two countries. From these causes it is not possible to negotiate a bill between Meshed and Bokhara, and the cost of the transport is very high.

The manufactures of Russia find ready access into Persia by the Caspian; but Tabreez and Teheran also receive Russian goods by way of Tiflis and the Caucasus. Latterly a route has been opened for English goods into the northern parts of Persia by way of Trebizonde, from which much benefit has accrued — the southern districts being supplied with English goods from Bushire, on the Persian Gulf. To the north-west of Bushire, the Karoon, a large and navigable river, ascends into the heart of Persia; and, under suitable arrangements, goods might be carried by this route to within a comparatively short distance of Ispahan.

APPENDIX B.

From "Profits upon British Capital expended on Indian Public Works." By Colonel A. Cotton, 1856.

THE "Friend of India," of the 18th October, states that the cost of the East Indian Railway may be taken at 10,000*l.* a mile, or 1,210,000*l.* for the whole distance opened. Everybody acquainted with the case knows that this is understated; at least it is universally believed that the cost has been much greater.

The total receipts for the six months ending June 1855 were 25,000*l.*, and this was the half of the year in which the Monsoon does not occur, so that the receipts were, probably, much larger than they would be in the other half.

The expenditure was 17,000*l.** and of this the items for repair of way and rolling stock were very trifling, on account of the apparatus being, as yet, quite new. Thus the item for repair of way for a hundred and twenty miles was 155*l.*, or 1*l.* 5*s.* a mile; that for repair of locomotives and tenders, 757*l.*; and that for carriages and waggons, 63*l.*

On the other hand, the "Friend" states that the cost of fuel and printing will be diminished. But nothing whatever is allowed for wear and tear of way and rolling stock. The permanent expenditure must, therefore, greatly exceed this sum.

* The expenditure on the railway was therefore two-thirds of the receipts. By the last report of the Ganges' Steam Navigation Company, it appears that during the year the expenditure of the steamers was only one-fourth of the receipts. The profits of that Company were 48 per cent., and the latest profits of a small Navigation Company on the Godavery were 55 per cent.

The balance is 8000L., or $\frac{2}{3}$ per cent. for the six months, equal to $1\frac{1}{3}$ per cent. per annum; leaving $3\frac{2}{3}$ per cent. to be made good out of the revenue of India.

The proportion of expenses to receipts is 68 per cent., and the "Friend" thinks it may be reduced below 60 per cent.; but for the reasons above given, it seems much more likely that the proportion will be increased when the wear and tear of the way and stock are allowed for.

But the startling fact is, that the total receipts are only 2 per cent. on the cost for the half year, or 4 per cent. per annum; 50,000L. on 1,200,000L.; even taking the cost at the "Friend's" estimate, and probably the real cost is much higher, and *the gross receipts not more than 3 per cent. per annum on it.* Even the "Friend," doing his utmost to make the best of the case, winds up with the magnificent hope that the railway will pay its expenses, and that consequently the shareholders, who are only guaranteed 5 per cent. *interest*, not *dividend*, will not have to pay a portion of that interest in order to make up the deficiency of the receipts compared with the expenditure.

It is not meant to be asserted that the receipts of the railway will not be ultimately more than this; they will no doubt greatly increase when the line is more extended; but at the present charges there is no reason to expect that the expenses will not increase more than in proportion, as the wear of the way and stock is felt; and we may certainly judge from this statement that the profits will be very insignificant, as they are in England.

But for the purposes of comparison with the results of money expended on irrigation and water-communication, this statement is quite sufficient. It shows the profit in the sixth year after the first capital was paid (1849), and so do the returns in the pamphlet show the profits of the eighth year from the commencement of the Godavery works in 1845. But in the case of the railway, this is the almost first profit received (if indeed there is really any profit at all), while the increase of revenues in the Rajahmundry Delta in the eight years has been

more than double the whole outlay up to the end of 1853 (180,000%); and the whole benefits derived to the district have certainly been as much as five times the capital expended. The Collector of the district officially estimated the saving caused by these works at 500,000% in the single year 1853. That the whole ultimate annual profits upon this capital of 180,000% are no more yet realised than those upon the railway expenditure, is certain.

If it is said that the railways will afford some great advantages to the country over those of irrigation and water-communications, I answer that the actual total money returns, so far as we can estimate them, are the best test we can have to show what is the real comparative advantage of different kinds of works. No test but this can prevent us from running into any kind of wild schemes whose advantages are all imaginary.

It is quite evident that as yet all that the community are willing to pay for a hundred and twenty miles of railway is 50,000% gross per annum, or 420% per annum per mile, which is only about 3 or 4 per cent. on its cost. If the rates were raised, no doubt the amount of traffic would be reduced; and, therefore, this is at present the utmost measure of its value in the estimation of the public, even allowing that no expense were incurred in working and repairs. To equal the results in Rajahmundry, we ought to be able to prove that the entire profits already received from the railway are at least five times the outlay, or about seven millions sterling, instead of 8000% direct returns, and perhaps, as much more in indirect profits—that is, in advantages to the travellers above the value of the fares.

The published results of the Bombay railway correspond exactly with those at Calcutta; the profits are a mere trifle, if there are really any at all, when allowance is made for wear and tear.

The following table gives a correct idea of the total profits upon the Rajahmundry works already realised:—

Years.	Average Revenues of 10 years before the works.	Revenue of each year since.	Additional Revenues in each year.	Total additional Revenues up to the end of each year.	Expenditure in each year.	Total Expenditure up to the end of each year.
	£.	£.	£.	£.	£.	£.
1846-7	196,000	242,000	46,000		24,400	
7-8		250,000	54,000	100,000	34,500	58,900
8-9		233,000	36,000	136,000	22,000	80,900
9-0		224,000	28,000	164,000	25,500	106,400
50-1		242,000	46,000	210,000	30,500	136,900
51-2		245,000	49,000	259,000	21,900	158,800
52-3		250,000	54,000	313,000	30,000	188,800
53-4		244,000	48,000	361,000		

Part of this expenditure was for repairs, and does not form a portion of the cost of the works ; so that while about 180,000*l.* had been expended, 360,000*l.* had been received in actual increase of revenue.

And if, in the same way, we compare the increase of sales of produce exported by sea only with the total expenditure, we have the following :—

Years.	Total Expenditure up to the end of each year.	Total additional sale of Produce by Sea only.
	£	£
1847-8	58,900	116,000
8-9	80,900	183,000
9-0	106,400	228,000
50-1	136,900	316,000
1-2	158,800	398,000
2-3	188,800	514,000
3-4		654,000

This takes no account of the additional sales by land, the diminished purchase of food from abroad, the increased consumption of their own produce by the people, and the saving in the cost of transport by the use of the canals. Adding for these, the

total gain to the people must be at least a million sterling, or more than five times the capital spent.

Such tables of the profits upon the railway expenditure for each year since the commencement of the undertaking would form a curious contrast to the above.

How can the profits of such hydraulic works be otherwise than enormous, when we consider the two facts, that the annual charge for interest and management for these works will be only 6*d.* per acre, while the increase of produce will be about 1*l.* 5*s.*; and secondly, the water costs the Government about 1*l.* for 300,000 cubic yards, while the people have been accustomed to raise it profitably from wells at 1*l.* for 5000 cubic yards, or at sixty times the cost to Government. If we consider the fact of rich Delta land being protected from floods, drained, irrigated, and supplied with water-transit at an annual charge of 6*d.* an acre, and water procured at one-sixtieth part of the money that we know it is worth, we shall not be surprised at any profits.

APPENDIX C.

COST OF TRANSPORT PER TON PER MILE IN AMERICA.

From the Annual Report of the Engineer of the State of New York, 1854.

					Mills.	Fraction of a Penny.
Ocean, long voyage	-	-	-	-	1	($\frac{1}{18}$)
„ short „	-	-	-	-	2 to 4	($\frac{1}{9}$ to $\frac{2}{9}$)
Lakes, long „	-	-	-	-	2	($\frac{1}{9}$)
„ short „	-	-	-	-	3 to 4	($\frac{1}{8}$ to $\frac{2}{9}$)
Rivers, Hudson and of similar character	-				2.5	($\frac{1}{7}$)

		Mills.	Fraction of a Penny.
Rivers St. Lawrence and Mississippi	-	3	($\frac{1}{3}$)
„ tributaries of Mississippi	-	5 to 10	($\frac{2}{7}$ to $\frac{4}{7}$)
Canals, Erie enlargement	-	4	($\frac{2}{5}$)
„ other large but shorter	-	5 to 6	($\frac{2}{7}$ to $\frac{1}{3}$)
„ ordinary size	-	5	($\frac{2}{7}$)
„ „ with great lockage	-	6 to 8	($\frac{1}{3}$ to $\frac{4}{9}$)
Railroads transporting coal	-	6 to 10	($\frac{1}{3}$ to $\frac{4}{9}$)
„ not for coal, favourable lines and grades	12.5		($\frac{1}{10}$)
„ „ steep grades, &c.	-	15 to 25	($\frac{4}{7}$ to $1\frac{1}{2}$)

APPENDIX D.

RECIPROCAL BENEFITS OF WATER AND RAILWAY TRANSPORT.

From the Annual Report of the Engineer of the State of New York, 1854.

The subject of Internal Improvements of this State cannot be properly examined without considering the canals and railroads as parts of a single system, and not, as has been erroneously supposed, as two systems antagonistic to each other.

It has been asserted that the revenue of the canals has been stationary or diminishing for several years past, and that this is owing to the competition of the trunk lines of railroads of this State. This alleged diminution of revenue on the canals has been contrasted with the increased receipts upon the railroad lines mentioned, and the opinion expressed that the competition of the latter would reduce the revenue of the canals, or render it stationary, by diverting a portion of its business.

For the purpose of showing the incorrectness of these opinions and statements, it is necessary to compare the nature and amount of business done by these roads with that of the canals, and to ascertain the effect of the former upon the latter.

The *first* error is in assuming to make a comparison between the *receipts* of a railroad company and the *tolls* which are collected on the canals by the State, as the former embrace the expenses necessary for keeping the works and machinery in repair, to pay the interest on the capital invested, and to reimburse the principal, and also the *whole expenses and profit charged upon the business done*, while the latter embrace only the charges necessary to keep the works in repair, and the payment of the interest and the principal expended upon their construction, and wholly omit the charges of the forwarders for the movement of the traffic.

The charges thus omitted embrace more than half of the whole cost of transportation upon the canals.

The *second* error is made by including in the comparison the sum collected by the railroads for the conveyance of passengers, while existing circumstances prevent any of this portion of the business from seeking the canals.

This item forms the largest amount of the receipts of the railroads in question.

The *third* error is the assumption that the freighting business done by the railroads, has been diverted from the canals, when, by an examination of that business, it will be seen,

1st. That the charges of railroad transportation being necessarily much higher than those of the canal, by taking the receipts instead of the tonnage, the comparison made is fallacious.

2nd. That a large portion of this freighting business was the transportation of articles, which would not have offered itself to the canals had there been no parallel railroads.

3rd. That many of these articles, being perishable, could not be carried on the canals, without serious loss to the owners.

4th. That the largest portion of the freighting business done by the railroads in question, is during that portion of the year when the canals are closed by frost.

5th. That the largest portion of the freighting business is the local business of the roads, which could not reach the canals without, in many cases, increasing the cost of transport beyond the value of the articles.

And finally, that the very roads in question and their tributaries (excepting the Northern), bring a larger amount of freight to the canal, than they convey of its appropriate business to market.

APPENDIX E.

SUPPLEMENTARY REMARKS.

Most of the important lines of water-communication in America have railways running beside them, partly to carry passengers and those light and perishable articles for which rapidity of transmission is important, and partly to carry on the communications of the country when the canals are closed by the frost. Notwithstanding the existence of a parallel railway, the traffic on the Erie Canal has increased so much that it has had to be doubled in width to accommodate the trade; and it is found that the great bulk of the articles, instead of being transmitted by railway when the canals are frozen, are kept over until the spring. The local traffic on the Central and Erie Railway in 1852 was ninety per cent of the whole; whereas on the Northern Railway the local traffic was only thirty-seven of the whole. On the New York and Erie Railway the products of the forest, manufactures, and miscellaneous articles had only a local traffic; the products of animals and of agriculture were four fifths local; and merchandise was nearly three fourths local.

The whole tonnage of the New York Northern Railway is six per cent; of the New York Central, nine per cent; of the New York and Erie, fourteen per cent.; of the Pennsylvanian Railway, two per cent; and of the

Baltimore and Ohio Railway, seven per cent of the tonnage of the Erie Canal.

The through tonnage carried by the Northern Railway is eight per cent; by the New York Central, two per cent; by the New York and Erie, three per cent; and by the Pennsylvanian and also by the Baltimore and Ohio Railways, it is two per cent of that carried by the Erie Canal.

The railway leading from New York along the banks of the Hudson, and which may be compared with that leading from Calcutta along the banks of the Ganges, has not been found to be a profitable line; and indeed railways in America, though much more profitable than railways in England, can scarcely be looked upon as very eligible investments for a country in which a high rate of interest prevails. Among those railways which expected to supersede water conveyance in this country may be mentioned that which connects London with Southampton. When the Southampton Docks were made, it was expected that vessels, instead of having to encounter the currents and dangers of the Thames, would unload their cargoes at Southampton, and send them up to London by railway. This expectation, however, has been completely disappointed; and were it not that the Government has made Southampton a postal station for those vessels which are engaged in performing the mail services, the Southampton Docks would be empty, except in so far as there was any local trade to draw vessels thither.

THE END.

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