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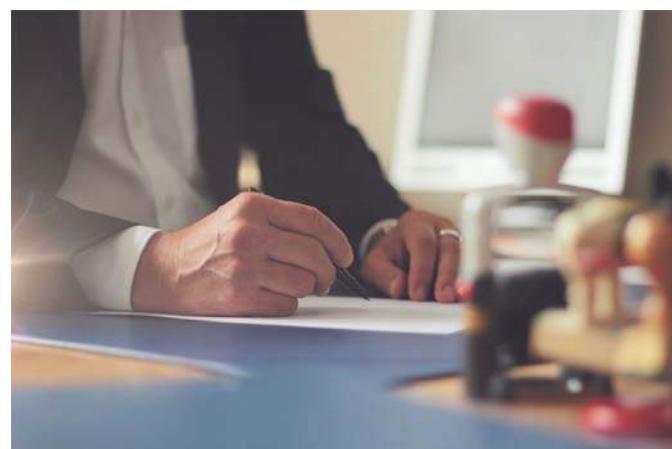
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Survey of Costs and Profitability of Tobacco Production on a Family Farm Property in Vale Do Rio Pardo

Fernando Batista Bandeira da Fontoura

ABSTRACT

This research addresses the survey and analysis of data from a family farm property, located in the Vale do Rio Pardo Region – RS, with the general objective to identify and analyze the total cost of growing tobacco on a property small-scale rural and highlight the result obtained with the cultivation of tobacco referring to the 2020/2021 harvest. In addition, the research contemplates relevant aspects about agriculture, tobacco growing and some peculiar characteristics for the cultivation of the tobacco. The present study is classified as a case study, with an exploratory descriptive nature of a qualitative character, the research carried out was bibliographical and documental. The data were collected through visits to the property under study, from September 2020 to May 2021. After collecting the data, it was possible to determine the economic result of the period, obtaining a gross income with the tobacco production in the amount of R$ 116,000.00, making it possible to analyze detailedly the results obtained in the 2020/2021 harvest. It was concluded that tobacco farming is important for the small-scale rural producer of the Vale do Rio Pardo. In the context in which the it is inserted, it has difficulties in relation to the diversification of cultivation in its properties and it is increasingly necessary to plan and control your investments.

Keywords: rural accounting, data collection, analysis, subsistence cultivation, tobacco.

Classification: JEL: O13

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Survey of Costs and Profitability of Tobacco Production on a Family Farm Property in Vale Do Rio Pardo

Levantamento De Custos E Lucratividade Da Produção De Tabaco Em Uma Propriedade Agrícola Familiar No Vale Do Rio Pardo

Fernando Batista Bandeira da Fontoura

RESUMO

A presente pesquisa aborda o levantamento e análise de dados de uma propriedade agrícola familiar, localizada na região do Vale do Rio Pardo - RS, com o objetivo geral de identificar e analisar o custo total para a produção de tabaco em uma propriedade rural de pequeno porte e evidenciar o resultado obtido com cultivo da cultura do tabaco referente à safra 2020/2021. Além disso, a pesquisa contempla aspectos relevantes sobre agricultura, fumicultura e algumas características peculiares para cultivo da cultura do tabaco. O presente estudo classifica-se como um estudo de caso, de cunho exploratório descritivo de natureza qualitativa, a pesquisa realizada foi bibliográfica e documental. Os dados foram coletados através de visitas na propriedade objeto do estudo, entre os meses de setembro de 2020 a maio de 2021. Após o levantamento dos dados foi possível apurar o resultado econômico do período, obtendo uma receita bruta com a produção de tabaco no valor de R$ 116.000,00, sendo possível analisar de forma minuciosa os resultados obtidos na safra 2020/2021. Concluiu-se que a fumicultura é importante para o pequeno produtor rural do vale do Rio Pardo. No contexto em que o mesmo está inserido, tem dificuldades em relação a diversificação de culturas em suas propriedades e cada vez mais se faz necessário planejar e controlar seus investimentos.

Palavras chaves: contabilidade rural, levantamento de dados, analise, culturas de subsistência, tabaco.

ABSTRACT

This research addresses the survey and analysis of data from a family farm property, located in the Vale do Rio Pardo Region – RS, with the general objective to identify and analyze the total cost of growing tobacco on a property small-scale rural and highlight the result obtained with the cultivation of tobacco referring to the 2020/2021 harvest. In addition, the research contemplates relevant aspects about agriculture, tobacco growing and some peculiar characteristics for the cultivation of the tobacco. The present study is classified as a case study, with an exploratory descriptive nature of a qualitative character, the research carried out was bibliographical and documental. The data were collected through visits to the property under study, from September 2020 to May 2021. After collecting the data, it was possible to determine the economic result of the period, obtaining a gross income with the tobacco production in the amount of R$ 116,000.00, making it possible to analyze detailedly the results obtained in the 2020/2021 harvest. It was concluded that tobacco farming is important for the small-scale rural producer of the Vale do Rio Pardo. In the context in which the it is inserted, it has difficulties in relation to the diversification of cultivation in its properties and it is increasingly necessary to plan and control your investments.

Keywords: rural accounting, data collection, analysis, subsistence cultivation, tobacco.

I. INTRODUÇÃO

A agricultura é o cultivo do solo, por meio de procedimentos, métodos e técnicas próprias. No meio rural há a diversidade de culturas agrícolas, no nosso país destaca-se o plantio da soja, café, tabaco, cana de açúcar, arroz, entre outras. O tabaco encontra-se na categoria da agricultura familiar e a sua maior produção é no sul do país.

Na região Sul do Brasil, o tabaco é uma das atividades agroindustriais mais significativas. Presente em 508 municípios e envolvendo em torno de 128 mil pequenos produtores. Aproximadamente 552 mil pessoas participam desse ciclo produtivo no meio rural, somando uma receita anual bruta de R$ 6,6 bilhões segundo a Associação dos Fumicultores do Brasil (Afubra). A produção alcançou 583 mil toneladas, sendo que deste volume 51% foram produzidos no Rio Grande do Sul, 28% em Santa Catarina e 21% no Paraná (SINDITABACO, 2021).

No Rio Grande do Sul localiza-se o Vale do Rio Pardo, onde concentra-se a maior capacidade de produção de tabaco do estado e também um dos maiores polos industriais de beneficiamento de tabaco no Brasil, onde parte dessa produção é direcionada para outros estados e a outra parte é exportada.

Desta forma a presente pesquisa realizará o levantamento e analise de dados de uma propriedade de pequeno porte agrícola familiar, localizada na Região do Vale do Rio Pardo/RS, tendo como objetivo principal identificar e analisar o custo total e a lucratividade da produção de tabaco em uma propriedade rural de pequeno porte, referente à safra 2020/2021.

Sabe-se que a cultura do tabaco também é alvo de muitas críticas em termos sociológicos por ser uma produção integrada no sentido de alienar a produtor somente a cultura do tabaco bem como fatores ambientais e de saúde pública.

Entretanto este estudo recorta como objetivo geral identificar e analisar o custo total para a produção de tabaco em uma propriedade rural de pequeno porte, bem como evidenciar o resultado obtido com cultivo da cultura referente à safra 2020/2021.

Como principal questionamento norteador indaga-se sobre a lucratividade da cultura que é produzida no sistema de economia familiar na região tendo com isso uma customização natural das propriedades que talvez em sistemas convencionais de produção não seria viável.

II. A FUMICULTURA

Atualmente o Brasil é o segundo maior produtor de tabaco do mundo e desde o ano de 1993 o maior exportador do produto, destinando cerca de 85% de sua produção anual para a exterior. De acordo com dados da Associação dos Fumicultores do Brasil – AFUBRA a região sul do país é responsável por aproximadamente 97% da produção nacional, destacando-se o Rio Grande do Sul como o maior produtor em fumo em folha do país. Além disso, o Brasil movimenta aproximadamente 6,6 bilhões de reais anualmente no setor, gerando cerca de 2 milhões de empregos diretos e indiretos.

No Rio Grande do Sul a região do Vale do Rio Pardo concentra os municípios com maior capacidade produtiva do estado e também um dos maiores polos industriais de beneficiamento de tabaco no Brasil, onde grande parte desta produção é escoada para os demais estados assim como para o exterior.

Contudo, a cultura do tabaco tem como principal característica ser cultivada principalmente por pequenos agricultores, que possuem suas propriedades rurais com aproximadamente 15 hectares destinando cerca de 20% desta área para a produção do tabaco segundo estudo realizado pela Afubra. O Sinditabaco (2016) destaca ainda que a área restante é reservada para culturas alternativas e de subsistência (35%), criações de animais e pastagens (20%), florestas nativas (16%) reflorestamento (11%). Outro índice considerável é que cerca de 28,7% das famílias não possuem área própria para produção e acabam trabalhando em forma de meeiros (o proprietário da terra disponibiliza parte da propriedade, e o meeiro, por sua vez, ocupa-se de todo o trabalho, repartindo com o dono da terra o resultado da produção) ou em forma de arrendamento. A quadro 1 demonstra o tamanho das propriedades e a quantidade de proprietários por de área que produzem o tabaco.

Quadro 1: Tamanho das propriedades agrícolas produtoras de tabaco

Hectáres	Famílias	%
0	44.106	28,70%
De 1 a 10	55.175	35,90%
De 11 a 20	35.415	23%
De 21 a 30	12.907	8,40%
De 31 a 50	4.807	3,10%
Mais de 50	1.320	0,90%
Total	153.730	100

Fonte: Sinditabaco e adaptado pelos autores(2016).

A produção do tabaco é muito significativa para essas famílias, pois o cultivo do fumo representa mais de 50% da renda obtida por elas. Outro fato importante destacado pela Afubra é de que as famílias produtoras de tabaco são compostas em média por 3 integrantes com condições plenas de trabalho.

No entanto, essas pequenas propriedades não produzem apenas tabaco, mas produzem alimentos que auxiliam na sua subsistência. A figura 1 demonstra grande parte das propriedades rurais que são destinadas a preservação de florestas nativas e outra grande porcentagem é destinada a produção de culturas alternativas e de alimentos como: batata, mandioca, feijão, soja, milho, entre outras culturas que servem de alimento no seu dia-a-dia.
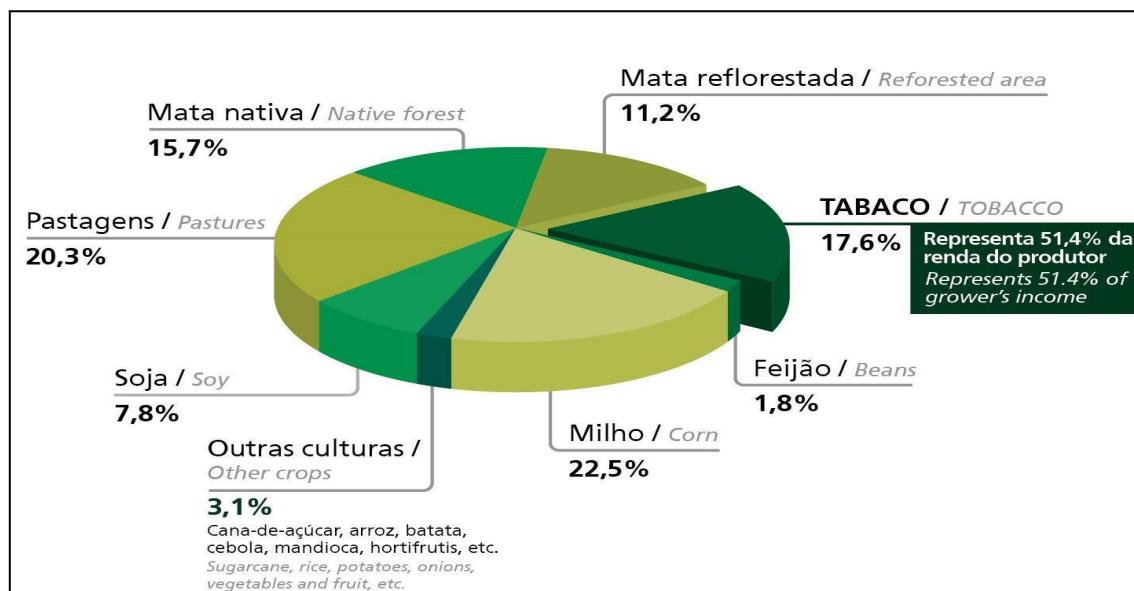
Figura 1: Perfil da propriedade dos produtores de tabaco

Fonte: Adaptado de Afubra (2016).

Mesmo o tabaco sendo responsável por boa parte da renda dos produtores rurais eles tem a necessidade de produzirem outras culturas para sua subsistência, e, desta forma, acabam reduzindo seus custos com alimentação da família e animais criados, otimizando o resultado produzido pelo tabaco para a aquisição de novos bens.

III. A CONTABILIDADE NA GESTÃO RURAL

A contabilidade é umas das ciências mais antigas do mundo, sua existência datada desde as primeiras civilizações. A contabilidade surgiu na necessidade de pessoas terem um instrumento que lhes fornecesse informações e dados que auxiliassem e suprissem as necessidades de mensurar e administrar seus bens. Johnson e Kaplan (1993, p. 5) ainda destacam que:

> Historiadores demonstraram que informes contábeis têm sido preparados há milhares de anos. Registros contábeis, remontando as antigas civilizações, foram encontrados gravados em blocos de pedra. [...]. A necessidade de registrar sobre transações comerciais tem existido sempre que as pessoas têm comerciado entre si nos mercados de troca.

Segundo Nagatsuka e Oliveira (2000) a contabilidade era desempenhada como um procedimento em que os proprietários de áreas rurais cuidassem de seus bens, como por exemplo, realizando a contagem de seus rebanhos. Desta forma, pode-se notar que a contabilidade era inicialmente mais usada para fins rurais.

O enfoque deste trabalho está voltado para o ramo da Contabilidade Rural, que de acordo com Crepaldi (2012), surgiu através da necessidade de produtores e empresas rurais que realizavam diversas transações de controlar o patrimônio, pois careciam de um método mais complexo de controle.

Neste sentido, Nepomuceno (2004, p. 15) descreve em seu livro que "a atividade rural, como também a industrial, comercial e de produção de serviços, é atividade econômica e, como tal, requer controle financeiro e acompanhamento específico. O autor ressalta que a contabilidade rural deve ser útil para conhecer os resultados obtidos na atividade rural.

Para Rodrigues (et al. 2015) a Contabilidade Rural compreende todos os ramos de atuação praticados dentro de uma propriedade rural. Crepaldi (2006, p. 86) destaca as seguintes finalidades da contabilidade rural:

- Orientar as operações agrícolas e pecuárias;
- Medir o desempenho econômico financeiro da empresa e de cada atividade produtiva individualmente;
- Controlar as transações financeiras;
- Apoiar as tomadas de decisões no planejamento da produção, das vendas e dos investimentos;
- Auxiliar as projeções de fluxos de caixa e necessidades de crédito;
- Permitir a comparação de *performance da* empresa no tempo e desta com outras empresas;
- Conduzir as despesas pessoais do proprietário e de sua família;
- Justificar a liquidez e a capacidade de pagamento da empresa junto aos agentes financeiros e outros credores;
- Servir de como base para seguros, arrendamentos e outros contratos;
- Gerar informações pra a declaração do Imposto de Renda.

A contabilidade rural tem várias finalidades associadas à forma de gerenciamento da propriedade rural que proporciona informações que auxiliam os produtores e proprietários rurais na tomada de decisões para que tenham o melhor resultado nas produções e atividades exercidas no período.

Em seu artigo Elesbão e Fontoura (2015) relatam o seguinte:

> Para que as informações sejam produzidas, a contabilidade de custos deve coletar e registrar dados ocorridos nas mais diversas atividades empresariais, organizar, analisar e interpretar os mesmos, para que posteriormente possa fornecer informações relevantes aos administradores empresariais, e assim possam tomar as decisões corretas à realidade da organização.

Portanto, para que a contabilidade possa fornecer as devidas informações para o acompanhamento e para que possam contribuir na tomada de decisão pelo produtor, primeiramente, devem-se reunir os dados das atividades realizadas no período, para que posteriormente seja feita uma análise destes dados e assim sejam levantadas as informações.

IV. METODOLOGIA

A pesquisa realizada caracteriza-se por ser um estudo de caso descritivo, que Segundo Andrade (2002) citado por Beuren e Rauppe (2006, p. 81) "a pesquisa descritiva preocupa-se em observar os fatos, registrá-los, analisá-los, classificá-los e interpretá-los, e o pesquisador não interfere neles". Ainda de acordo com Beuren e Rauppe (2006) esse tipo de pesquisa também contribuem para identificar as relações existentes em uma determinada população.

Quanto aos procedimentos utilizados para levantamento de dados, a pesquisa foi documental e bibliográfica. De acordo com Beuren e Rauppe (2006) na pesquisa documental, os documentos são classificados em dois tipos: fontes de primeira mão, os que não receberam qualquer tratamento analítico, e fontes de segunda mão, que já foram analisados e tratados analiticamente.

Beuren e Rauppe (2006, p. 86) definem a pesquisa bibliográfica como sendo:

> Um problema a partir de referenciais teóricos publicados em documentos. Pode ser realizada independentemente ou como parte da pesquisa descritiva ou experimental. Ambos os casos buscam conhecer e analisar as contribuições culturais ou cientificas do passado existentes sobre um determinado assunto, tema ou problema.

A abordagem do trabalho classifica-se em qualitativa, pois o estudo será realizado através de análises mais complexas a respeito da cultura do tabaco. Beuren e Rauppe (2006, p. 92) destacam que "abordar um problema qualitativamente pode ser uma forma adequada de conhecer a natureza de um fenômeno social". Segundo os autores esse modelo de pesquisa é utilizado na contabilidade, pois a mesma é classificada como uma ciência social aplicada. Como é um estudo de caso com o objetivo de fazer uma análise aprofundada do fenômeno, justifica-se o uso desse modelo de abordagem.

A pesquisa observou questões que envolveram a produção de tabaco em uma propriedade agrícola familiar localizada no vale do Rio Pardo, foram apresentados todos os custos que envolvem a produção de tabaco e sua lucratividade, servindo como base para realização do estudo.

V. ANÁLISE DOS DADOS

O presente estudo apresenta o levantamento dos custos de produção ee a lucratividade do cultivo da cultura do tabaco de uma propriedade rural, localizada no município de Herveiras, situado no Vale do Rio Rardo, sendo está à principal fonte de renda da família.

5.1 Apresentação Da Propriedade Objeto Do Estudo

Para realização da pesquisa utilizou-se uma propriedade agrícola familiar de pequeno porte que dispusesse dos dados sobre o cultivo do tabaco. Atualmente, a propriedade dispõe de 34 hectares, sendo que, 10 hectares foram adquiridos, faz aproximadamente 20 anos, e o restante corresponde a herança familiar. A figura 2 demonstra a propriedade que forneceu os dados para a elaboração deste estudo.
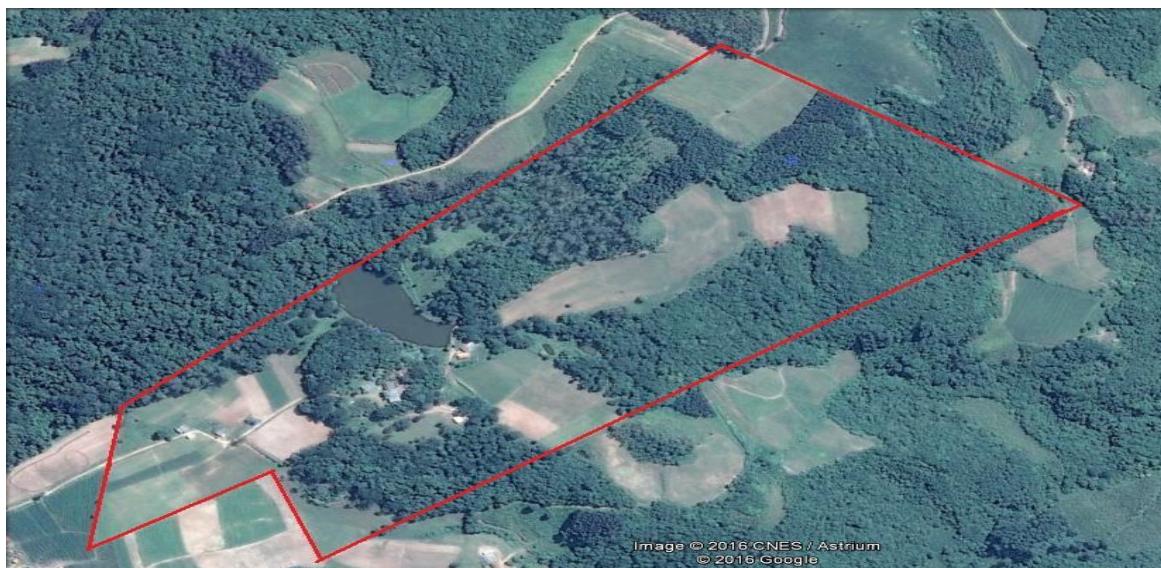
Fonte: Google Earth 2016 e adaptado pelo Autor

Figura 2: Propriedade fornecedora dos dados.

Dos 34 hectares da propriedade, 17 hectares são próprios para o cultivo e 17 hectares compostas por mata nativa, mata essa oriunda de reflorestamento e pastagens. Nos 17 hectares que são possíveis ser cultivados, o tabaco é o principal cultivar e, desta forma, proporcionando maior fonte de renda da família.

Para cultivo do tabaco são destinados 6 hectares da propriedade, outros 5 hectares são utilizados como área de moradia, lazer e infraestrutura para colheita do tabaco que exige um espaço grande.

A família mantenedora da propriedade é composta por 4 integrantes, sendo 2 casais. Em grande parte do ano conta-se apenas com mão de obra própria, porém no período de colheita do tabaco emprega-se dois trabalhadores, que auxiliam nas mais variadas tarefas.

5.2 Levantamento dos Custos da Produção do Tabaco

Com ênfase em alcançar os objetivos propostos na pesquisa, o primeiro tópico a ser levantado refere-se aos custos e despesas empregadas na cultura do tabaco na safra 2020/2021, utilizando a absorção de todos os custos de acordo com os recursos utilizados.

Primeiramente realizou-se o levantamento do imobilizado utilizado no cultivo do tabaco. Pelo tabaco ser a cultura de maior influência na renda da família, todo o material utilizado na propriedade está diretamente ligado a ele. Os equipamentos, instalações, implementos e máquinas têm como base o preço praticado no mercado local no ano de 2020, sendo que o preço apurado conforme apresentado no quadro 2 serviu como base para o cálculo da depreciação do imobilizado utilizado na safra de 2020/2021.

Quadro 2: Levantamento do imobilizado utilizado na produção do tabaco.

Itens	Qntd.	Valor Unitário	Valor Total	Vida Útil	Taxa (%)	Depreciação / Exaustão
1. DEPRECIAÇÃO	----	----	R$ 246.178,00	----	----	R$ 15.990,30
1.1 Construções e Benfeitorias	----	----	R$ 130.000,00	----	----	R$ 4.500,00
1.1.1 Galpão	1	R$ 35.000,00	R$ 35.000,00	50	2	R$ 700,00
1.1.2 Estufas de Secagem	5	R$ 15.000,00	R$ 75.000,00	25	4	R$ 3.000,00
1.1.3 Varanda	1	R$ 20.000,00	R$ 20.000,00	25	4	R$ 800,00
1.2 Máquinas e Equipamentos	----	----	R$ 7.000,00	----	----	R$ 500,20
1.2.1 Tecedeira	2	R$ 3.000,00	R$ 6.000,00	15	6,67	R$ 400,20
1.2.4 Medidor de Temperatura	5	R$ 200,00	R$ 1.000,00	10	10	R$ 100,00
1.3 Utensílios	----	----	R$ 11.478,00	----	----	R$ 1.033,20
1.3.1 Pulverizador Manual	3	R$ 550,00	R$ 1.650,00	10	10	R$ 165,00
1.3.2 Plantadeira Manual	4	R$ 45,00	R$ 180,00	12,5	8	R$ 14,40
1.3.3 Prensa de Enfardar	2	R$ 380,00	R$ 760,00	20	5	R$ 38,00
1.3.4 Balança de Pesagem	1	R$ 390,00	R$ 390,00	20	5	R$ 19,50
1.3.5 Motosserra	2	R$ 1.250,00	R$ 2.500,00	10	10	R$ 250,00
1.3.6 Semeador	2	R$ 130,00	R$ 260,00	20	5	R$13,00
1.3.7 Marcador de Bandeja	2	R$ 45,00	R$ 90,00	20	5	R$ 4,50
1.3.8 Bandejas de Isopor	520	R$ 6,50	R$ 3.380,00	10	10	R$ 338,00
1.3.9 Arcos	60	R$ 12,00	R$ 720,00	20	5	R$ 36,00
1.3.10 Salitrador Manual	3	R$ 180,00	R$ 540,00	10	10	R$ 54,00
1.3.11 Regador	6	R$ 38,00	R$ 228,00	10	10	R$ 22,80
1.3.12 Trouxas de Ráfia	250	R$ 2,50	R$ 625,00	10	10	R$ 62,50
1.3.13 Inchada	5	R$ 31,00	R$ 155,00	10	10	R$ 15,50
1.4 Veículos e Implementos	----	----	R$ 97.700,00	----	----	R$ 9.956,90
1.4.1 Trator	1	R$ 72.000,00	R$ 72.000,00	10	10	R$ 7.200,00
1.4.2 Carreta Agrícola	2	R$ 3.500,00	R$ 7.000,00	8	12,67	R$ 886,90
1.4.3 Subsolador (pé de pato)	1	R$ 2.200,00	R$ 2.200,00	10	10	R$ 220,00
1.4.4 Grade Arrastão	1	R$ 4.000,00	R$ 4.000,00	10	10	R$ 400,00
1.4.5 Arado	1	R$ 3.900,00	R$ 3.900,00	10	10	R$ 390,00
1.4.6 Pulverizador	1	R$ 7.200,00	R$ 7.200,00	10	10	R$ 720,00
1.4.7 Envergador	1	R$ 1.400,00	R$ 1.400,00	10	10	R$ 140,00
2. EXAUSTÃO	----	----	----	----	----	R$ 3.996,00

Survey of Costs and Profitability of Tobacco Production on a Family Farm Property in Vale Do Rio Pardo

2.1 Terra	6	R$ 20.000,00	R$ 120.000,00	30	3,33	R$ 3.996,00
TOTAL (1+2)	-----	-----	R$ 366.178,00	-----	-----	R$ 19.986,30

Fonte: Elaborado pelos autores, baseado em dados da propriedade.

De acordo com o quadro 2 o custo total com depreciação e exaustão do período foi de R$ 19.986,30 sendo que a depreciação consumiu a maior parcela deste valor com R$ 15.990,30, já a exaustão do período foi de R$ 3.996,00. Dos R$ 19.986,30 que representam a despesa com depreciação, R$ 4.500,00 são despesas das construções e benfeitorias, R$ 1.033,20 correspondem a utensílios utilizados e R$ 500,20 são remetidos as máquinas e equipamentos. Já a depreciação com veículos e implementos totalizou R$ 9.956,96, porém somente 55% deste valor está diretamente ligado ao tabaco, ou seja, apenas R$ 5.476,30 foram consumidos pela produção do tabaco.

Após ser efetuado levantamento do imobilizado utilizado na produção do tabaco, partimos para levantamento dos custos indiretos da propriedade. Por tratar-se de uma propriedade rural, os custos indiretos foram levantados a partir da apuração do quadro do imobilizado. É composto, basicamente, pelas depreciações e energia elétrica que foi consumida no período. Porém, como utiliza-se da terra para obter o produto final, ocorre também a exaustão, ou seja, são os recursos indiretos ligados a produção. O quadro 3 informa os custos indiretos que foram apurados durante a safra de 2020/2021.

Quadro 3: Levantamento dos custos indiretos da propriedade rural

1. Depreciação de máquinas e equipamentos	R$	500,20
2. Depreciação de construção e benfeitorias	R$	4.500,00
3. Depreciação de utensílios	R$	1.033,20
4. Depreciação de veículos e implementos	R$	5.476,30
5. Exaustão da terra	R$	3.996,00
6. Energia elétrica	R$	650,00
Total	R$	16.155,70

Fonte: Elaborado pelos autores, baseado em dados da propriedade.

De acordo com o levantamento os custos indiretos da propriedade totalizaram o valor de R$ 16.155,70 na safra de 2020/2021. Depois de efetuado cálculo das despesas referente à depreciação e exaustão do imobilizado, levantou-se os custos com a mão de obra utilizada na produção do tabaco.

Como já mencionado anteriormente, a família dispõe de quatro integrantes para a realização das atividades diárias na propriedade, porém, na época de colheita há a necessidade de contratar mais duas pessoas para o auxílio no trabalho.

Inicialmente calculou-se o preço da hora trabalhada, no qual utilizou-se como base de cálculo o preço médio pago na região pelo dia trabalhado dividido por 8 horas diárias, correspondente ao turno de trabalho. Ou seja, dividiu-se R$ 70,00, valor referente ao um dia de trabalho, dividido por 8 horas trabalhadas por dia. Resultante no valor de R$ 8,75 a hora trabalhada[1].O quadro 4, demonstra os gastos diretos com mão de obra durante a safra de 2020/2021.

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[1] Refere-se ao valor pago pela hora trabalhada em atividade agrícola no município de Herveiras – RS, podendo sofrer alterações em outras regiões.

Quadro 4: Custos diretos com mão de obra

MAPA DE APRORIAÇÃO DOS CUSTOS COM MÃO DE OBRA						
Itens	Referência	Qntd.	Pessoas Envolvidas	Valor Unitário	Valor Total	Porcentagem (%)
1. SEMEADURA E MANUTENÇÃO	-----	-----	-----	-----	R$ 1.732,50	3,91
1.1 Preparo do Canteiro	Hh	20	3	R$ 8,75	R$ 525,00	1,18
1.2 Semeadura	Hh	22	4	R$ 8,75	R$ 770,00	1,74
1.3 Manutenção das Mudas	Hh	25	2	R$ 8,75	R$ 437,50	0,99
2. PREPARO DO SOLO	----	----	----	----	R$ 3.657,50	8,25
2.1 Preparo do solo	Hh	87	1	R$ 8,75	R$ 761,25	1,72
2.2 Aplicação de Herbicidas	Hh	15	1	R$ 8,75	R$ 131,25	0,30
2.3 Adubagem	Hh	25	4	R$ 8,75	R$ 875,00	1,97
2.3 Plantio	Hh	54	4	R$ 8,75	R$ 1.890,00	4,27
3. MANUTENÇÃO DA CULTURA	-----	-----		-----	R$ 4.830,00	10,90
3.1 Replantio	Hh	22	2	R$ 8,75	R$ 385,00	0,87
3.2 Aplicação de Uréia	Hh	20	4	R$ 8,75	R$ 700,00	1,58
3.3 Aplicação de Salitro	Hh	42	4	R$ 8,75	R$ 1.470,00	3,32
3.4 Capina	Hh	40	6	R$ 8,75	R$ 2.100,00	4,74
3.5 Aplicação de Herbicidas	Hh	21	2	R$ 8,75	R$ 367,50	0,83
3.6 Desponte	Hh	36	3	R$ 8,75	R$ 945,00	2,13
3.7 Aplicação de Antibrotante	Hh	32	2	R$ 8,75	R$ 560,00	1,26
4. COLHEITA	-----	-----		-----	R$ 20.790,00	46,92
4.1 Colheita, Costura e Secagem	Hh	396	6	R$ 8,75	R$ 20.790,00	46,92
5. PÓS COLHEITA	-----	-----	-----	-----	R$ 13.300,00	30,02
5.1 Classificação e Manocação	Hh	320	4	R$ 8,75	R$ 11.200,00	25,28
5.2 Enfardação	Hh	60	4	R$ 8,75	R$ 2.100,00	4,74
6.TOTAL (1+2+3+4+5)	-----	-----		-----	R$ 44.310,00	100
7. PRODUTIVIDADE DO TABACO	-----	-----	-----	-----	R$ 116.000,00	100
7.1 Fumo Virginia PVH 2254	Arroba	800	-----	R$ 145,00	R$ 116.000,00	100

8. CUSTO DE MÃO DE OBRA POR ARROBA PRODUZIDA (7/6)	-----	-----	-----	-----	R$ 55,39	38,20

Como é possível observar, o quadro 4, demonstra todas as atividades que envolvem mão de obra, desde o preparo e semeio de canteiros até a venda do tabaco. O Quadro compõe-se pelas atividades realizadas, horas trabalhadas, pessoas envolvidas em cada atividade, valor da hora trabalhada e o somatório do valor que foi depositado em cada atividade, também, tem-se a porcentagem que cada atividade utilizou do somatório total das atividades na produção do tabaco. Além disso, o quadro dispõe de um comparativo de quanto foi consumido de mão de obra com a receita produzida na venda do tabaco.

As atividades desenvolvidas para a produção do tabaco foram divididas em subgrupos. Os subgrupos estão divididos da seguinte forma:

➢ Semeadura e manutenção das mudas, sendo que foi aplicado o valor de R$ 1.732,50 para a realização das atividades;
➢ Preparo do solo, foi gasto o total de R$ 3.657,50;
➢ Manutenção da cultura, as atividades desenvolvidas neste subgrupo totalizaram R$ 4.830,00, sendo que para a capina do tabaco utilizou-se de mão de obra contratada;
➢ Colheita, para a realização da colheita do tabaco contratou-se 2 empregados efetivos, a contratação dos empregados resultou em 132 horas de trabalho desenvolvidas por eles no período de colheita. O valor total com a mão de obra na colheita foi de R$ 20.790,00;
➢ Pós-colheita, para a separação de classes, manocação e enfardamento do tabaco, consumiu-se um total de 380 horas de trabalho, o que gerou em um custo de R$ 13.300,00.

O valor total consumido com mão de obra foi de R$ 44.310,00, sendo que na safra 2020/2021 produziu-se aproximadamente 800 arrobas de tabaco vendidas a uma média de R$ 145,00 a arroba, totalizando, desta forma, em R$ 116.000,00. Desta maneira, conseguiu-se estimar o custo de mão de obra por arroba produzida, que foi de R$ 55,39. Também foi efetuado o cálculo da porcentagem do custo com a mão de obra sobre a receita produzida, obtendo 38,20%.

Para finalizar levantamento dos custos realizados com cultivo da fumicultura, serão apresentados os custos diretos com insumos utilizados na produção de tabaco da propriedade.

Assim como para o cálculo do custo com a mão de obra, os custos diretos também foram divididos em subgrupos com as mesmas nomenclaturas. Porém, ao invés, de nomear em atividades, nomeou-se com o nome do produto que foi utilizado em determinada etapa da produção. Obtendo, desta forma, os custos diretos envolvidos com a produção do tabaco. O quadro 5 demonstra como foi realizado o cálculo dos custos diretos.

Quadro 5: Custos diretos com a produção de tabaco

Mapa De Aproriação Dos Custos Diretos Pelo Método De Custeio Absorção					
Itens	Referência	Qntd.	Valor Unitário	Valor Total	Porcentagem (%)
1. Semeadura E Manutenção	-----	-----	-----	R$ 2.384,00	9,59
1.1 Lona plástica preta	m²	110	R$ 2,25	R$ 247,50	1,00
1.2 Lona plástica transparente	m²	120	R$ 2,75	R$ 330,00	1,33
1.3 Talagarça de Algodão	m²	120	R$ 3,15	R$ 378,00	1,52

1.4 Substrato Carolina	sc.	30	R$ 13,50	R$ 405,00	1,63
1.5 Sementes PVH 2254	uni.	7	R$ 110,00	R$ 770,00	3,10
1.6 Fungicida Infinito	l.	1,5	R$ 120,00	R$ 180,00	0,72
1.7 Inseticida Rovral Supra	pct.	0,25	R$ 294,00	R$ 73,50	0,30
2. PREPARO DO SOLO	----	----	----	R$ 8.358,50	33,63
2.1 Diesel Trator	l.	175	R$ 3,10	R$ 542,50	2,18
2.2 Herbicida Gamit 360 sc	l.	9	R$ 114,00	R$ 1.026,00	4,13
2.3 Herbicida Boral 500 sc	l.	6	R$ 225,00	R$ 1.350,00	5,43
2.3 Adubo	kg.	4000	R$ 1,36	R$ 5.440,00	21,89
3. MANUTENÇÃO DA CULTURA	-----	-----	-----	R$ 4.632,00	18,64
3.1 Uréia	kg.	450	R$ 1,25	R$ 562,50	2,26
3.2 Salitre	kg.	1350	R$ 2,20	R$ 2.970,00	11,95
3.3 Inseticida Rovral Supra	pct.	1,75	R$ 294,00	R$ 514,50	2,07
3.4 Antibrotante Prime Plus	l.	9	R$ 65,00	R$ 585,00	2,35
3.5 Herbicida Roundup	l.	8	R$ 17,00	R$ 136,00	0,55
4. COLHEITA	-----	-----	-----	R$ 9.477,50	38,14
4.1 Lenha	m³	165	R$ 55,00	R$ 9.075,00	36,52
4.2 Fio de Algodão	uni.	35	R$ 11,50	R$ 402,50	1,62
5. TOTAL (1+2+3+4)	-----	-----	-----	R$ 24.852,00	100
6. PRODUTIVIDADE DO TABACO	-----	-----	-----	R$ 116.000,00	100
6.1 Fumo Virginia PVH 2254	arroba	800	R$ 145,00	R$ 116.000,00	100
7. CUSTO DIRETO POR ARROBA PRODUZIDA (6/5)	-----	-----	-----	R$ 31,07	21,42

Fonte: Elaborado pelos autores, baseado em dados da propriedade.

Como é possível observar no quadro 5, os custos diretos aplicados por arroba de fumo produzida foram de R$ 31,07, sendo que totalizou o valor de R$ 24.852,00, representando 21,42% da receita obtida com a venda do tabaco. Este valor dividisse em 4 subgrupos, sendo que para o primeiro subgrupo, semeadura e manutenção, foi responsável por consumir R$ 2.384,00, o segundo subgrupo, preparo do solo consumiu R$ 8.358,50, no terceiro subgrupo, colheita e manutenção, foram aplicados R$ 4.632,00 e, por fim, a colheita dispôs de R$ 9.477,50.

Observa-se o quanto cada material utilizado representou do custo direto total da produção. No item 1 (semeadura e manutenção), consta todos os materiais que se utilizou para produzir aproximadamente 110.000 mudas de tabaco, pois pode haver perdas, tanto no canteiro quanto na lavoura, necessitando de replantio da mesma.

No preparo do solo, constam todos os insumos utilizados para realizar a planta do tabaco, o qual foram utilizados 175 litros de diesel para realizar todas as atividades na lavoura, tais como: lavração, subsolagem, discagem, envergação e aplicação de agrotóxico. Os herbicidas foram aplicados com pulverizador acoplado ao trator, o que resulta em um maior consumo do produto. Como também tem-se o adubo utilizado para produzir 90.000 pés de tabaco.

Para a manutenção da cultura, todos os insumos são utilizados para o desenvolvimento da planta. Contendo os fertilizantes, inseticida, fungicida e antibrotante. Também utilizou-se herbicida para conter as ervas daninhas, mantendo a lavoura sem inços que poderiam prejudicar o desenvolvimento do fumo.

No item 4, consta o que utilizou-se para a secagem e amarração do tabaco nas varas. O proprietário tem eucaliptos em sua propriedade e a lenha utilizada é retirada dali. Porém, para ter o real custo que foi consumido para a secagem da folha do fumo, utilizou-se o preço do metro praticado no mercado.

5.3 Comparativos Dos Custos

Posteriormente, foram levantados individualmente todos os custos empregados na safra 2020/2021 elaborou-se o quadro 6, onde é apresentado o valor de R$ 66.606,58. Ou seja, valor que representa todos os recursos que foram consumidos para produção do tabaco.

Quadro 6: Somatório dos custos empregues na produção de tabaco

1. Custos com mão de obra	R$ 44.310,00
2. Custos diretos	R$ 24.852,00
3. Custos indiretos	R$ 16.155,70

Fonte: Elaborado pelo autor, baseado em dados da propriedade.

Ao apurar os custos totais da produção, foi necessário realizar o cálculo do custo de produção por arroba produzida de fumo. Para isso, precisa-se dividir o custo total pela quantidade de arrobas produzidas, ou seja, R$ 85.317,70 divididos por 800 arrobas, resultando em um custo de R$ 106,65 por arroba produzida. Nota-se que os custos com mão de obra correspondem a 51,94% dos custos totais envolvidos na produção do fumo.

Após ter sido apurado os custos utilizados na produção do tabaco, foi necessário elaborar um gráfico que demonstrasse como foram aplicados os recursos apresentados anteriormente. A figura 3, informa os respectivos valores apurados.
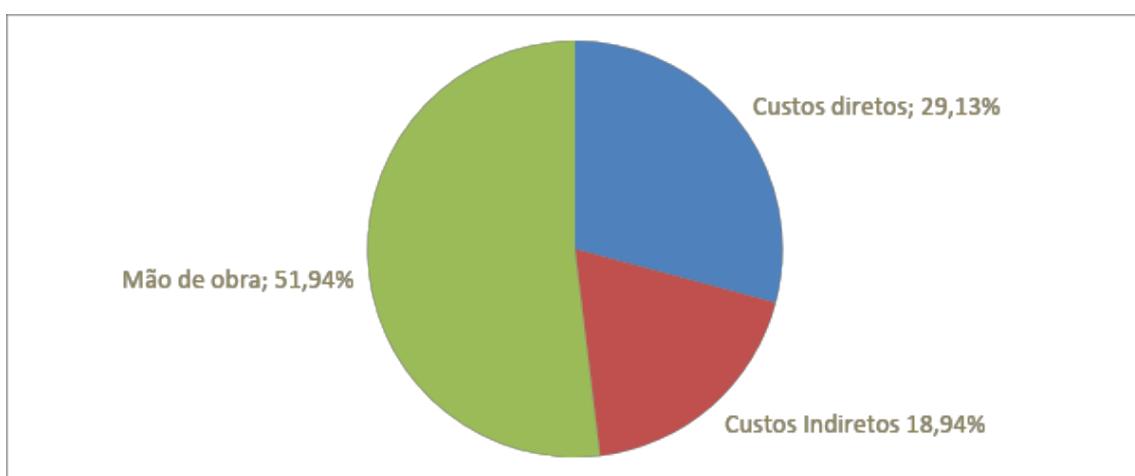
Fonte: Elaborado pelos autores, baseado em dados da propriedade

Figura 3: Comparativo da distribuição dos custos

Como pode ser constatado, a figura 3 apresenta a porcentagem que cada grupo de custo consumiu do valor total dos gastos envolvidos com o cultivar do tabaco. Sendo que do valor total, os insumos diretos ligados ao produto consumiram 29,13%. Já os recursos com mão de obra utilizaram-se de 51,94% deste valor, enquanto os custos indiretos consumiram 18,94% do valor total empregado na safra 2020/2021.

No figura 3 apresentada, fica evidente o elevado percentual de recursos consumidos com mão de obra para a realização das atividades envolvidas diretamente com o tabaco.

5.4 Apuração do Resultado da Produção de Tabaco

Levantados todos os gastos empregues na produção do tabaco na safra 2020/2021, perfez a necessidade de fazer o levantamento da receita obtida com a venda do produto, bem como de realizar a apuração dos resultados a fim de obter qual a real contribuição do tabaco para o produtor rural.

Para tal, a receita do tabaco foi mensurada de acordo com a sua produtividade, ou seja, o valor da receita bruta obtida com a venda do fumo se deu através do cálculo da quantidade de arrobas produzidas multiplicada pelo preço de venda da arroba. Sendo que foram comercializadas 800 arrobas ao preço médio de R$ 145,00 por arroba, totalizando em uma receita bruta de vendas no valor de R$ 116.000,00. De forma que se pudesse proporcionar uma melhor evidenciação do resultado apurado na safra 2020/2021 elaborou-se uma Demonstração do Resultado do Exercício. O quadro 7 demonstra a DRE apurada no período.

Quadro 7: Demonstração do resultado da safra 2020/2021

Demonstração de Resultado	SAFRA 2020/2021
(=) Receita bruta da atividade rural	R$ 116.000,00
Venda da produção rural	R$ 116.000,00
(-) Imposto sobre a venda (FUNRURAL)	-R$ 2.668,00
(=) Receita líquida da atividade rural	R$ 113.332,00
(-) Custo da produção	-R$ 85.317,70
(=) Resultado bruto	R$ 28.014,31
Receitas financeiras	R$ 3.372,69
(=) Resultado líquido do período	R$ 31.387,00

Fonte: Elaborado pelos autores, baseado em dados da propriedade.

Como demonstrado na DRE, o resultado líquido do período foi de R$ 31.387,00. Contudo, neste valor é acrescido de R$ 3.372,62 referentes a receitas financeiras. Receitas Financeiras obtidas com queda de granizo, uma vez que o produtor era segurado pela Afubra, para o caso de eventos climáticos que pudessem causar danos em sua produção. Este valor, referente ao seguro, é líquido, visto que já foi amortizado o valor da contratação do mesmo.

Por outro lado, há o desconto da contribuição social (INSS) da receita bruta de venda. O valor de R$ 2.668,00 refere-se ao FUNRURAL, que detêm a taxa de 2,3%, sendo debitado diretamente, pela empresa compradora do tabaco, da receita bruta.

Outro ponto que ganha destaque é o Custo da Produção Rural, ao compararmos o CPV com a receita bruta de venda, nota-se que este consumiu 73,55% da receita bruta obtida no período, o que resultou em um valor de R$ 85.317,70. Este custo torna-se tão expressivo pois utiliza-se dos custos com mão de obra, os custos diretos com insumos e os custos indiretos. Com maior destaque para os custos de mão de obra que consumiram aproximadamente 52% deste valor.

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Se analisado o resultado líquido do período em comparação com a Receita Bruta, apresenta um retorno de 26,45% sobre a receita bruta de vendas. Este percentual é dado após todos os custos e despesas já terem sido descontadas do valor de venda.

O resultado positivo com a venda do tabaco poderia ser mais elevado. Porém, foram consideradas as despesas com depreciação do imobilizado, exaustão da terra e energia elétrica que consumiram 13,93% da receita bruta de venda. Visto que deve-se destacar que este percentual poderia ser maior, uma vez que utilizou-se apenas 55% da despesa com a depreciação de veículos e equipamentos, já que o restante desta depreciação é correspondente ao custo das demais culturas produzidas na propriedade.

Cabe ressaltar, também que a exaustão da terra é calculada apenas como custo de oportunidade, visto que ela só é realmente aproveitada como custo para culturas permanentes.

Considerando todos os dados obtidos, percebe-se que a lucratividade proporcionada pelo tabaco foi abaixo do esperado, posto que todos os gastos foram recuperados com aproximadamente 74% da renda total obtida com a produção de tabaco na safra 2020/2021.

VI. CONCLUSÃO

A realização do presente estudo apresentou informações relevantes sobre característica do cultivo da cultura do tabaco em uma propriedade rural localizada no Vale do Rio Pardo, constatou-se no levantamento dos dados que o tabaco é uma das principais culturas cultivadas por pequenos agricultores na região, sendo que esta cultura apresenta boa lucratividade comparada a outras culturas, que são cultivadas em pequenas propriedades, transformando-se em uma das principais fontes de renda da região. No caso da propriedade objeto do estudo a receita líquida referente a safra 2020/2021 foi de R$ 31.387,00

A fumicultura, assim como toda produção agrícola, está sujeita às incertezas advindas de adversidades climáticas como vendaval e granizo, que podem vim a gerar muitas perdas para os produtores. Além dessas questões, observou-se que o hábito de fumar vem sofrendo severas restrições institucionais nos últimos anos, obrigando a cadeia produtiva do tabaco a adaptar o seu processo de produção a cada nova mudança no ambiente institucional. As restrições institucionais têm provocado elevados custos de transação, especialmente, para as agroindústrias.

Este contexto torna o fumicultor elo mais vulnerável aos choques de mercado, tanto no âmbito de oscilações nos preços do produto, quanto com relação a possíveis alterações na curva de demanda em virtude das campanhas antitabagistas que vem ganhando força no mercado. Entretanto ficou constatado que, devido à estrutura minifundiária de que dispõem o custo de oportunidade inerente à substituição do fumo, ou até mesmo à diversificação de culturas, precisa ser trabalhada de forma continua com os agricultores, pois os mesmos não estão preparados para essa transição de culturas de forma imediata.

O estudo por ser de natureza qualitativa não visa generalização dos achados sendo uma análise de profundidade de um caso concreto. Como sugestão de novos estudos seria importante aprofundar estudo sobre cultura do tabaco, analisando a diversificação na produção rural da região e entender o porquê essa diversificação ainda não atinge números expressivos, sendo este um tópico emergente e a análise do reflexo dessa diversificação precisa ser analisada de forma estratégica.

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Adapting Education to the Development of Post-Industrial Processes in an Economy: Extra- Curricular Project-based Learning for Developing the Innovative Abilities of High School and University Students

Prof. Alexander N. Kosarikov & Dr. Natalia G. Davydova

ABSTRACT

The post-industrial orientation of an economy towards professionals capable of developing and implementing innovative solutions determines the need for rethinking the goals of education and changing educational technologies.

Based on the analysis of the distributions of statistical indicators characterizing changes in national education systems in connection with the development of the economy, steady trends in the growth of the population's level of education and the duration of the higher education cycle, which goes beyond competitive expediency, are shown.

At the same time, the trends of increasing educational loads and informational saturation of education can be alleviated by modern opportunities for extra-curricular forms of education that are compatible with business activity and career development of a specialist.

A critical solution is the development of interdisciplinary integration skills in project-based activity within the framework of extra-curricular education that corresponds to the tasks of developing innovative directions in the economy.

Keywords: NA

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ABSTRACT

The post-industrial orientation of an economy towards professionals capable of developing and implementing innovative solutions determines the need for rethinking and changing educational technologies.

Based on the analysis of the distributions of statistical indicators characterizing changes in national education systems in connection with the development of the economy, steady trends in the growth of the population's level of education and the duration of the higher education cycle, which goes beyond competitive expediency, are shown.

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A critical solution is the development of interdisciplinary integration skills in project-based activity within the framework of extra-curricular education that corresponds to the tasks of developing innovative directions in the economy.

The stability of the functioning of the developed system of extra-curricular education for high school and university students, which has undergone a period of interregional scaling, is determined by several methodological principles oriented towards the psychology of the youth audience, including: the personalized nature of learning using individual educational cells; the use of emotional competitive elements related to academic support of project-based activities; the inclusion of hybrid forms of digital information and communication technologies in the educational process and the testing of the results of project-based learning.

Practical results make it possible to identify the effectiveness of the system's methodological complex for the entire period of academic advancement. In addition, it allows for using proven innovations for educational support at an early stage of a professional career.

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I. INTRODUCTION

Structural changes in the economy during the transition period to post-industrial development necessitate rethinking the tasks of modernizing education. Stability of trends in educational policy depends on the degree to which they correspond to the priorities of post-industrial labor and employment structures. Ensuring the flexibility and promptness of the educational response (i.e., making changes to the education system) to the processes of dynamic changes in technology and management occurring during the transition period determines the relevance of research aimed at maintaining the conformity of the acquired knowledge and skills to the needs of the economy.

During the systematic transition to an innovative economy in the post-industrial stage, the significance of scientific achievements and technological and organizational innovations have increased and have become the main tools for economic development. These tools replace the resource contribution to the economy (i.e., the use of natural resources, including fossil fuels, as the previous economic driver). They are associated with a consistent increase in the education level of society and an increase in time spent on education. In the new economy, human potential creates innovations, and they ensure economic growth. During the transition period to the post-industrial stage, the development of the intellectual level and the improvement of professional opportunities take the leading positions in the public assessment of careers. The priority of modernizing education during the transitional period in the economy is the formation and development of a class of highly qualified specialists (Toffler 2004) capable of initiating and ensuring the implementation of post-industrial innovative changes in socio-economic development.

The innovative orientation of development in the post-industrial economy is associated with functional corrections to the main links of the educational system and an expansion of the range of knowledge and skills acquired through the learning process. Both factors are necessary for organizing and implementing the prompt transfer of breakthrough scientific research results into the real economy.

However, the possibilities of the educational strategy that ensures the correspondence of the qualification obtained during the learning process to the conditions of the post-industrial stage of economic development are limited.

Firstly, the consistent strengthening of the increase in the informational saturation of educational programs in the traditional hierarchy of basic education is limited by the acceptable duration of the learning period. Therefore, the importance of extracurricular programs that allow for the combination of learning with practical activity and the implementation of career goals is intensified in the configuration of the education system towards the goals and dynamics of post-industrial development.

One of the key tasks also becomes the practical use of the potential of modern distance information and communication technologies (ICT) in providing educational support for business activity. The use of the contemporary potential of ICT in project-oriented extra-curricular education allows for the individualization of learning, methodologically ensuring adaptation to the post-industrial dynamics of the implementation of scientific results at the early stages of acquiring basic knowledge: during the completion of school education and transition to the next stage of professional training. In other words, the start of a professional career during the extended education period should not be delayed, as competitive advantages may be lost. It is necessary to combine career and education, and this becomes a stimulus for the development of extra-curricular education.

In this article, we will analyze the experience of a distributed network for the extra-curricular project-based education system of high school students that we have created (Kosarikov, Davydova 2021).

This system is designed in a multi-sectoral format of public-state partnership (PSP) and is currently operational in all regions of the Russian Federation. 20-years of experience in this field allows us to evaluate the practical impact of the main methodological approaches, that were laid down on the basis of the system development, on the sustainability and effectiveness of learning. These approaches have undergone lengthy testing in regions that differ in levels of development and sectoral features of the economy. Hybrid options for extra-curricular education, combining classroom and distance learning, have been incorporated into the technology of the educational process. The possibilities of modern ICT have been utilized both for territorial distribution and for transferring developed methods of

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non-formal extra-curricular education in schools to the next level of academic advancement in the university environment. Extra-curricular project-based education accompanies the period of basic qualification training when high school and university students receive interdisciplinary training simultaneously with the standard course of study. This allows for the prompt correction of acquired skills in view of the high dynamics of the changes in technology and management during the learning process. The system is based on the rules of mastering interdisciplinary integration methods. In the process of project-oriented interdisciplinary education, connections are created between the learner and the teacher. These are the elements of professional socialization. They make it possible to use the stability of non-formal educational interaction to organize horizontal, peer-to-peer (p2p) expert-educational support schemes for business activity at the early stages of career development. In other words, the developed system moves from "education for all" to individual education in a peer-to-peer format, where the student and the teacher become colleagues and exchange opinions, ideas, and project solutions, ultimately contributing to the development of the post-industrial economy.

II. THE INFLUENCE OF POST-INDUSTRIAL ECONOMIC DEVELOPMENT ON MODERNIZING EDUCATIONAL PROCESSES

The transition to the post-industrial stage is associated with several processes, including replacing natural resources involvement as the main driver of economic development and the increased importance of transferring scientific achievements to the economy.

At the same time, the scope and volume of technological and organizational innovation implementations are expanding. The growth of the innovative component of the economy during the transition to post-industrial development is related to the processes of modernizing education. These processes are aimed at expanding and strengthening the influence of a class of highly qualified specialists whose qualification corresponds to the tasks of developing innovative solutions and operational transferring scientific results to the technological sphere. Positive feedback loops are formed between the modernization of the economy and the requirements for the specialists' qualification level. Thus, through the sequential strengthening of the innovation component of the economy, economic growth drives an "educational spiral": people, who have received new education, change the economy, and then the new economy demands even more educated people.

Within the framework of the post-industrial economy, a closed cycle of events is being formed: economic growth through the development of innovations determines the need for specialists with a wide range of knowledge and integrative interdisciplinary skills that are necessary for the development and operation of new technologies. At the same time, the sequential expansion of the influence and growth of the scientific potential of specialists sets the direction for a new round of innovative renewal of technologies and the next level of qualification requirements.

The dynamics of economic growth during the transition to the post-industrial stage of development is associated with the constant strengthening of investment support for the education sector (Figure 1). The tendency to increase the overall level of education in post-industrial countries corresponds to the tasks of mitigating the consequences of intellectual inequality for the sustainability of post-industrial development. Such group elitism arises as a result of the increased leading role of highly qualified specialists. Society, in turn, seeks to maintain stability and avoid educational inequality by responding with an increase in the duration of education.

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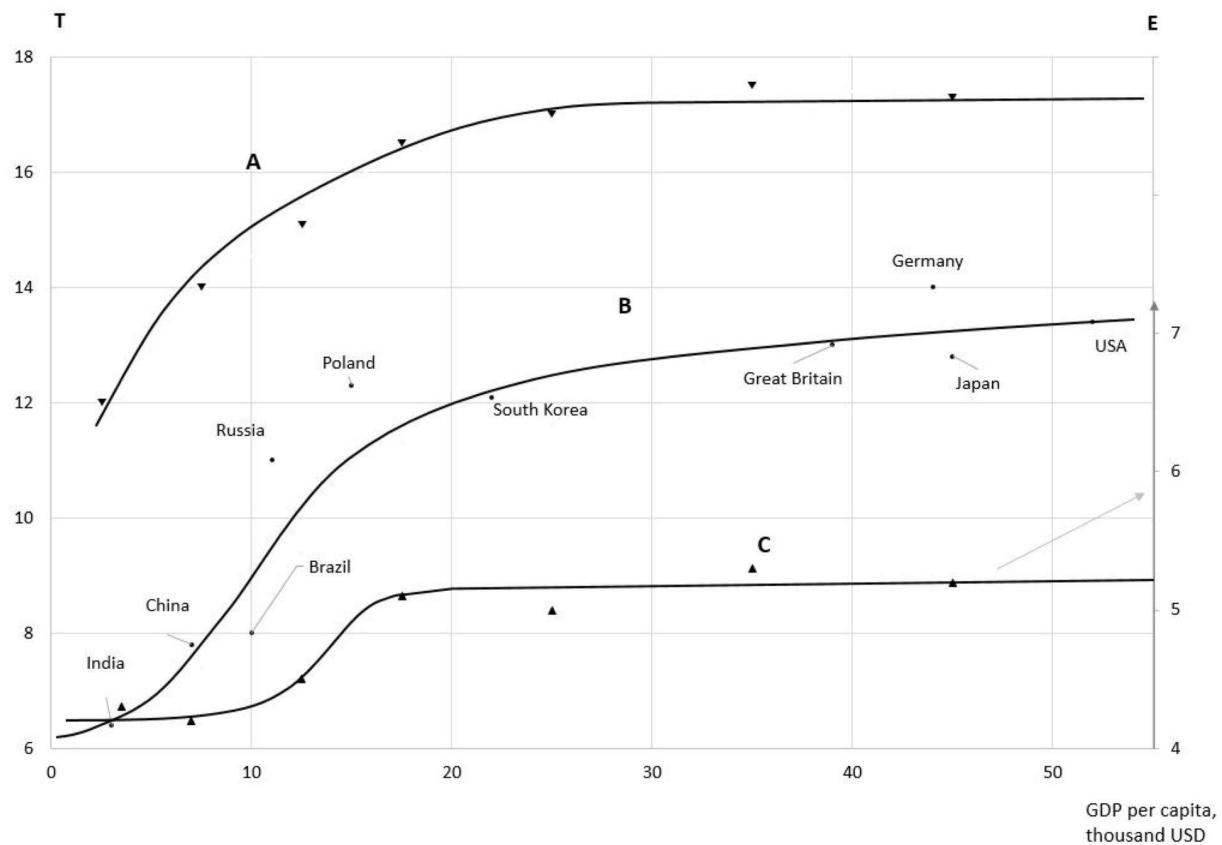
Figure 1

– T - duration of education, years;
– E - investment in education as a percentage of GDP;
– graph A - duration of education required to obtain higher education in countries with different levels of economy;
– graph B - the relationship between the distribution of average education duration (indicators of education) and the level of economic development;
– graph C - the relationship between education expenditure (as a percentage of the country's GDP) and the level of the economy.

The graphs in Figure 1 were obtained based on the analysis of the distributions of the statistical indicators of education duration, education expenditure, and the level of economic development for countries with populations over 10 million people (Ranking of countries by the duration of study 2018; World Bank indicators 2016, Economic data 2020; GDP by economic sectors 2018) . The data are oriented towards average values within selected GDP intervals (in USD per person per year at nominal value).

The averaging was carried out for countries with close indicators of per capita GDP. The size of the intervals for averaging was chosen with a step of 10,000 USD per person per year. Four groups of almost 40 countries with per capita GDP indicators of 0-10, 10-20, 30-40, and 40-50 thousand USD per person were analyzed.

Radical changes in the employment structure and requirements for the level of education and professional training of specialists occur during the transition period of the economy to the post-industrial stage of development. The transition period begins when the share of the service sector

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reaches 50% of GDP and ends when the economic equilibrium level of industries that form the gross internal product is reached up to a GDP level of about 15...17 thousand USD/person/year). Here, equilibrium means achieving equal labor productivity in the leading sectors of the economy: there is a leveling of the average contribution to GDP of those employed in the service sector and those engaged in other sectors of the economy.

The relationship between the growth of average education duration and the economy' pace during the transition period is close to exponential (Figure 1, A) and is characterized by positive feedback. Upon completion of the transitional economic period, the indicators of the average duration of study/education of society in developed countries acquire a stable value for post-industrial development, which is approximately 70-75% of the duration of the entire cycle of study for higher education: 17 … 17.5 years.

The level of education (as measured by the average duration of education) in developed countries largely corresponds to the post-industrial employment landscape, where over 70% of jobs in developed post-industrial countries are linked to innovative development in the service sector and oriented towards highly skilled specialists.

The modernization processes in education, the implementation of methodological innovations, the use of advanced information and communication technologies, and the growth of academic workload and duration are reflected in global trends of educational investment policy. The distribution of statistical indicators of education expenditure (Fig. 1, B) shows a characteristic step in the transition of financing to a level close to 5.2-5.3% of GDP within a narrow range of economic development (approximately from 13 to 15 thousand USD/person/year). In this range, the experience of the transitional period changes is fixed. This is followed by an increase in expenditures, which linearly accompanies economic development (Fig. 1, C).

The institutional correction of national standards for economic support of educational development (that part of GDP directed towards education financing) relies on accumulated experience from the transitional period and, therefore, is lagging and catching-up in nature. In other words, basic educational processes are lagging behind. It is necessary to introduce a mechanism that allows a person to adapt to rapidly occurring processes in technology and management.

III. ON THE PRACTICE OF EXTRA-CURRICULAR EDUCATION IN THE TRANSITION PERIOD

The system of extra-curricular education developed in our organization (Kosarikov, Davydova 2022) is not formalized by institutional regulations and it is aimed at training the project abilities of high school and university students. The system is focused on using integrative methods into the practice of applying scientific results in real economic sectors. The system's replication in the regions of the Russian Federation has led to the creation of a network structure of extra-curricular education distributed throughout the country, which is combined with a contest of school and university students' projects.

The organizational basis of the system is a multi-sectoral educational cooperation in the format of a public-state partnership (PSP). The members of the partnership are educational organizations, public organizations, municipal and state authorities in the field of education, as well as universities and scientific institutes. The territorial distribution of our regional network centers follows the administrative division of the country. Management of the system combines the vertical cycle of annual project contest organization - from planning to standardization of final procedures (Deming

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2018) - with a focus on modern decentralization trends (Laloux 2014) in regional center management. The elements of regional decentralization are technologically efficient in solving the problems of network expansion and ensuring the sustainability of the functioning of regional centers of extra-curricular education.

The organizational and methodological integrity of the non-formal education system is ensured by an innovative combination of learning with the stages of a vertically organized students' projects contest. The inclusion of competitive elements in the educational process corresponds to the ambition and initiative of the school and university age periods and opens up opportunities for initial training in competitiveness in the field of intellectual activity. Within the system, we practice public projects' presentation and defense of the project's results with the remote participation of external audiences. Students go through several stages of municipal, regional, and all-federal competitive events. After completing each stage, a list of leaders is formed.

Through the practice of the system's functioning, it is demonstrated that basic school education provides the opportunity for transitioning from the traditional vertical study of basic disciplines to the comprehensive mastery of integration methods, including STEM competencies (McDonald 2016; Asghar, Ellington, Rice, Johnson & Prime, 2012) for managing project-oriented activities and the development of combinatorial, divergent project solutions. The framework of the general direction of extra-curricular project-based education - an innovation for ensuring sustainable development - determines *the thematic integrity* of non-formal learning in the conditions of organizational decentralization of management.

The extra-curricular format of the education system, combined with a national contest of the students' projects, and the openness of the teaching methodology for the broad use of digital information and communication technologies, enable the leveling of the influence of differences associated with the specific features of schools (Brunner, Keller, Wenger, Fischbach, Lüdtke 2012) including differences in the students' basic education due to geographical location, including remoteness from leading scientific and educational centers of the country.

Decentralization of the system management also leads to a shift in the thematic focus of the projects carried out during extra-curricular education toward local problem-solving. The themes of student projects are associated mainly with the tasks of active monitoring of local territories (EPCI 2019-2022). Thus, our system promotes the principle of "Think globally, act locally" simultaneously in the spheres of environmental protection and sustainable development and education for sustainable development. We note the general trend of applying integration approaches to problem formulating and solving within the research activities of high school and university students in the form of an increasing share of interdisciplinary projects:

- Using mathematical modeling,
- Applying digital technologies to adapt remote sensing data to the tasks of monitoring and predicting changes in local ecosystems and water bodies,
- Developing software elements of artificial intelligence that enable the forecasting of technogenic changes,
- Creating virtual reality reflecting the consequences of economic decisions for sustainable development.

The range of thematic areas in project-oriented learning reflects the possibilities of the system of extra-curricular education going beyond narrowly specialized learning. High school and university students choose project directions focusing on a wide range of educationally relevant issues for

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sustainable development (Kopnina 2012; Rushton & Batchelder 2012). In the 2021-2022 academic year, a number of projects were identified as the most advanced based on competitive testing, with potential for technological implementation and use in professional scientific research, including:

- adaptation of remote space sensing results to assess the transformation of glaciers in the Central Siberian Plateau (Krasnoyarsk region),
- digital modeling of greenhouse gas emissions from bottom sediments in the Volga Basin (Republic of Tatarstan),
- use of magnetohydrodynamic effects for co-generation of electricity in tidal power plants in the Barents Sea (Murmansk region),
- modeling of adsorption-magnetic filtration of wastewater from microplastics (Samara region) and others.

The inclusion of the periods of individual learning in the structure of extra-curricular education and emphasizing the development of personal inclinations and abilities allows for the enhancement of the effectiveness of new information acquisition (Vainikainen, Hautamaki, Hotulainen, Kupiainen 2015; Watkins, Lei, Canivez 2006) and the expansion of skills of integrating scientific results with the target tasks of projects. The use of distance ICT learning removes geographic limitations in the interaction of system participants and creates feedback with leading specialists and scientific teams within the framework of PSP, which has a significant impact on the level of students' projects development.

The main burden of mastering integration STEM skills in project-oriented learning falls on *individual educational cells*, which include the project author, consultant specialists, and the learning organizer-teacher.

These individual cells are combined in the system into a horizontal peer-to-peer structure (Ahn, Weng, Butler 2013), which provides educational support throughout the entire period of extra-curricular education. The potential for the stability of feedback loops in the "student-consultant-teacher" chain, which is characteristic of individual learning (Henderson, Phillips, Ryan, Boud, Dawson, Molloy, Mahoney 2019; Azbel, Ilyushin, Morozova 2021), is projected onto the sustainability of the functioning of the p2p-network, formed from educational cells, at all levels of academic advancement: from high school students to university students.

Trajectories of Information Exchange and Clusters of Intensive Creative Interaction in P2P Networks.

Information exchange trajectories and clusters of intensive creative interaction within the framework of the p2p network are chosen by the participants-authors of projects independently, guided by the thematic focus of the project. The participants also use hybrid ones: remote and direct contacts, in the process of educational conferences and centralized workshops.

The closed/auditory format of discussions during the learning process and competitive procedures supports the majority of participants, around 80%, including project authors, experts, and pedagogical organizers of education, as per survey results. At the same time, remote interactive forms of discussions meet the conditions for expanding the interested audience and utilizing elements of peer-to-peer exchange. The external audience for interactive educational events, transmitted in real-time, usually exceeds the number of direct participants, ranging from 100-150 people to 5-6 thousand viewers.

The study reveals that the maximum level of using distance technologies is limited by the need to preserve the emotional component of horizontal connections and by the conditions for group

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professional socialization of participants in the educational process. However, restrictions limiting the use of remote ICT are significantly mitigated by organizing event broadcasts in a mixed format. A group of direct learning participants, including project authors and experts in thematic directions/nominations, are present in the venue, while interested parties participate in discussions remotely.

The study shows that the solution to the problem of objective testing of the success of education (Paulsen, Valdivia 2022; Wang, Shute, Moore 2015; Sun, Shute, Stewart, Yonehiro, Duran, D'Mello 2020) in the format of educational support for the projects contest, is organically combined with the development of practicing skills for a public demonstration of knowledge, professional competencies and promotion of the project results in a competitive environment. The autonomy of project authors in choosing directions and in implementing project developments, demonstrating personal competence during competitive presentation and promotion of the project, elements of socialization, and belonging to a professional community that are typical for project activities, correspond to the age ambitions of the target audience. The methodological orientation towards the psychological needs of the students (Deci, Ryan 2012) enhances the attractiveness and sustainability of the developed system of extra-curricular education.

IV.   CONCLUSION

The increase in the level of education in society during the transition to the post-industrial stage of development has a significant impact on changes in consumption priorities and demands for organizational and technological modernization. The level of education becomes a leading factor in the post-industrial transformation of the economy and employment structure.

During the transitional period, with per capita GDP values ranging from 5 to 17 thousand USD/year, the average duration of education increases from 7 to 13 years, and the requirements for the educational level of highly qualified professionals reflect a 40% increase in the average period of the educational cycle, estimated to be around 17...17.5 years. The emerging trend in post-industrial countries towards an increase in the average duration of education, which characterizes the level of education in society, up to 70...75%, meets the challenges of mitigating the socio-economic consequences of educational stratification.

Maintaining competitive advantages of an early experience of professional activity in the context of post-industrial growth of the duration of basic education highlights the importance of additional forms of education that are open to using modern digital ICT, and allowing for an effective combination of the educational process with academic and business careers. The absence of the necessity of institutional regulation of the correction of programs for non-formal extra-curricular education provides an opportunity for an operational, synchronized educational response to the post-industrial changes in employment structure priorities caused by inter-sectoral competition and dynamic dissemination of technological and organizational innovations during the transitional period.

Developed for a youth audience of high school and university students, the system of extra-curricular project-based education relies on the organizational potential of the multi-sectoral public-state partnership.

The main element of the learning process is individual educational cells, the format of which allows for the support of the participants' own project developments. An educational cell includes the student, who is the author of the project, a specialist-expert in the chosen project area, who is involved in the learning process within the framework of the public-state partnership, and a teacher-organizer of the training.

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The individual cells that personalize learning are combined into a horizontal network of peer-to-peer educational cooperation. The stability of the educational cells and horizontal network connections is methodologically ensured by hybrid - face-to-face and distance learning formats - and by the use of modern digital information and communication technologies.

The methodology for transitioning from subject-based basic education to intellectual and expanded versions of STEM education includes a range of positions oriented towards meeting the primary psychological needs of the young audience, such as:

- The autonomy of choosing research and project directions,
- The competitiveness of the results of project-based learning and public demonstration of competence during competitive advancement (contest) of the author's project developments,
- The formation of elements of professional belonging-group socialization in the network of the individual educational cells.

The integrity of the educational system is maintained by combining learning with the vertical of preparation and conducting of a national contest of the students' projects and by the general thematic direction of projecting for the implementation of sustainable development provisions.

Personalization of learning using individual educational cells and the main set of organizational and methodological provisions of the project-based integrated education maintains effectiveness for the entire period: from completing high school to obtaining higher education. As our practice in applying educational innovations has shown, it can be used to support education in the early stages of a professional career.

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Impact of Government Expenditure on Selected Health Indicators: A Study on Bihar and Odisha

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ABSTRACT

Purpose of Study: Regional disparities and inequality continue to be a feature of Indian economy even after seven decades of independence. Many of its social indicators need much improvement. Some states are particularly more backward with large proportions of their population being officially poor while some others are comparatively in better position. Such inter-regional disparities have compounded policy challenges of the governments in the poorer states. Against this background, the present study aims to study the dimension of inter-regional disparity for select less advanced states in India.

Methodology: A double log model was used in this study to analyze government expenditure's impact on development projects or schemes. Health-wise, less advanced states, viz. Bihar and Odisha are chosen for this purpose. The study uses the actual data on government expenditure in the social sector, mainly on health. The data on a per capita basis is used for each state to analyze the impact of the per capita government's expenditure on select social indicators. The analysis is done separately for both states.

Keywords: birth rate; death rate; infant mortality rate & total fertility rate.

Classification: JEL: H51

Language: English

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Purpose of Study: Regional disparities and inequality continue to be a feature of Indian economy even after seven decades of independence. Many of its social indicators need much improvement. Some states are particularly more backward with large proportions of their population being officially poor while some others are comparatively in better position. Such inter-regional disparities have compounded policy challenges of the governments in the poorer states. Against this background, the present study aims to study the dimension of inter-regional disparity for select less advanced states in India.

Methodology: A double log model was used in this study to analyze government expenditure's impact on development projects or schemes. Health-wise, less advanced states, viz. Bihar and Odisha are chosen for this purpose. The study uses the actual data on government expenditure in the social sector, mainly on health. The data on a per capita basis is used for each state to analyze the impact of the per capita government's expenditure on select social indicators. The analysis is done separately for both states.

Finding: It was found an inverse relationship between per capita government health expenditure and health indicators i.e., IMR, Birth Rate, Death Rate and TFR in all selected states.

Keywords: birth rate; death rate; infant mortality rate & total fertility rate.

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I. INTRODUCTION

In a developing country like India where significant part of population are poorer and living under miserable conditions and have to struggle daily for their livelihood, so it is not possible for them to access health care, education and other social services at their own. So, it becomes the duty of the government to provide effective social services at a very reasonable cost. According to (Gupta, 2002), "Health care services have high level of externalities rather than curative services, a minimum package of these services provided by the government would reduce mortality rates". Since, governments in developing countries always have scarcity of funds, so it is necessary to ensure that the funds are used effectively and the desired results are attained at social front. So, it is also important to check the effectiveness of government expenditure on the improvement of social indicators. Further, government's spending is also important to uplift the living standards of the poorer people in the society. As Gera, in her studies also found that government investments in education, health and in the provision of infrastructure can have direct effect on moving household out of poverty (Gera, 2007). Further, Ranjan and Sharma (2008) examined the effect of government development expenditure on economic growth and they discovered a significant positive of government expenditure on economic growth. A study found, educational attainment at basic levels (secondary level) and low infant mortality rates have been shown to have a positive effect on economic growth also (Barro and Lee, 1993). Studies on both developed and developing countries have indicated that sufficient amount of government spending on

education and health improves human development and lessens poverty burden as well (Barro and Lee, 1997; Swaroop, 1996). However, it is also necessary to mention that the solely the increase in public spending is not sufficient but the quality of expenditure with good public policies also required. As stated, a government could increase the public spending by a large amount but this does not ensure that it would have desired result on economic and social development as the quality of this spending also matters (Bussato and Brunori, 2011).

Despite the importance of government spending and its role on improvement of social sector, there are not sufficient number of studies have been done in India to evaluate the impact of government spending on social indicators. Thus, present study is an attempt to evaluate the impact of government spending on some selected social indicators and further it will also make a significant contribution to the present literature. As the number of social indicators are very large, so it is not feasible to assess every indicator given the time and data constraint. Hence, the study has selected four indicators i.e., Infant Mortality Rate (IMR), death rate, birth rate and total fertility rate as indicators of health. The study has chosen Bihar and Odisha states.

The following social indicators have been selected for the present study.

Infant Mortality Rate (IMR): It is the number of deaths per 1,000 live births of children under one year of age. It is considered as an indicator of maternal and infant health status.

Death Rate: The average annual number of deaths during a year per 1,000 Population at midyear; also known as crude death rate. Death rate in 2021 was 7.3 deaths/ 1000 Population in India.

Birth Rate: The average annual number of births during a year per 1,000 persons in the population. In 2021, birth rate was 19 births/ 1000 population at midyear; also known as crude birth rate.

Total Fertility Rate (TFR): It is defined as average number of children that would be born to a woman if she experiences the current fertility pattern throughout her reproductive span (15-49 years). In 2021, TFR was 2.3 in India i.e., 2.3 births per woman.

II. LITERATURE REVIEW

Gerard F. Anderson al.et (2000), revealed that the USA spent more on health care as compare to other countries. USA spent 14% of GDP on health care in 1998 while OECD median was 8% of GDP and results also suggested that Americans enjoys better health care system than other OECD countries. Shenggen Fan et al. (2002) found that government spending on agricultural R & D and irrigation, and on rural infrastructure like roads and electricity have directly contributed to reduce rural poverty. Paulo S. L. (2002), results confirmed some correlation between government spending and social indicators. While, results also asserts that per capita spending and as a percent of GDP have relevance to social outcome, but share of government spending in GDP may be misleading. Emanuele Baldacci et al. (2003) found that public spending is an important determinant of social outcomes, especially in education sector. Further, it suggests intra-sectoral allocation of spending matters rather than increase in social spending only. Niloy B. M. et al. (NA) suggest that aggregate capital expenditure of government has a positive effect on economic growth while aggregate current expenditure has no effect on growth. Gera, N. (2007) found that government spending in education, health and in infrastructure have a direct effect on moving ouseholds out of poverty. Nurudeen, A. and Usman, A. (2010), Findings reveal that government's capital expenditure, recurrent expenditure and expenditure on education have negative effect on economic growth while government's expenditure on transport and health have positive impact on economic growth. Chandra, A. (2011) found bidirectional relationship between these two. Further, study concludes that economic growth affects the level of government spending on education without any lag effects while investment in education also impact the economic

growth with time lag. Craigwell, R. et al. (2012) revealed that government expenditure on health has a significant positive effect on health status while, expenditure on education has no significant impact on either primary or secondary school enrolment. Maitra, B., and C.K. Mukhopadhyay (2012) shown that impact of education and health spending on growth is not an instantaneous but with gestation lags. Initially, expenditure on education and health improves human capital which manifests itself in the form of economic growth. Further, it is found that the gestation lag of education spending was longer than that of health-care spending. Savaş Çevik, M. & Okan Taşar (2013) found that government health spending has significant impact on under-5 child mortality rate and on infant mortality rate. Study also concludes that composition of government health expenditure also matters not only the size of expenditure. Tae Kuen Kim and Shannon R. Lane (2013) shown a negative relationship between public the health expenditure and the infant mortality rate (IMR), while positive association between public health expenditure and life expectancy is found. Thus, the study concludes that expanding public health expenditure improves overall health condition. Bhakta, R. (2014) shown that public expenditure on Supplementary Nutritional Program has positive impact on health status of children which also has indirect positive impact on education. Study also concludes that public expenditure on elementary education has direct impact on the enrolment rate. Virupakshapp a D Mulagund (2015) suggested that public health expenditure in India have increasing trend during this period. Further, study concludes that public health expenditure has positive impact on health indicators i.e, it resulted in fall in maternal mortality rate (MMR), infant mortality rate (IMR), fall in total fertility rate (TFR) and improves life expectancy. Wong Sing Yun and Remali Yusoff (2015) indicated there is a unidirectional causal relationship from GDP to education expenditure and from GDP to health care expenditure. Thus, study concludes that GDP affect both the education and health care expenditure. However, reverse causal relationship is not found between them. K. P. K. S. Lahirushan

et al. (2015) exhibited a positive impact of government expenditure on GDP in Asian region. Study further concludes that there is a unidirectional causality from economic growth to government expenditure and government expenditure to economic growth. Sineviciene, L. (2015), Results show that there is an inverse relationship between economic development and government's expenditure on public order and safety, and economic affairs. While, positive relationship is found between economic development and government's expenditure on social protection and health. Study further concludes that government should pay more attention to the needs which ensure sustainable development in the long-run. Mittal, P. (2016), shown that there is a direct relationship between the social sector spending and human development index (HDI) of the Indian states. So, study recommends that the public expenditure should increase further to achieve balanced and improved human development in India. Solihin, A., et al. (2017), shown that government spending in education sector is relatively inefficient. Further, it states that government's expenditure for education has no significant impact on education index. This implies government expenditure for education sector is not effective in improving education index. Jiranyakul, K. (2007) results of Granger causality test reveal the unidirectional causality from government expenditure to economic growth. Similarly, the results of least square method with lagged variables also show that there is a positive impact of government expenditure on economic growth.

In doing the above, the present study seeks to fill up some research gaps found in the literature. The study has used government's expenditure on per capita basis while most of the studies have taken the overall government's expenditure in their analysis (Yun and Yusoff, (2015), Mello and Pisu, (2009), Kim and Lane, (2013) and others). Further, mostly studies have considered gross enrolment rates as output Lopes, (2002), Baldacci, Guin-Siu and De Mello (2003), Craigwell, Lowe and Bynoe, (2012); however, enrolments do not reflect actual output as it does not exclude the drop outs. Present study has

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covered this drawback by considering NER which is the net of Gross Enrolment Ratio (GER) and dropout rates.

III. OBJECTIVE(S) OF STUDY

1. To evaluate the impact of government expenditure on selected social indicators in less advanced Indian states.
2. To suggest policy implications for better utilization of public expenditure on social sectors.

III. METHODOLOGY

For the purpose of determining the impact of government's expenditure on social indicators, the study has applied log-log or double-log model. In case of Log-log models, the coefficients are used to determine the relative impact of independent variable(s) on relative impact of dependent variable. Here, the independent variable is government expenditure and the social indicator(s) chosen are the dependent variables. The coefficients in a log-log model represent the elasticity of dependent variable with respect to independent variable. Therefore, log-log model presents the empirical interpretation in elasticity term i.e., percentage change in dependent variable due to one percent change in explanatory variable.

Log-log model is represented as:

$$\ln Y_i = \ln \beta_1 + \beta_2 \ln X_i + u_i$$

(1) Where In= Natural log (i.e., log to the base e, and where e = 2.718)

Equation (1) is thus:

$$\ln Y_i = \acute{\alpha} + \beta_2 \ln X_i + u_i$$

The coefficients are estimated by OLS regression. Six equations will be fitted/estimated for each selected state.

The study is based on secondary data. Data on health indicators i.e., infant mortality rate (IMR), Death Rate, Birth Rate and Total Fertility Rate (TFR) is collected from various editions of Sample Registration Surveys (SRS Data, Census of India) for the period 2001 to 2022. Similarly, data on government's health expenditure were collected from RBI database on states (RBI website) for the period 2001 to 2022. Consequently, for analysis of health indicators the number of observations for each state is 18.

VI. DATA ANALYSIS AND RESULTS INTERPRETATION

Table 1: Odisha Birth Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	2.486159	0.034363	72.35068	0.0000
ln_ Per Capita Health Expenditure	-0.100182	0.005986	-16.73666	0.0000
R-squared	0.955649			
Adjusted R-squared	0.952237			
S.E. of regression	0.014214			
Sum squared residual	0.002627			
Log likelihood	43.59160			
F-statistic	280.1159			
Prob(F-statistic)	0.000000			

Table 1 provides the results of analysis showing impact of per capita health expenditure on birth rate for state of Odisha for the period 2001 to 2022. Here, the birth rate is dependent variable while the per capita expenditure on health is independent variable. From the table we can see that the explanatory variable's coefficient has a negative sign which tells there is an inverse relationship between health expenditure and the birth rate i.e., an increase in government expenditure on health causes fall in birth rate. Further, coefficient has -0.10 values which mean

if the value of explanatory variable is increased by 1 percent, then the value of dependent variable decreases by 0.10 per cent. From the analysis table we can see the R-squared value is 0.9556 which tells 95.56 percent of variation in dependent variable birth rate is explained by independent variable. The p-value is 0.0000 being less than the significant level of 5% percent which shows that the explanatory variable is statistically significant and, therefore, the null hypothesis that the coefficient of explanatory variable is zero will be rejected. It means we can say that the per capita public health expenditure on health has impact on birth rate.

Table 2: Odisha Death Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	1.526188	0.048452	31.49869	0.0000
ln_ Per Capita Health Expenditure	-0.117343	0.008440	-13.90293	0.0000
R-squared	0.936982			
Adjusted R-squared	0.932135			
S.E. of regression	0.020043			
Sum squared residual	0.005222			
Log likelihood	38.43740			
F-statistic	193.2915			
Prob(F-statistic)	0.000000			

Table 2 provides the results of analysis between per capita health expenditure and the death rate. Here, the death rate is dependent variable while the per capita expenditure on health is independent variable. From the table we can see that the coefficient has a negative sign which tells there is an inverse relationship between health expenditure and the death rate. The explanatory coefficient value is -0.11 which means an increase in per capita health expenditure causes 0.11 percent fall in death rate. The R-squared value is 0.936 which tells 93.6 percent of variation in dependent variable is explained by independent variable. As we can see that the p-value is 0.0000 which is appearing against the explanatory variable is statistically significant because the p-value being less than the significance level of 5 percent (0.05), hence the null hypothesis of that, the explanatory variable is statistically insignificant and being rejected.

Table 3: Odisha Infant Mortality rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	2.267239	0.077929	29.09365	0.0000
ln_ Per Capita Health Expenditure	-0.336219	0.013575	-24.76789	0.0000
R-squared	0.979248			
Adjusted R-squared	0.977652			
S.E. of regression	0.032236			
Sum squared residual	0.013509			
Log likelihood	31.30917			
F-statistic	613.4486			
Prob(F-statistic)	0.000000			

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Table 3 provides the results regarding the impact of government's expenditure on health on infant mortality rate (IMR). Here, infant mortality rate is a dependent variable. The squared-R is 0.97 which tells that around 97 percent of the variation in dependent variable is explained by the independent variable. As we can see that the p-value is 0.0000 being less than the significant level of 5% percent which shows that the explanatory variable is statistically significant and, therefore, the null hypothesis that the coefficient of explanatory variable is zero will be rejected. Apart from this, the negative symbol with explanatory variable shows that there is negative relationship between the dependent variable and explanatory one. The explanatory coefficient value is -0.336 which indicates that 1 percent increase in per capita may lead to 0.336 percent fall in IMR.

Table 4: Odisha Total Fertility Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.020812	0.072761	0.286029	0.7794
ln_ Per Capita Health Expenditure	-0.147003	0.012675	-11.59828	0.0000
R-squared	0.911876			
Adjusted R-squared	0.905098			
S.E. of regression	0.030098			
Sum squared residual	0.011777			
Log likelihood	32.33842			
F-statistic	134.5201			
Prob(F-statistic)	0.000000			

Table 4.8d provides the results of analysis between per capita health expenditure and total fertility rate (TFR). Here, the total fertility rate is dependent variable while the per capita expenditure on health is independent variable. From the table we can see that the coefficient has a negative sign with value of -0.14 which tells there is an inverse relationship between health expenditure and the TFR i.e., an increase in per capita health expenditure results in 0.14 percent fall in TFR. The R-squared value is 0.911 which tells 91.1 percent of variation in dependent variable TFR is explained by independent variable per capita expenditure on health. The p-value is 0.0000 which is appearing against the explanatory variable is statistically significant because the p-value being less than the significance level of 5 percent (0.05), hence the null hypothesis of that, the explanatory variable is statistically insignificant and being rejected.

Table 5: Bihar Birth Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	3.066362	0.060341	50.81755	0.0000
ln_ Per Capita Health Expenditure	-0.047210	0.009447	-4.997567	0.0002
R-squared	0.657676			
Adjusted R-squared	0.631343			
S.E. of regression	0.031945			
Sum squared residual	0.013266			
Log likelihood	31.44520			
F-statistic	24.97568			
Prob(F-statistic)	0.000244			

Table 5 provides the results of analysis showing impact of per capita health expenditure to birth rate for state of Bihar. Period of the study is from 2001 to 2022. Here, the birth rate is dependent variable while the per capita expenditure on health is independent variable. From the table we can see that the explanatory variable's coefficient has a negative sign which tells there is an inverse relationship between health expenditure and the birth rate i.e., an increase in government expenditure on health causes fall in birth rate. Further, coefficient has -0.0472 values which mean if the value of explanatory variable is increased by 1 percent, then the value of dependent variable decreases by 0.0472 per cent. From the analysis table we can see the R-squared value is 0.6576 which tells 65.76 percent of variation in dependent variable birth rate is explained by independent variable. The p-value is 0.0002 which is appearing against the explanatory variable is statistically significant because the p-value is being less than the significance level of 5 percent (0.05), hence the null hypothesis of that the explanatory variable is statistically insignificant and being rejected. It means we can say that the per capita public health expenditure on health has impact on birth rate.

Table 6: Bihar Death Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	1.466497	0.116643	12.57247	0.0000
ln_ Per Capita Health Expenditure	-0.081164	0.018261	-4.444628	0.0007
R-squared	0.603111			
Adjusted R-squared	0.572581			
S.E. of regression	0.061753			
Sum squared residual	0.049574			
Log likelihood	21.55844			
F-statistic	19.75472			
Prob(F-statistic)	0.000661			

Table 6 gives the results relating to the impact of government's expenditure on health on death rate in Bihar. Here the death rate is dependent variable. From the table we can see that the per capita health expenditure coefficient has a negative sign which tells there is an inverse relationship between health expenditure and the death rate i.e., an increase in government expenditure on health causes fall in death rate. The coefficient has -0.081 value which means 1 percent increase in per capita health expenditure causes 0.081 percent fall in death rate. The R-squared value is 0.6031 which tells 60.31 percent of variation in dependent variable death rate is explained by independent variable. Further, we can see that the p-value is 0.0007 which is appearing against the explanatory variable is statistically significant because the p-value is being less than the significance level of 5 percent (0.05), hence the null hypothesis of that the explanatory variable is statistically insignificant and being rejected here also.

Table 7: Bihar Infant Mortality Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	3.117815	0.217910	14.30779	0.0000
ln_ Per Capita Health Expenditure	-0.132202	0.034115	-3.875217	0.0019
R-squared	0.536001			
Adjusted R-squared	0.500309			
S.E. of regression	0.115365			
Sum squared residual	0.173018			

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Log likelihood	12.18402			
F-statistic	15.01731			
Prob (F-statistic)	0.001914			

Table 7 provides the results regarding the impact of government's expenditure on health on infant mortality rate (IMR) in Bihar. Here, infant mortality rate is a dependent variable. The squared-R is 0.5360 which tells that around 53.60 percent of the variation in dependent variable is explained by the independent variable. As we can see that the p-value is 0.0019 being less than the significant level of 5% percent which shows that the explanatory variable is statistically significant and, therefore, the null hypothesis that the coefficient of explanatory variable is zero will be rejected. Apart from this, the negative symbol with explanatory variable shows that there is negative relationship between the dependent variable and explanatory one. The coefficient has -0.132 value which means 1 percent increase in per capita health expenditure results in 0.132 percent fall in death rate.

Table 8: Bihar Total Fertility Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.769332	0.142379	5.403411	0.0001
ln_ Per Capita Health Expenditure	-0.091269	0.022290	-4.094599	0.0013
R-squared	0.563256			
Adjusted R-squared	0.529661			
S.E. of regression	0.075377			
Sum squared residual	0.073863			
Log likelihood	18.56790			
F-statistic	16.76574			
Prob(F-statistic)	0.001266			

Table 8 provides the results of analysis between per capita health expenditure and total fertility rate (TFR) in Bihar. Here, the total fertility rate is dependent variable while the per capita expenditure on health is independent variable. From the table we can see that the coefficient has a negative sign with value of -0.091 which tells there is an inverse relationship between health expenditure and the TFR i.e., an increase in per capita health expenditure results in 0.091 percent fall in TFR. The R-squared value is 0.5632 which tells 56.32 percent of variation in dependent variable TFR is explained by independent variable expenditure on health. The p-value is 0.0013 which is appearing against the explanatory variable is statistically significant because the p-value being less than the significance level of 5 percent (0.05), hence the null hypothesis of that the explanatory variable is statistically insignificant and being rejected.

The results of this study are consistent across all variables considered for the study. Our principal conclusion can be summarized as per capita government expenditure on health helps to reduce infant mortality rate, birth rate, death rate and total fertility rate in Bihar and Odisha states. These results indicate that the government should increase its budgetary allocations on health and family welfare as well. These results are also important in considering the fact that there should be the commitment of more funds health. Although only commitment of funds to social sector is not sufficient, better utilization of funds right direction in effective manner is most important. Thus, it is also essential for the government to look after the efficiency and transparency of its budgetary allocations to ensure that these funds are fully utilized (Yun and Yusoff, 2015). Thus, analysis of this study can pave way in determining the optimal mix of government's expenditure and good governance.

VII. FINDINGS AND SUGGESTIONS

It was found an inverse relationship between per capita government health expenditure and health indicators i.e., IMR, Birth Rate, Death Rate and TFR in all selected states. Findings reveal that,

- One percent increase in per capita government health expenditure decreases IMR by 0.13 percent, Death Rate by 0.08 percent, Birth Rate by 0.047 percent and TFR by 0.09 percent in Bihar state.
- And, in Odisha, one percent increase in per capita government health expenditure decreases IMR by 0.33 percent, Death Rate by 0.11 percent, Birth Rate by 0.10 percent and TFR by 0.14 percent.
- At 5 percent level of significance, p-values indicate that government expenditure has significant impact on the selected social indicators.

It indicates that increase in government spending results in fall in IMR, Birth Rate, Death Rate and TFR. Therefore, the government should further increase its expenditure in health and family welfare. However, merely increasing the allocation of funds to the social sector is not sufficient, effective utilization of funds also necessary. Thus, it is also essential for the government to look after the efficiency and transparency of its budgetary allocations to ensure that these funds are fully utilized. Therefore, policy-makers should address other important factors also apart from allocating public expenditure like the effectiveness of the government schemes in health and family welfare, and proper implementation of such schemes.

VIII. CONCLUSION

From various studies, it can be intuitively explained by the fact that because of extreme poverty and deprivation in India the welfare of the society can be increased by greater involvement of government. At the policy level, the present study recommends that public expenditure should increase further to have a balanced and improved human development of the concerned states. So, an increase in social sector expenditure should also be considered as one of the priorities to promote efficiency in growth and development. Hence, sufficient amount of government funds is recommended to provide support to policies and programs necessary to achieve welfare, growth and development of these states in particular, and the country in general. Therefore, the study is an attempt to analyze the relationship between the public spending on health sector and the selected health indicators in Bihar and Odisha. The study has used the state - level data for the selected states to estimate the direct and indirect effects of government's expenditure on social indicators. The findings clearly indicate that government expenditure does have impact on selected social indicators. The results of the study shows that per capita expenditure on health is inversely related with all the four selected health indicators i.e., increase in per capita expenditure leads to fall in Birth Rate, Death Rate, Infant Mortality Rate (IMR) and Total Fertility Rate (TFR) in both states, however, the amount of decrease will depend on their respective coefficient values.

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Effect of Electronic Payment System on Economic Growth in Nigeria

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ABSTRACT

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Effect of Electronic Payment System on Economic Growth in Nigeria

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ABSTRACT

This study examines the effect of the electronic payment system on economic growth in Nigeria. Here electronic payment system was denoted as the transactions through the point of sales, web pay channel and mobile payment channel, while economic growth was denoted as gross domestic product. Quarterly time series data were collected from the Central Bank of Nigeria statistical bulletin between 2012Q1 and 2021Q4. Philip Perron test was used to test the stationarity of the data and the Johansen cointegration test was utilized to determine the presence of a long-run relationship. Vector Error Correction Model (VECM) was used for analysis since cointegration was established in the series. Dynamic Ordinary Least Square regression was used to test the effect of the electronic payment system on economic growth in Nigeria. The findings showed that point of sales and mobile payment channels are significant drivers of economic growth in Nigeria, while web pay channels had an insignificant effect on economic growth in Nigeria. It was recommended that government should subsidise the purchase of points of sale such that most traders, vendors and business people will be able and willing to own one. There is a need for more investment to be made in the internet network by the government of Nigeria and to also make favourable policies that will entice more private sector-driven investment in the industry. More neo-banks should be licensed and encouraged to drive the cashless policy which will promote healthy competition with the commercial banks.

Keywords: point of sales, web pay channel, mobile payment channel, economic growth.

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I. INTRODUCTION

Globally, electronic payment systems have received wide acceptance in various countries. The booming commerce has birthed globalization, therefore the need for more electronic payment systems. Nigeria as a developing nation is also experiencing the development of various forms of electronic payment methods including online internet banking, mobile banking, Automated Teller Machine (ATM), phone banking, SMS banking, fund transfer services, Point of Sales banking, and use of debit cards. These channels keep expanding with the introduction of the e-naira wallet, soft token, and National domestic card scheme which are aimed at the development of the financial sector and Nigerian economic growth.

Several policies have been made in Nigeria to promote the electronic payment system. These policies include redesigning the currency to reduce the amount of physical cash in circulation, reducing daily physical withdrawal to N20,000 naira per person to promote electronic payments, and introducing Neobanks such as VBank, Kuda, and Opay to carry out payment activities using financial technology. Despite these efforts, the Nigerian Gross Domestic Product, which measures economic growth, does not appear to have responded in the same direction. According to the quarterly reports of both the National Bureau of Statistics and the Central Bank of Nigeria, the GDP stood at N20,329,062million at the end of December 2021, N17,349,381million at the end of the first quarter of 2022, and N17,285,882million at the end of the second quarter of 2022 (CBN, 2022). This suggests that the Gross Domestic Product has been declining.

Thus it is pertinent that this study is undertaken to establish the veracity of this position or otherwise.

This research thus fills the gaps in the literature in this area by examining the effect of the electronic payment system on economic growth in Nigeria from 2012Q1 to 2021Q4. Given the rising policies in support of the electronic payment system (Currency redesign, Daily withdrawal limits etc) it becomes imperative to ask:

i. What is the effect of Point of Sales on economic growth in Nigeria?
ii. How have the web payment channels affected Nigerian economic growth?
iii. What is the effect of mobile payment channels on economic growth in Nigeria?

The study hypothesized that:

H_{o1}: Point of Sales have no significant effect on economic growth in Nigeria.
H_{o2}: Web pay channels have no significant effect on economic growth in Nigeria.
H_{o3}: Mobile payment channels have no significant effect on economic growth in Nigeria.

II.   LITERATURE REVIEW

2.1 Concept of Electronic Payment Systems

Electronic payment systems (e-payment systems) refer to the automated processes of exchanging monetary value among parties in business transactions and transmitting this value over the ICT networks (Amin et al., 2018). In Nigeria, e-payment is effecting payment from one end to another end through the medium of the computer without manual intervention beyond inputting payment data. It is the ability to pay the suppliers, vendors and staff salaries electronically at the touch of a computer button (Udeghi & Hanzace, 2018).

In the wake of the cashless policy, the e-payment system has become a medium through which monetary substance circulates conveniently, especially in a developing economy like Nigeria where carrying cash around is habitual. In Nigeria, the e-payment system formed the fundamental starting point of her modern market economy; a well-functioning e-payment system has been recognized to have much relevance on financial stability, monetary policy and overall economic activity (Aduda & Kingoo, 2018). Historically, the Central Bank of Nigeria (CBN) introduced a payment system which facilitated e-payment in 2002. During this period, Nigeria's Automated Clearing System (NACS) was introduced as a veritable platform for the development of electronic payment and to reduce the clearing of cheques period. Shortly after was the introduction of the Automated Teller Machine (ATM), web pay channels, Point of Sales and mobile payment channels, just to mention a few. Electronic payment systems come in different forms, some of the e-payment systems related to this study are Point of Sales, web pay channels and mobile payment channels.

III.   POINT OF SALES

The point of sale (POS) is a location where a transaction occurs between a buyer and a seller. It is the final step in a retail transaction where the buyer pays for the goods or services purchased from the seller (Friedman & Johnson, 2019). Point of Sales (POS) terminals is a terminal that enables buyers to make payments using payment cards such as (Visa, MasterCard, verve, etc) issued to them by any bank in or outside Nigeria directly into other accounts (Isibar, 2018). In recent years, the POS has evolved to include electronic payment systems that make transactions faster, easier, and more secure.

A POS system typically includes hardware and software components that enable the processing of sales transactions. The hardware may include a cash register, barcode scanner, card reader, receipt printer, and other peripheral devices. The software component may include a user interface, inventory management, and reporting features (Smith, 2018). One of the main advantages of a POS system is that it can reduce errors and streamline the checkout process, resulting in faster transactions and increased customer satisfaction (Maverick, 2021). POS systems can also help businesses manage their inventory, track sales data, and generate reports that can provide valuable insights into their operations (Lee, 2019).

IV. WEB PAY CHANNELS

Web pay channels also known as internet banking are a type of e-payment system that involves transactions carried out over the Internet. Web pay channels refer to online payment gateways that enable customers to purchase goods and services from businesses or individuals through the internet (Foster, 2018). These channels allow customers to pay for their purchases electronically, without the need for cash or physical payment methods. It is a simple way of paying for online purchases directly from the customer's bank. It also offers the possibility of enjoying banking services from their homes or offices (Jun & Cai, 2011). Anyanwaokoro (2017) asserted that web pay channels are online platforms through which customers of the bank can access their accounts and accomplish financial transactions using the internet. With internet banking customers can view account balances, transfer funds between sister accounts, and transfer funds in favour of third parties.

Web pay channels can be integrated into e-commerce websites, enabling businesses to accept online payments for their products or services. Examples of popular web pay channels include PayPal, flutterpay, Alipay, and Square, which provide secure payment processing services that protect the sensitive information of customers during transactions. One significant advantage of web pay channels is that they provide convenience and ease of use for both businesses and customers. With web pay channels, customers can make purchases from anywhere at any time, as long as they have an internet connection. Businesses can also receive payments in real-time, without having to wait for checks to clear or for manual processing (Russell, 2016).

V. MOBILE PAYMENT CHANNELS

Mobile payment channels also known as M-banking or SMS banking are the term used for performing balance checks, account transactions, payments etc. through mobile banking products such as mobile phones (Clive, 2017). Mobile payment channels are one of the latest ways of making payments through mobile phones. This involves sending a payment request through a text message (USSD) or the bank's mobile application. Mobile payments reduce the time and stress of using a credit card or cash as account details are already linked with the banks' software (Hodagho, 2016).

Mobile payment products provide basic banking services to customers from their mobile phones. It is an SMS-driven platform which facilitates access to banking services using cell phones. The services available on the mobile banking product include mini statements and checking of account history, alerts on account activity or passing of set thresholds, monitoring of term deposits, domestic and international fund transfers, micro-payment handling, bill payment processing, portfolio management services, the status of requests for credit, including mortgage approval and insurance coverage, cheque book and card requests, ATM location, general information such as weather updates, news and location-based services (Andrea et al., 2022).

IIV. CONCEPT OF ECONOMIC GROWTH

Economic growth involves a substantial increase of the national income per capita, in a wider sense, it involves the increase of the GDP, GNP and NI, including the production capacity, expressed in both absolute and relative size. (Aldaas, 2021). Economic growth is best measured with Gross Domestic Product (GDP) as it gives information about the size of the economy and how an economy is performing (Haller, 2012).

Gross domestic product (GDP) is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific period (Azeez, 2011). As a broad measure of overall domestic production, it functions as a comprehensive scorecard of a given country's economic health. Though GDP is typically calculated on an annual basis, it is sometimes calculated every quarter as well. Isibar (2018) is of the view that the calculation of a country's GDP encompasses all private and public consumption, government outlays, investments,

additions to private inventories, paid-in construction costs, and the foreign balance of trade. Of all the components that make up a country's GDP, the foreign balance of trade is especially important. The GDP of a country tends to increase when the total value of goods and services that domestic producers sell to foreign countries exceeds the total value of foreign goods and services that domestic consumers buy. When this situation occurs, a country is said to have a trade surplus. If the opposite situation occurs, that is if the amount that domestic consumers spend on foreign products is greater than the total sum of what domestic producers can sell to foreign consumers, it is called a trade deficit (Edet, 2019). In this situation, the GDP of a country tends to decrease.

VI. EMPIRICAL REVIEW

6.1 Point of Sales and Economic Growth

Andrea et al. (2022) investigated the effect of e-payment systems on the gross domestic product of Nigeria. Specifically, the study was set to determine the effect of the Automated Teller Machine (ATM) payment system, Point of Sale (POS) payment system and mobile applications payment system on the gross domestic product in Nigeria. The study adopted an ex-post facto research design. The population comprised all the quoted telecommunication companies listed on the Nigeria Stock Market as of 2020 while the sample size comprised MTN Nigeria, eTranzact, Chams Plc, Courteville Business Solutions Plc and Omatek Plc. A judgmental sampling technique was used in the selection of the sample. Auto Regressive Distributed Lag Model (ARDL) was used as the analytical technique. The study revealed that ATM payment systems, Point of Sales (POS) payment systems and mobile applications payment systems have significant effects on economic growth in Nigeria. The study recommended that banks should constantly upgrade hardware and software whenever a new feature for enhancing security becomes available.

6.2 Web Pay Channels and Economic Growth

John (2019) estimated the relationship between electronic (e-payment) systems and economic growth in Nigeria. Monthly available Data for Nigeria on values of various payments systems were analyzed using the Autoregressive Distributed Lagged regression (ARDL) method covering the period of (2012-2017). The result indicates a significant positive relationship between the electronic payment system and economic growth in terms of real gross domestic product (GDP) growth. Automated Teller Machines had a positive significant impact on economic growth. This means that ATM-based transaction encourages more cash, and possessions and may not yield the required goal of low cash-based transactions within Nigeria's banking populace. POS and web-based transactions (WBT) had a significant impact on the real GDP growth, but INTERBANK transactions, have an insignificant impact on GDP growth while mobile payment (MOP) has a negative contribution to the impact on real GDP growth. Point of Sales (POS) transactions are also the most patronized electronic banking tool and this is seen from the descriptive analysis, followed by web-based transactions. POS and WBT have the highest average among all other variables. This implies that POS and WBT are significantly part of the major determining factors influencing and contributing to the real GDP growth output in Nigeria, while other variables such as INTERBANK transactions are relevant but contribute minimally and drive real GDP output negatively down, as reflected in the results. Since the successful implementation of the e-payment systems has much to do with internet connectivity and mobile banking, efforts should be made to design or improve the internet security framework to check online fraud. There should be adequate legislation on all aspects of the operations of the e-banking and cashless system so that both the operators of the system and the public can be adequately protected.

6.2 Mobile Payment Channels and Economic Growth

Njoku et al. (2020) examined the impact of electronic banking on economic growth in Nigeria over the period of 2009 – 2018 using quarterly data. Secondary data were collected from the CBN

Statistical Bulletin and the Nigerian Bureau of Statistics to establish the relationship between the dependent variable (Real GDP) and the independent variables (Automated Teller Machines, Point-of-Sale, Internet Banking and Mobile Banking). The research adopted the Vector Error Correction Model (VECM) and the results of the analysis show that electronic banking has significantly impacted the economic growth of Nigeria. The VECM result shows that the model explains about 58.97% of the total variations in Economic growth as explained by the independent variables during the period of the study. The result of the analysis shows that Electronic Banking has a significant relationship with Nigeria's economic growth, while Point of Sales, Internet Banking and Mobile Banking, individually have no significant effect on Nigeria's economic growth, while Automated Teller Machine has a significant effect on economic growth in Nigeria for the period under consideration. The research recommends that the government should reduce the charges for the use of electronic means of transactions to encourage people to use them more often.

Ogbeide et al. (2016) investigated the impact of electronic banking on Nigerian economic growth. They made emphasis on the long debate that has been made on the relationship between financial development and the growth of the economy. They further determined if there exists a long-run relationship between e-banking and economic growth in Nigeria employing the Autoregressive Distributed Lag (ARDL) bond testing technique. Economic growth (RGDP) was regressed on some measures of e-banking (Automated Teller machine, Mobile banking, Web banking and Point on Sales Terminal) for the period 2009 to 2014 quarterly data. The Pairwise Granger Causality test was also adopted to determine the direction of causality. The results of the study showed that e-banking had a significant impact on economic growth. ATMs and MB were found to have a positive impact on economic growth while POS and WB showed a negative impact. The result of the study further showed that there is a long-run relationship between e-banking and economic growth and that e-banking Granger causes economic growth in Nigeria. The study thus

recommended the improvement of the technological base of the country and policy measures to encourage the efficient performance of the banking sector as well as regulation and control of the banking activities.

6.3 Theoretical Framework

Innovation Diffusion Theory

The core theory which was adopted and aligned with the research is the Diffusion of Innovation theory (DOI) developed by Rogers (1976), which is pertinent to the explanation of the causality between the pertinent variables. One of the earliest theories that has sought to investigate the variables that can lead a person to accept an innovation or a new technology is the notion of diffusion of innovation. This theory's key tenet is that adopting innovations involves reducing uncertainty. People will gather and combine information on the newest technologies in order to lessen ambiguity. This method produces opinions about employing technology. People then decide whether to accept or reject technology based on these ideas. The adoption of new technology or any innovation is influenced by five key concepts, according to this theory: compatibility, relative advantage, trial ability, complexity, and observability, as described by Rogers (1995). Adoption of new technologies is a process for reducing uncertainty.

This idea explains why people choose a technological modality over a more conventional one (Isibor et al., 2018). It is concerned with the application of a new technological idea, technique, or method. According to this hypothesis, members of a social system spread technological innovation via particular channels. The stages of transmission are knowledge (understanding the technology's existence and functions), persuasion (having a positive attitude about it), decision (adopting it), implementation (using it), and confirmation (benefits based on positive use of it).

Individuals and banks tend to gather and synthesize knowledge to lessen uncertainty regarding new technology. First, the perceived superiority of an innovation over the idea it replaces is referred to as the relative advantage.

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Analyzing the advantages and disadvantages of a change, which may be expressed economically or socially, is necessary for adoption. The degree to which an invention is viewed as consistent with current values, prior experiences, and potential users' demands is referred to as compatibility. It is assessed in light of the adopter's sociocultural norms and beliefs, previously popular theories, and the demand for innovation from the client. If the technology is compatible with how they now conduct financial transactions and does not conflict with their current beliefs, it has a better chance of being accepted in the context of internet banking.

Thirdly, complexity is described as the level of perceived difficulty in using and understanding an innovation. The degree of physical or mental effort required to employ an innovation is measured by its complexity. The fourth definition of the belief of trial ability is the extent to which an innovation may be tested out on a small scale. This conviction enables the adopter to test innovation so that it has meaning for them. The fifth belief is observability, which is the extent to which an innovation's results are apparent to other people.

With the exception of observability, the four tenets of innovation diffusion theory are, however, put to the test for internet banking. Because the targeted technology chosen by Baraghani (2008) was related to internet banking, observability was not included in his analysis. People typically use the internet for private banking, so other people would not be able to see or observe these transactions. These four ideas have a good impact on an individual's attitude toward using Internet banking, which in turn has a positive impact on their intention to use the technology.

Our theory is relevant to this study because it recognizes that innovation spreads over time to members of a social system (Omojolaibi et al. 2016; Rogers, 1976) and that economics operates under generally well-established and well recognized overarching frameworks that can guide investigations. However, in the context of the current study, diffusion is the expansion of cashless payment, where consumers seek for more

quick and efficient transactions and businesses look for new revenue streams. Consequently, Tee and Ong (2016) believed the diffusion of electronic payment will result in the adoption of cashless transactions within the society or community, subject to the types of innovation adopters and innovation-decision process, therefore, since the consequences of diffusion in electronic payment depend on how quickly the society is willing to adopt electronic payment through different stages of innovation processes, the consequences of the adoption of electronic payment differs in a different society.

VII.   METHODOLOGY

The research design adopted for this study is ex post facto design. This study uses quarterly time series data covering the period 2012Q1 to 2021Q4. The variables of the study are Point of Sales, web pay channels, mobile payment channels and Gross Domestic Product. Data for the study was obtained from the Central Bank of Nigeria Statistical Bulletin 2021. Descriptive statistics were used to explain the data. A stationarity test was conducted to test for the presence of unit roots in the time series data. In addition, the co-integration test was conducted to investigate the possible correlation among the variables of this study. A vector error correction model was also used: The vector error correction model is a restricted type of VAR designed for the use of non-stationary series that are known to be co-integrated. The data obtained was also analyzed using Dynamic Ordinary Least Square regression through Eviews 10 Statistical Package. The analysis process of this study follows the following steps:

The Phillips-Perron (PP) unit root test was employed to determine the order of integration of the variables in an attempt to establish the stationarity level of the variables. The PP unit root test is conventionally said to have greater unit root detection ability when compared with the ADF unit root test. The PP test is thus preferred to the Augmented Dickey-Fuller (ADF) because it deals with a potential correlated error by employing a correction factor that estimates the long-run variance of the error process.

$$\Delta y_{t-1} = \alpha_o + \lambda y_{t-1} + \ldots + \lambda y_{t-p} + \varepsilon_t$$

Cointegration

Johansen (1990) developed two likelihood ratio tests: The Trace Test and the Maximum Eigenvalue Test. The two procedures test for the presence of cointegrating vectors between Point of Sales, web pay channels, mobile payment channels and Gross Domestic Product.

$$\Delta Y t = \mu + \sum_{i=1}^{n-1} \Gamma i \Delta Y_{t-i} + \sum_{i=0}^{m-1} \gamma i \Delta X_{t-i} - ECM_{t-1} + \varepsilon_t$$

where Δ is the first difference operator, Y_t is a p x 1 vector of stochastic variables, X_t is the independent variable, ECM is the error-correction coefficient and is also called the adjustment coefficient, l is a vector of constants, and ε_t is a vector of normally, independently, and identically distributed errors with zero means and constant variances and p is several variables.

VIII. ERROR CORRECTION MODEL

Granger (1987) showed that if two variables are cointegrated, then they have an error correction representation. The Error Correction Model (ECM) provides information about the long-run, and short-run relationship as well as the speed of adjustment between the variables in incorporating the estimated equation, the error correction term (ECT).

$$\Delta Y_t = a_o + b_1 \Delta X_t - \lambda \hat{u}_{t-1} + Y_t$$

The model is specified as follows:

$$GDP = f(POS, WPC, MPC) \quad (1)$$

The econometric form of equation (1) is represented as:

$$GDP_t = \beta_o + \beta_1 POS_t + \beta_2 WPC_t + \beta_3 MPC_t + \mu_t \quad (2)$$

Where: GDP = Gross Domestic Product; POS = Point of Sales; WPC = Web Pay Channels; MPC = Mobile Payment Channels; β_o =Intercept or Constant; $\beta_1 - \beta_3$ = Slope of the regression line concerning the independent variables; μ=Error Term. The Cointegration model of the study is represented by:

$$\Delta GDP_t = \mu + \sum_{i=1}^{n-1} \Gamma i \Delta GDP_{t-i} + \sum_{i=0}^{m-1} \gamma_1 \Delta POS_{t-i} + \gamma_2 \Delta WPC_{t-i} + \gamma_3 \Delta MPC_{t-i} + ECM_{t-1} + \varepsilon_t \ldots \ldots (3)$$

Where: GDP = Gross Domestic Product; POS = Point of Sales; WPC = Web Pay Channels; MPC = Mobile Payment Channels; and ECM = Error-correction coefficient; ε = Error term; Δ = First difference operator; μ =Intercept or Constant; $_{t-i}$ = Time lagged; $\gamma_1 - \gamma_3$ = Coefficient of independent variables.

IX. RESULTS AND DISCUSSION

Table 1: Descriptive Statistics

	GDP	POS	WPC	MPC
Mean	28699881	301291.3	6101201.	650464.2
Maximum	49276018	2089077.	46645986	4764969.
Minimum	16450360	1456.918	2031.660	514.5233
Std. Dev.	8492651.	531586.9	12728662	1292346.
Observations	40	40	40	40

Source: Eview Version 10 Output, 2023

Table 1 reveals that gross domestic product has a mean value of 28,699,881, meaning that Nigeria had an average quarterly foreign inflow of N28,699,881 million for the period under consideration, while the deviation from the mean (standard deviation) was 8,492,651. This means

that gross domestic product was normally distributed because the standard deviation value was lower than the mean value. The maximum gross domestic product within the period of this study was 49,276,018. This implies that the highest gross domestic product is not more than N49,276,018 million within 40 quarters. Table 1 also shows the minimum value to be 16,450,360, meaning that gross domestic product per quarter was not less than N16,450,360 million for the period under review.

Point of Sales had a mean value of N301,291.3 million while the deviation from the mean was N531,586.9 million. This indicates that the Point of Sales was not normally distributed since the standard deviation value was greater than the mean value. The maximum value within the period under consideration was 2,089,077, implying that the highest cumulative Point of Sales transaction used in the electronic payment per quarter under review was not more than N2,089,077 million. While the minimum value paid through the Point of Sales payment channel per quarter was not less than N1,456.918 million for the period under review.

Web pay channels had a mean value of N6,101,201 million while the deviation from the mean was N12,728,662 million. This indicates that the web pay channels were not normally distributed since the standard deviation value was greater than the mean value. The maximum value within the period under consideration was 46,645,986, implying that the highest cumulative web pay channels transaction used in the electronic payment per quarter under review was not more than N46,645,986 million. While the minimum value paid through the web pay channels per quarter was not less than N2,031.660 million for the period under review.

Finally, the mobile payment channel had a mean value of N650,464.2 million while the deviation from the mean was N1,292,346 million. This indicates that the mobile payment channel was not normally distributed, since the standard deviation value was greater than the mean value. The maximum value within the period under consideration was 4,764,969, implying that the highest cumulative value from the mobile payment channel within a quarter was not more than N4,764,969 million for the period under review. The minimum value of N514.5233 million indicates the lowest total value paid through the mobile payment channel for a quarter within the period under review.

Table 2: Unit Root Test

Variables	Adj. T-Statistic	Prob. Values	Order of Integration
GDP	-9.702196	0.0000	I(1)
POS	-3.214800	0.0020	I(1)
WPC	-6.901472	0.0000	I(1)
MPC	-6.092884	0.0001	I(1)

source: researcher's computation 2023.

To examine the existence of stochastic non-stationarity in the series, the research establishes the order of integration of individual time series through the unit root tests. The test of the stationarity of the variables adopted was Phillips-Perron (PP) test. The variables tested were GDP, POS, WPC, and MPC with results as presented in Table 2.

From Table 2, it can be seen that all the variables were found to be stationary at the first difference, that is, at order I(1). The PP test statistics were greater than their respective tabulated values and their p-values are all below the 0.05 significant level for this study. Since the variables were found stationary at first order I(1), the Johansen cointegration approach was applied to determine the long-run relationship among the variables.

Table 3: Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)			
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.911016	152.6676	47.85613	0.0000
At most 1 *	0.720080	60.73429	29.79707	0.0000
At most 2	0.275414	12.35071	15.49471	0.1409
At most 3	0.002860	0.108833	3.841466	0.7415
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.911016	91.93328	27.58434	0.0000
At most 1 *	0.720080	48.38358	21.13162	0.0000
At most 2	0.275414	12.24187	14.26460	0.1019
At most 3	0.002860	0.108833	3.841466	0.7415

Source: Eview Version 10 Output, 2023

The Trace test of Johansen cointegration shows that there is an indication of cointegration at 0.05 significance level as shown in its Trace statistics of None and At most 1 (152.6676, and 60.73429) are greater than their respective 0.05 Critical Values (47.85613, and 29.79707), while their p-values (0.0000, and 0.0000) are all below the 0.05 level of significance for this study. Also, the Maximum Eigenvalue test of Johansen cointegration shows that there is an indication of cointegration at a 0.05 significance level as the Max-Eigen statistics for None, and At most 1 (91.93328, and 48.38358) are greater than their respective 0.05

Critical Values (27.58434, and 21.13162), while None, and At most 1 p-value of 0.0000, and 0.0000 respectively are all below the 0.05 level of significance for this study. Since there is cointegration in the two criteria of the Johansen cointegration test, it implies that there is a long-run relationship between gross domestic product and the three variables of the electronic payment system (Point of Sales, Web pay channel and Mobile payment channels) considered. Therefore, this suggests the use of the Vector Error Correction model (see Appendix II).

Table 4: Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic
POS	84.79623	11.89884	7.126431
WPC	-0.143013	0.250593	-0.570699
MPC	-27.71097	7.233641	-3.830847
C	20548465	712436.9	28.84251
R-squared	0.955039	Mean dependent var	
Adjusted R-squared	0.932559	S.D. dependent var	
S.E. of regression	1992507.	Sum squared resid	
Long-run variance	6.08E+12		

Source: Eview Version 10 Output, 2023

Point of sales has a significant effect on economic growth because the p-value is 0.0000 which is lower than the 5% significant level, indicating that an increase in point of sales will automatically increase economic growth to the extent of 84.79623. Therefore, the study rejects Ho_1, which states that point of sales has no significant effect on economic growth in Nigeria.

However, the analysis showed that the web pay channel has no significant effect on economic growth because the p-value is 0.5735 which is greater than the 5% significant level, indicating that an increase in the web pay channel will not automatically decrease economic growth to the extent of 0.143013. Therefore, the study accepts Ho_2, which states that the web pay channel, has no significant effect on economic growth in Nigeria.

According to the analysis, mobile payment channels have a significant effect on economic growth because their p-value is 0.0008 which is lower than the 5% significant level, indicating that an increase in mobile payment channels will automatically decrease economic growth to the extent of 27.71097. Therefore, the study rejects Ho$_3$, which states that mobile payment channels have no significant effect on economic growth in Nigeria.

The coefficient of determination (R2) is 0.955039 implying that the electronic payment systems explain variation in economic growth to the extent of 96%, while the remaining variation was explained by other variables not captured in the model.

Table 5: Post-Estimation Test

| Description	Probability values
Normality Test: Jarque-Bera P-value:	1.506089 0.470931
Serial Correlation F-statistics P-value	0.189553 0.6661
Heteroskadasticity Test F-statistics P-value	1.568907 0.2138

Source: Researcher's computation, 2023

Table 5 above indicates that the data is skewed, denoting that the data are normal. This is corroborated by the Jarque-Berra Statistic of 1.506089 and its corresponding P-value of 0.470931 which is greater than the p-value of 0.05.

The Breusch-Godfrey Serial Correlation LM Test indicates that there is no autocorrelation. This is given by the F-statistic of 0.189553 and its corresponding P-value of 0.6661. The Breusch Pegan Test of Heteroskedasticity with F-statistics 1.568907 and its corresponding P-value of 0.2138 indicates that there is no problem with heteroskedasticity.

Table 6: Stability Test

Variable	Coefficient	Std. Error	t-Statistic
POS	84.79623	11.89884	7.126431
WPC	-0.143013	0.250593	-0.570699
MPC	-27.71097	7.233641	-3.830847
C	20548465	712436.9	28.84251
R-squared	0.955039	Mean dependent var	
Adjusted R-squared	0.932559	S.D. dependent var	
S.E. of regression	1992507.	Sum squared resid	
Long-run variance	6.08E+12		

Source: Eview Version 10 Output, 2023

The stability of the model was checked using the CUSUM test and it shows that the model is stable as it is within the 5% boundary.

IIX. CONCLUSION AND RECOMMENDATIONS

The main objective of the study is to empirically examine the effect of the electronic payment system on economic growth in Nigeria for the period 2012Q1 to 2021Q4. Based on the findings of the study, it can be concluded that there is an existence of a long-run equilibrium relationship between point of sales, web pay channels, mobile payment channels and economic growth in Nigeria.

The study concludes that point of sales has a significant effect on economic growth in Nigeria. This means that the use of point of sales as a channel of payment in Nigeria does have a proportionate increase on the gross domestic product. This finding is in line with the works of Andrea et al. (2022) and John (2019). However, the web pay channel does not significantly increase economic growth. This result is in tandem with the findings of Njoku et al. (2020) that web pay channels have no significant effect on the economic growth of Nigeria. But does not support the findings of John (2019) who found that the web pay channel has a significant effect

on the gross domestic product, meaning that an increase in transactions through the web or the internet will lead to an increase in gross domestic product. The mobile payment channels on the other hand had a significant effect on economic growth in Nigeria. This indicated that funds transacted through mobile channels of payment contribute to the gross domestic product of the economy in Nigeria. This result is in agreement with the findings of John (2019) and Ogbeide et al. (2016) who found that mobile payment contributes to real GDP growth. Nevertheless, this finding is not in alignment with the conclusions of Njoku et al. (2020), that mobile payment channels have no significant effect on Nigerian economic growth.

Based on the findings of this study, it is recommended that:

In the wake of the Central Bank of Nigeria's cashless policy, point of sales should be encouraged by the government through CBN as an alternative source of payment. This should be done by subsidizing the amount needed for its purchase, such that most traders, vendors and business people will be able and willing to own one.

Though the web pay channel had an insignificant effect on economic growth, this could be a result of the slow internet network transmission usually experienced in the process of completing transactions which can be traced to inadequate investment in the fibre-related transmission of networks like the 5G that is already in use in developed nations like the USA, UK, but yet to be implemented in Nigeria. Therefore, there is a need for more investment to be made in the internet network by the government of Nigeria and to also make favourable policies that will entice more private sector-driven investment in the industry.

Finally, the Central Bank of Nigeria has done well by licensing a lot of neo-banks like Kuda, Opay, Palmpay and a lot more as they have enhanced real-time transactions where most commercial banks failed especially in the face of the sudden transition to the cashless economy driven by the implementation of the cashless policy. However, the Central Bank of Nigeria needs to put in place more control measures that will guarantee the safety of depositors' funds since these neo-banks do not have walk-in physical structures.

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Environmental Policy: Effect on Oil and Gas Sector

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ABSTRACT

Inclination for green deeds has been demonstrated repeatedly despite global distress over the energy crisis of winter 2021. Accordingly, the question of energy security is by far neglected in favor of environmental issues, threatening to harm the oil and gas sector in terms of its financial results. This study, thus, aims to gauge the effect of environmental regulation on the financial functioning of companies in the fossil fuel sector, employing panel data for 72 oil and gas companies drawn from the top 200 largest fossil fuel firms by market capitalization in 21 countries during a three-year period (2018-2020). Results of the study demonstrate that oil and gas companies have been exposed to financial risks provoked by the government's regulatory framework of environmental related issues, impacting the fossil-based companies' financial performance as a consequence, albeit only at a moderate level. On the basis of the research findings, the study also discusses some possible implications for countries in terms of their environmental policy in accordance with the corresponding economic-specific characteristics: developed and energy-import dependent (Western Europe, Japan, South Korea), developing and energy-import dependent (China), developed and energy-import independent (the United States, Canada).

Keywords: energy, environmental policy, financial performance, oil and gas, financial risks.

Classification: JEL Code: Q58

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Inclination for green deeds has been demonstrated repeatedly despite global distress over the energy crisis of winter 2021. Accordingly, the question of energy security is by far neglected in favor of environmental issues, threatening to harm the oil and gas sector in terms of its financial results. This study, thus, aims to gauge the effect of environmental regulation on the financial functioning of companies in the fossil fuel sector, employing panel data for 72 oil and gas companies drawn from the top 200 largest fossil fuel firms by market capitalization in 21 countries during a three-year period (2018-2020). Results of the study demonstrate that oil and gas companies have been exposed to financial risks provoked by the government's regulatory framework of environmental related issues, impacting the fossil-based companies' financial performance as a consequence, albeit only at a moderate level. On the basis of the research findings, the study also discusses some possible implications for countries in terms of their environmental policy in accordance with the corresponding economic-specific characteristics: developed and energy-import dependent (Western Europe, Japan, South Korea), developing and energy-import dependent (China), developed and energy-import independent (the United States, Canada).

I. INTRODUCTION

Energy topics, among which energy's economic roles, energy security and environmental issues, have been regularly voiced in scholarly dialogues and discussions. In this regard, energy security and environmental issues are often seen mutually exclusive unless a future breakthrough in technology realizes the fourth energy transition. Obtaining a compromise between the two goals is often challenging, as the prerequisites for a green transition are yet to be readily available, while the mounting concerns over energy insecurity are constantly rising over the past few years. Recently, research attention seems to be directed at curtailing environmental deterioration (see [Cui et al., 2021; Luo et al., 2021; Ma, Zhang & Yin, 2021; Schabek, 2020; Wang, Li & Zhang, 2021; Wang et al., 2021]), illustrating a bias towards green issues. This has led us to question whether energy security is by far neglected, which contributes to swell the probability of energy shortage in industrial manufacturing and eventually distort the normal functioning of the economy.

Both historical and modern evidence is available to interpret the roles of energy in maintaining economic health. Specifically, in the time series analysis model in Stern D.'s study (1993, 2000), energy is included as an imperative factor explaining the growth of GDP, in addition to capital and labor. As of the past, many industrial booms, which have breathed life into the human standard of living, were the implication of an "energy-fed" innovation, for example "coal-fired steam power", "oil-fired internal-combustion engines" or "electricity" [The Economist, 2008]. Many researchers and scholars

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have placed energy innovation as the center of the arguments interpreting the driving force behind the historic Industrial Revolution in Great Britain [Allen, 2009; Pomeranz, 2012; Stern & Kander, 2010; Wrigley, 1988; Wrigley, 2010]. In the present climate, the production of almost all the necessities for maintaining a fulfilling life, ranging from petroleum, cars, food, buildings, machinery and equipment involves the use of energy. By this token, energy activates a mechanism to affect consumers' welfare by the costs and quality of goods and services, the power and status of the national economy, as well as the availability of job opportunities [The National Academies, 2022].

As a contrast to energy's strategic roles, the world is shouldering the escalating burden of energy insecurity due to a persistent energy crisis since 2021, which have constantly shown no signs of alleviating its severity in some years to come. Statistical records illustrate unprecedented variations in gas, oil and coal prices, with an increase of +290%, +50% and +47%, respectively [Matos & Gili, 2022]. The robust recovery of the global economy following the years of COVID's recession has constantly stimulated demand for energy [Berahab, 2022; Gilbert & Bazilian, 2022; Matos & Gili, 2022]. Soaring demand in parallel with supply disruptions due to the catastrophic impact of the pandemic has amplified the state of imbalance between supply and demand [Berahab, 2022; Gilbert & Bazilian, 2022]. Besides, socio-economic aspects, including geopolitics, hostile competition on the same LNG supply market between Europe and Asia also participated in the sudden upwards of energy prices [Berahab, 2022; Gilbert & Bazilian, 2022; Matos & Gili, 2022].

In this context, the fourth energy transition seems to be a promising solution to the opportunity cost of energy security and environmental issues. However, historical evidence suggests that the transition from one energy source to another often takes a long period of time [Ritchie, Roser & Rosado, n.d.]. Meanwhile, the prolonged energy crisis has built up an intensifying pressure on the speed of the transition path. To observe a clear progress in energy transition from fossil fuels to renewable resources will require addressing some major challenges, including geopolitical concerns, financial constraints, and especially technological innovation [Nevshehir, 2021]. Due to the challenges related to the immutable laws of physics and chemistry, technological innovation in energy transition calls for the pursuit of novelty rather than improvements to existing technology [Nevshehir, 2021]. In other words, the green transition should be accompanied by the construction of new power plants based on environmentally friendly technology, and this involves being nominated as a national policy objective [Sachs et al., 2019]. Research by Kordana S. et al. (2019) defines the "intermittent" and "uncontrollable" nature as the major technical obstacles to the integration of RES into power systems. As an additional point, Nevshehir N. (2021) states that low energy conversion rates and the RES's reliance on fossil fuels can drive the green energy industry against sustainability; and emphasizes the importance of weighing the challenges and opportunities until the introduction of a disruptive technology.

What has exacerbated the already vulnerable problem of energy security is the fact that fossil-fuel-based companies, which dominate the global energy supply, are incurring grave financial risks. Presence of instability in the fossil-based energy sector has been showing signs since before 2020, as a result of the rise of the renewable energy sector and regulatory burden [NWC, n.d.]. Furthermore, investment pressure is cited as one of the main hurdles targeting fossil fuel companies [NWC, n.d.]. For example, programs like the Climate Action 100+ Initiative, which has so far aroused the interest of more than 700 investors, representing $68 trillion of assets under management, are joining forces to place financial constraints on countries generating most of the global greenhouse gas emissions [Climate Action 100+, 2022; NWC, n.d.]. Additionally, Oliver Wyman argues that a heavy carbon emission tax can expose many oil and gas companies to a higher risk of default by more than 2-3 times [Nauman & Temple-West, 2020]. Besides, many banks have initiated their first steps to safeguard themselves from the risks accompanying loan provisions to oil and gas companies. A number

of central banks are inclined to include climate change risks to a stringent test. For instance, the UK central bank plans to devise a strategy of modeling companies' exposure to the Paris Agreement goals [Nauman & Temple-West, 2020]. In another case, a British multinational universal bank Barclays has been bearing the pressure of terminating fundings to some fossil fuel companies. In the favor of climate regulations, energy companies are constantly voicing their concerns over the threat of being cut off from loans and bond markets [Nauman & Temple-West, 2020].

On this account, this study seeks to gauge the effect of environmental policies on the financial health of fossil energy companies and suggest the features of environmental policies in a modern oil and gas sector. It, however, by no means argues against the sustainable goals but aims to find a compromise to satisfy the conflicting interests between ensuring energy security and maintaining environmental health. As the problem of energy security becomes more acute, the introduction of stringent environmental policies targeting oil and gas companies only can add more fuels to the severity of energy imbalance and harm the already vulnerable global economy during the historic COVID's recession. While the fourth energy transition is inevitable, it must be tailored to the socio-economic, political and security contexts, and this is how the research has a role to play.

II. LITERATURE REVIEW

2.1. Measuring Firms' Financial Performance

Corporate finance is a dominating research question in the economic field and has awakened the interest of many scholars in the financial world. Measuring the financial performance of a company, accordingly, has convincing grounds to be based on. Most studies perceive ROA, or ROE as a well-reasoned tool to study the financial status of a firm. The study of Battisti E. et al. (2020), which aims to interpret the impact of knowledge management practices on the financial results of global startups, employs a DEA model, with revenue and ROA being included as output variables [Battisti, 2022]. Likewise, some papers examining energy firms describe ROA and ROE as a decent approach to report the financial functioning of the firms. Schabek T. (2020) selects both indicators ROE and ROA to demonstrate the financial health of sustainable power producers in emerging markets and believes that those are "the most natural and popular measures" when reporting financial strength of a firm. Quite similarly, Cui Y. et al. (2021) argue that ROE is an ideal indicator to learn the financial disclosure of a firm, while Wang X. et al. (2021) uses ROA, current ratio (CR) and total asset turnover (TAT) to depict a company's solvency, operating capacity and profitability.

By comparison, ROA and ROE both aim to assess companies' efficiency in allocating financial resources. Factoring in the two variables' pros and cons, some studies argue that ROA performs better compared to ROE in reporting profit potentials, as it rules out the inclusion of any purposeful and unstable attempt in profit enhancement [Hage et al., 2013; Zhang et al., 2014]. Adding to the point, the difference between ROE and ROA regarding the effect of leverage and debt explicitly supports the use of ROA. Accordingly, a company's high ROE may indicate an attribution of profits to its capital structure rather than to its financial management capacity. In line with the formula, ROE poorly represents how efficiently a company employs its assets by borrowing and issuing bonds [Mcclure, 2021]. While debt can allow a firm to fulfill its short-term goals, an excessive amount of debt may lead the company to more exposure to instability in the long term. A company with poor management of debt means having a risky capital structure, threatening its future viability [Hage et al., 2013]. In this study, the companies of research interest are all in one specific industry – oil and gas sector, which causes no inconvenience regarding imbalanced ROA distribution across different industries as suggested by Birken E. (2021) and Gallo A. (2016). For all the illustrated points, this study opts for the

use of ROA as a variable that illustrates a company's financial image. ROA of oil and gas companies in the research sample is calculated by the following formula:

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

2.2. Measuring Environmental Policy Stringency

Considerable effort has been invested to construct a measurement of environmental policy stringency in a number of studies (see [Cole & Elliott, 2003; Damania, 2001; Dasgupta, 2010; Eliste & Fredriksson, 2002; Grether & Mathys, 2012; Harris, Konya & Matyas, 2002; Hilton & Levinson, 1998; Sauter, 2014; Xing & Kolstad, 2002]); however, there is yet a broadly accepted indicator [Sauter, 2014]. The principal drawback of previous attempts is that they are rarely constructed on a strong theoretical basis but are mainly driven by data availability [Knill, Schulze & Tosun, 2012]. Inevitably, these indicators show lack of effectiveness in gauging the stringency of state regulations on environmental issues, which have been touched on in the research of Sauter C. (2014). Firstly, a survey or self-reporting approach (see [Dasgupta, 2010; Eliste & Fredriksson, 2002]) falls short of objectivity and thus is often biased [Sauter, 2014]. Secondly, the monetary approach (as suggested by Magnani E. (2000), Pearce D. & Palmer C. (2001)) is far too specific when including only one regulatory instrument and excluding the implementation of other policies. Another problem that should be addressed is the effect of imbalanced distribution of cross-country efficiency. High public expenditure on environmental issues does not necessarily interpret a country's stringency in terms of environmental policies [Sauter, 2014]. Thirdly, policy-specific approach (see [Nakada, 2006; Smarzynska & Wei, 2001]), likewise, is rather too particular to describe the characteristics of national environmental policy as a whole [Sauter, 2014]. Finally, the group of performance indicators (see [Cole & Elliott, 2003; Damania, 2001; Grether & Mathys, 2012; Harris, Konya & Matyas, 2002; Hilton & Levinson, 1998; Xing & Kolstad, 2002]) tries to quantify the problem that environmental policies attempt to solve; hence shows little relevance to policy stringency [Sauter, 2014].

Besides, some approaches have advanced one step further as constructed on a sound methodological basis (see [Botta & Koźluk, 2014; Sauter, 2014]). Sauter C. (2014) argues that a good index should be based on a description of the phenomenon it tries to measure, hence allowing us to identify its sub-components. Considering the definitions proposed by Sauter C. (2014) and Botta E. & Koźluk T. (2014), the composite index approach of OECD is an ideal choice in the framework of this study. To specify, Sauter C. (2014) determines pollutant policies as the focus of his research, or in a narrower term - anthropogenic CO_2 emissions. Meanwhile, Botta E. & Koźluk T. (2014) give a more comprehensive definition to environmental policy: "a higher, explicit or implicit, cost of polluting or environmentally harmful behavior" [Botta & Koźluk, 2014]. Furthermore, their research offers two types of environmental policy stringency: EPS index for the energy sector and economy-wide EPS. This study, hence, uses the EPS index for the energy sector as the independent variable because it takes into account the environmental policies targeted at the energy sector.

According to Botta E. & Koźluk T. (2014), the structure of the EPS index for the energy sector has two components: market-based and non-market-based instruments, which are equally weighted. Market-based policies include government regulations by means of taxes, trading schemes, and feed-in tariffs (FITs), with the weight of each type being 33%. Besides, non-market policies are divided into standards (emission limit values) and R&D subsidies for the renewable energy sector; both have the weight of 50%. The score for each regulatory component is determined by a cross-country comparison, based on which the value of EPS is calculated. The value of EPS may vary from 0 to 6, with 6 indicating the highest level of stringency [Botta & Koźluk, 2014].

2.3. The Determinants of Financial Performance of Firms

In addition to the independent and dependent variables, the research model also includes some control variables, including corporate financial indicators and macroeconomic factors. The choice regarding control variables is based on the results of former studies on relevant topics. Existing literature on the determinants of financial performance of firms is the major source of information to construct the research model. Description of the research model is presented in Table 1.

Table 1: Research Model

Variable	Determined by	Measured by	Role	References
Financial performance	ROA	Net profits divided by total assets	Dependent variable	[Battisti, 2022; Qi et al., 2022; Schabek, 2020; Wang, Li & Zhang, 2021; Zhang et al., 2014]
Environmental policy stringency	EPS	Composite index approach developed by OECD	Independent variable	[Botta & Koźluk, 2014]
Firm-level indicators				
Firm size	SIZE	Natural logarithm of total assets	Control variable	[Ang, 2022; Erdogan & Yamaltdinova, 2019; Luo et al., 2021; Ma, Zhang & Yin, 2021; Schabek, 2020; Siddique et al., 2021; Sun et al., 2020; Wang, Li & Zhang, 2021]
Growth rate of total revenues	GROW	Growth rate of total revenues in a given year	Control variable	[Ang, 2022; Ma, Zhang & Yin, 2021; Schabek, 2020; Sun et al., 2020]
Capital investment	CAIN	Natural logarithm of capital expenditures divided by total revenue	Control variable	[Schabek, 2020; Siddique et al., 2021]
Capital structure	LIQU	Current assets divided by current liabilities	Control variable	[Alkaraan et al., 2022; Lim, Wang & Zeng, 2018; Ma, Zhang & Yin, 2021; Sun et al., 2020; Wang, Li & Zhang, 2021]
Firm age	AGE	Natural logarithm of years gap between year of establishment and current year	Control variable	[Cui et al., 2021; Lim, Wang & Zeng, 2018; Liu, Fang & Xie, 2021; Siddique et al., 2021; Wang, Cho & Lin, 2019; Wang, Li & Zhang, 2021; Wang & Zou, 2018]
Country-level indicators				
Economic development	GDPC	GDP per capita	Control variable	[Sun et al., 2020]
Financial development	FIND	Ratio of financial system deposits to GDP	Control variable	[Sun et al., 2020]

Source: research results

Overall, the research model consists of 1 independent variable (EPS) and 7 control variables (SIZE, GROW, CAIN, LIQU, AGE, GDPC and FIND). Most studies suggest a positive causal relationship between revenue growth and the companies' financial results. Revenue growth demonstrates increased demand for energy, efficiency of revenue management and reinforced competitiveness [Schabek, 2020; Sun et al., 2020]. Capital investment is also expected to amplify financial performance, as it enables to unlock production potential of the companies [Schabek, 2020]. In addition, macroeconomic factors should presumably have a positive impact on the financial performance of firms. Macroeconomic variables (GDPC and FIND) portray the overall economic and financial state of a country. Stability of the macroeconomic environment fosters a healthy business climate for firms' development, thus contributing to the corporate financial growth.

Nonetheless, current literature also shows contradictions in some respects. Firstly, according to Schabek T. (2020), firm size is expected to positively affect financial performance of a company owing to economy of scale. However, evidence from some other studies argues against his suggestion, addressing major drawbacks of large-scale firms, such as challenges in internal management [Sun et al., 2020]. Capital structure is another factor subjected to heated debate. On the one hand, Schabek T. (2020) supports the idea that taking risks improves expected returns, which will correspondingly result in higher ROA. On the other hand, he contends that taking more debts will equivalently expose the company to higher risks, which will eventually lead to a probable bankruptcy. By comparing current assets with current liabilities, capital structure allows to learn a company's capacity of covering its liabilities.

So far, little efforts have been made to assess the impact of environmental policy on the financial functioning of oil and gas companies, as data unavailability challenges the feasibility of research [Sauter, 2014], which leaves a gap in existing literature. As environmental policy "increases the costs of environmentally harmful behavior" [Botta & Koźluk, 2014], it is supposed to affect the financial performance of oil and gas firms in a negative way. Hence, following hypothesis is proposed:

H_1: Increased stringency of environmental policy produces a negative impact on the financial performance of oil and gas companies.

The remaining parts of this study aim to test the hypothesis, as well as resolve the contradicting suggestions in previous literature.

III. DATA AND METHODOLOGY

3.1. Data Source & Data Processing

To begin with, the methodology, data sampling and the choice of research period of this study are subjected to the effect of data availability. Correspondingly, the study inevitably has borne some certain shortcomings, which will further be addressed in the conclusion. In this analysis, "data processing" will be performed to treat the drawbacks and limit the potential defects. In terms of methodology, the study employs a quantitative approach for a panel dataset of 21 countries over a three-year period (2018-2020).

The selected countries for analysis are mainly OECD members; non-member countries include Brazil, China, India, Indonesia, Russia, South Africa. As those are the dominant players in the energy market, local firms take an active participation in the global energy sector. Statistical data for the six-point assessment of environmental policy stringency of 27 OECD members and 6 non-member countries in the period 1990-2015 are available and can be extracted from OECD iLibrary [OECD Statistics, n.d.]. The data for country-level control variables, including economic development and financial

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development are extracted from the database of the World Bank Group and the Global Economy [TheGlobalEconomy, 2022; World Bank Data, n.d.].

For a firm-level study on a specific industry, it is apparent that one of the possibly finest approaches for the choice of firms is using Standard Industrial Classification code (SIC code) to pick a list of companies in the industry of interest. Unfortunately, the author's accessibility to a compiled dataset of corporate financial reports (e.g. COMPUSTAT , Bloomberg Professional) is limited. As an alternative, companies are sorted out from the list of top largest oil and gas companies by market capitalization, according to a survey of 6,029 companies in the fossil energy sector reported by Global Ranking [Companies Market Cap, n.d.]. Data for corporate financial reports, including annual income statement and annual balance sheet, are compiled using the companies/market query of Dow Jones Factiva. The companies with the absence of any needed financial indicator in the examined period (2018-2020) are removed from the sample to ensure the transparency and reliability of the modeling method. Eventually, the number of oil and gas companies selected for sample analysis is 72. Drawing a sample of companies from the list of major players in the oil and gas industry by market capitalization is also because they are the leaders in ensuring global energy security. Regarding regional distribution of oil and gas companies, the U.S oil and gas firms constitute about 50% of the total number of companies selected. Other companies are located in different parts of the world, including Asia-Pacific, Europe and Africa, but with much less frequency.

In the earlier part, we accept that most aspects of the study rest on the matter of data inaccessibility. We have also discussed that the figures for national environmental policy stringency, quantified by the composite index methodology developed by OECD are available for the period 1990-2015. However, financial performance data compiled using the company profile analysis tool of Dow Jones Factiva are available in a different period (2018-2020), resulting in an inconsistency in terms of possible research period between the dependent and independent variables. This entails the adjustment of one of the two variables in line with the other regarding research period. In this regard, the choice for the period 1990-2015 appears to offer much of a comparative advantage. Firstly, a wider range of years may involve a compiled dataset with considerably larger observations, contributing to raise the research's reliability. Secondly, the impact of the global economic shock factor, caused by the COVID-19 pandemic, is not to be included. However, the data on the financial performance of fossil fuel firms in the corresponding period go beyond the author's accessibility, unless subject to a manual process of aggregating financial statements of each company for each year. Due to the time limit of the study, the option illustrates infeasibility. Alternatively, the period 2018-2020 is preferably selected as the research period. To treat the data for environmental policy stringency, the author employs the FORECAST function in Microsoft Excel to project the approximate values for this variable in the period 2018-2020. The FORECAST function in Microsoft Excel predicts future values for an indicator using a linear regression, meaning along a line of best fit based on historical data [Microsoft Support, n.d.]. In this case, we assume that the set of EPS between 1990 and 2015 for each country is a single time series, and is a function correlated with time (or variable t) by a linear function. Given such assumptions, the FORECAST function in Microsoft Excel is reasonably implemented to project the future values of EPS from 2018-2020. Forecast results of the corresponding EPS in the period 2018-2020 are presented in Table 2.

Table 2: Results of forecast model for EPS in Microsoft Excel

Country	2018	2019	2020
Australia	3.70	3.84	3.97
Austria	3.79	3.88	3.97
Brazil	0.41	0.41	0.41
China	1.87	1.93	2.00

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Finland	4.18	4.30	4.43
France	4.31	4.46	4.60
Greece	2.66	2.72	2.78
Hungary	3.83	3.96	4.10
India	1.43	1.48	1.52
Indonesia	1.07	1.11	1.14
Italy	3.37	3.46	3.55
Japan	3.07	3.15	3.23
Korea, Republic Of	3.95	4.09	4.23
Norway	3.51	3.61	3.72
Poland	3.33	3.44	3.55
Portugal	3.15	3.24	3.33
Russian Federation	0.87	0.89	0.91
South Africa	1.04	1.07	1.09
Spain	3.71	3.81	3.91
Sweden	4.15	4.28	4.40
United States	3.15	3.24	3.34

Source: sample analysis

3.2. The Empirical Model

The obtained data after "data processing" will be analyzed using a variety of econometric models for a panel dataset: Pooled Ordinary Least Squares (Pooled OLS), Fixed-Effects Model (FEM), Random-Effects Model (REM). The rationale for the choice of the most appropriate model is the absence of defects, specifically serial autocorrelation and heteroskedasticity. The comparison of models is facilitated by employing a set of econometric tests (White test, Wooldridge test, Hausman test and modified Wald test). If none of the models appears to be defect-free, the Generalized Least Squares (GLS) model will be implemented to treat the defects in the existing models and is expected to quantify a more accurate estimate. Factoring in all the points mentioned, the best-fitted model will be selected to translate the magnitude of the effect of environmental policy stringency on the financial performance of oil and gas firms. The analytical framework is handled using STATA 17.0, a powerful and user-friendly instrument in dealing with econometric models.

All things considered, the function explaining the impact of the government's environmental policy instruments on the financial disclosure of oil and gas companies during the period 2018-2020 is expressed as follow:

$$ROA_{it} = \alpha_0 + \alpha_{jt}EPS_{jt} + \sum_{it=1}^{n} \beta_{it}\varphi_{it} + \sum_{jt=1}^{k} \beta_{jt}\varphi_{jt} + \varepsilon_{it} + \varepsilon_{jt}$$

Where:

ROA_{it}: Returns on assets of company i in year t;

EPS_{jt}: Environmental policy stringency of country j in year t;

φ_{it}: Column vector of firm-level variables for firm i in year t;

φ_{jt}: Column vector of country-level variables for country j in year t;

$\alpha_{jt}, \beta_{it}, \beta_{jt}$: regression coefficients for EPS of country j in year t, firm-level variables of firm i in year t, country-level variables of country j in year t, respectively;

α_0: intercept;

ε_{it}, ε_{jt}: stochastic error terms of the firm i in the year t and of the country j in year t, respectively;

The inclusion of variables in the model is in accordance with the determinants of financial performance of oil and gas firms, as discussed in Literature Review.

IV.   RESULTS

4.1. Descriptive Statistics

Table 3:   Illustrates a statistical description of all variables in the research model. The figures for statistical indicators (mean, standard deviation, minimum and maximum values), derived from STATA.17, are all presented. Hence, a brief overview on the sample firms' financial characteristics and status of the national macroeconomic development is revealed.

Table 3: Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
ROA	216	.0717589	.1215171	.000904	1.481774
EPS	216	2.789413	1.060305	.410083	4.600321
SIZE	216	9.233017	2.869745	1.164829	13.00132
GROW	216	-.8030386	.4360811	-.9992752	4.088889
CAIN	216	-1.877375	1.042194	-5.281641	2.075864
LIQU	216	1.326832	.7883415	.1436719	4.375285
AGE	216	3.718515	.8325743	1.791759	5.209486
GDPC	216	10.20054	1.11618	7.564087	11.31774
FIND	216	.8825157	.4150424	.3449367	2.545475

Source: results analysis

First of all, the companies selected as input data for the sample have a level of ROA ranging from 0.09% to 148%, demonstrating a sound success in terms of financial functioning in general. The mean value of ROA is 7.7%, which outperforms the corresponding figure for the energy sector as a whole (5.09%, as suggested by Factiva, Factset Research Systems Inc.).

In addition, other firm-specific indicators (size, liquidity), also represent an optimistic result of corporate financial health, as the mean values are relatively high (9.23 and 1.33, respectively). The figures suggest that principally, the selected oil and gas companies are relatively large in terms of acquired assets and have a rigid capital structure, with total assets exceeding total liabilities by about 33%. The results are rather comprehensible, as the list of 72 oil and gas companies is sorted out from a record of top 200 ranking companies by market capitalization in the fossil energy sector. The table also demonstrates that those companies are inclined to a shrinking trend of revenues, which can be learnt through a negative average revenue growth (-0.80%).

In terms of the EPS index, the value range [0.41; 4.60] implies a high level of disparity among 21 countries in terms of the stringency of the government's environmental policy instruments. Generally, the level of environmental regulation stringency is rather modest with a mean value of only 2.79 points, as compared to the maximum value of 6 points.

Besides, the overall health of national macroeconomics, depicted by the financial and economic developments, shows promising results in the investigated countries. Specifically, 21 countries in the research sample have an average percentage of financial system deposits to GDP equal to 88%, indicating that typically, firms' exposure to financial support from national financial institutions is relatively high.

4.2. Correlation Analysis

Table 4: Illustrates the correlations of the independent and control variables. The extent to which those variables correlate with one another can be interpreted using Pearson-correlation coefficients and their corresponding significance values.

Table 4: Correlation analysis

|	EPS	SIZE	GROW	CAIN	LIQU	AGE	GDPC	FIND
EPS	1.0000							
SIZE	-0.0336	1.0000						
	0.6229							
GROW	0.0276	-0.0878	1.0000					
	0.6864	0.1988						
CAIN	0.0480	0.0652	0.3078	1.0000				
	0.4827	0.3405	0.0000					
LIQU	-0.0937	-0.1265	0.2861	-0.1364	1.0000			
	0.1699	0.0635	0.0000	0.0452				
AGE	0.1302	0.2667	-0.1575	-0.1690	0.0454	1.0000		
	0.0561	0.0001	0.0205	0.0129	0.5073			
GDPC	0.7773	0.1869	0.0839	0.2239	-0.0325	0.1577	1.0000	
	0.0000	0.0059	0.2192	0.0009	0.6346	0.0204		
FIND	0.4011	-0.4183	-0.0176	-0.1682	-0.0705	0.0220	0.3523	1.0000
	0.0000	0.0000	0.7969	0.0133	0.3025	0.7478	0.0000	

Source: results analysis

Results in the table show that 13 pairs of variables are found to be statistically correlated, with a confidence level of 95%. They are (CAIN ~ GROW), (LIQU ~ GROW, CAIN), (AGE ~ SIZE, GROW, CAIN), (GDPC ~ EPS, SIZE, CAIN, AGE) and (FIN ~ EPS, SIZE, CAIN, GDPC). Overall, the country-level control variables observe a correlation with most of the remaining indicators, with the number of correlated pairs being 4 for each variable. Moreover, it can also be interpreted that national macroeconomic indicators are the contributing factor to the stringency of environmental policies, depicted by a relatively high correlation coefficient (0.78 and 0.40, respectively). Apart from GDPC and FIND, EPS does not have correlation with any other variable, indicating that the choice of independent

variable is sensible. The remaining pairs of variables show only a modest level of interaction, with the correlation coefficients all less than 0.4, implying that the independent variables moderately correlate with each other and thus are acceptable to use in analysis. Considering the above preliminary assessment, the chosen variables have only a modest level of correlation, indicating that the model is suitable for use and with least likelihood of multicollinearity.

4.3. Regression analysis

The role of this section is twofold. Firstly, it aims to determine the most appropriate model for the selected panel data sample. Secondly, it seeks to gauge the effect of the government's environmental regulation on the financial performance of oil and gas companies. Figure 1 below depicts the results of econometric tests in an attempt to select the best model.
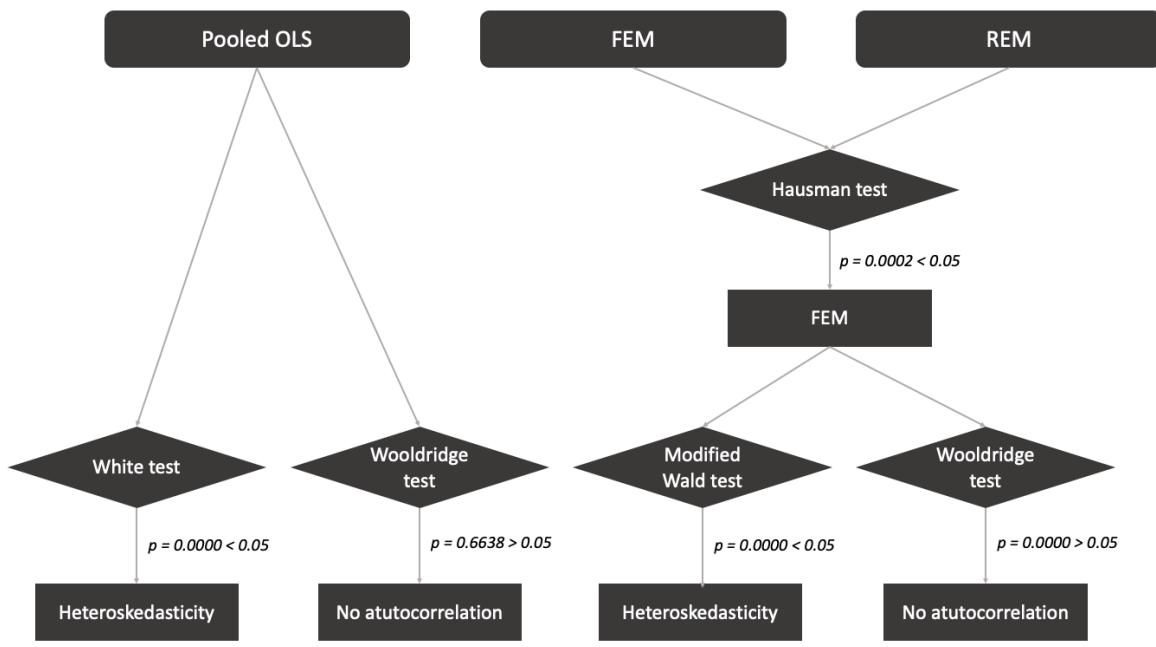
Source: author

Figure 1: Econometric test results for 3 models

As illustrated, neither of these models is an appropriate choice, as heteroskedasticity exists in both cases. On this point, the GLS model with adjustment for heteroskedasticity will then be implemented to address the matter of heteroskedasticity in the previously mentioned models. The result of the GLS model reveals an absence of first-order autocorrelation and heteroskedasticity, showing advantages compared to Pooled OLS, FEM and REM. In addition, the significance value of F test is equal to 0.0000 < 0.05, indicating that generally, the model is statistically significant. Table 5 below describes a comparative analysis of Pooled OLS, FEM, REM and GLS models and reveals the figures for standardized beta value of each model.

Table 5: Comparison of Pooled OLS, FEM, REM and GLS

	(1) Pool OLS	(2) FEM	(3) REM	(4) GLS
EPS	-0.0165 [-1.58]	-0.0294 [-0.16]	-0.0168 [-1.49]	-0.00712*** [-2.89]
SIZE	-0.00315 [-1.06]	-0.206*** [-3.97]	-0.00324 [-1.01]	-0.00290*** [-3.35]
GROW	0.198*** [11.85]	0.185*** [8.68]	0.200*** [11.85]	0.207*** [22.05]
CAIN	-0.0362*** [-4.87]	-0.0612*** [-4.13]	-0.0383*** [-4.91]	-0.0225*** [-8.76]
LIQU	-0.0208** [-2.26]	-0.0286 [-1.44]	-0.0214** [-2.20]	-0.00407 [-1.57]
AGE	0.00497 [0.59]	0.280 [1.15]	0.00479 [0.53]	0.00316* [1.83]
GDPC	0.0230** [2.08]	0.145 [0.84]	0.0236** [1.99]	0.00774*** [2.60]
FIND	-0.0414** [-1.99]	0.0390 [0.24]	-0.0414* [-1.85]	-0.0282*** [-5.17]
_cons	0.0492 [0.58]	-0.428 [-0.21]	0.0432 [0.47]	0.178*** [6.03]
N	216	216	216	216
R-sq	0.424	0.510		

Source: results analysis

As heteroskedasticity has been treated using the GLS method, most variables in the proposed research model are statistically significant, with the only exception being liquidity. Hence, the number of factors explaining the dynamics of financial performance of oil and gas companies has increased significantly compared to the previous models. In addition, evidence from all the three previous models suggests that environmental policy stringency does not affect how well a business is performing financially, which argues against the proposed hypothesis. The GLS model, on the contrary, demonstrates a clear causal relationship between state regulation on environment-related issues and the financial performance of oil and gas firms. Details about standardized beta and the corresponding significance value of each variable by GLS method are presented in Table 6.

Table 6: GLS model estimation of standardized beta value and its significance

ROA	Coefficient	Std. err.	z	P>z	[95% conf.	interval]
EPS	-.0071206	.0024618	-2.89	0.004	-.0119455	-.0022956
SIZE	-.0028954	.0008646	-3.35	0.001	-.0045899	-.0012008
GROW	.2074184	.0094071	22.05	0.000	.1889809	.2258559
CAIN	-.0225032	.0025701	-8.76	0.000	-.0275405	-.0174659
LIQU	-.0040665	.0025904	-1.57	0.116	-.0091436	.0010106
AGE	.0031565	.0017281	1.83	0.068	-.0002305	.0065434
GDPC	.0077445	.0029789	2.60	0.009	.001906	.013583
FIND	-.0282458	.0054609	-5.17	0.000	-.038949	-.0175426
_cons	.177922	.0294881	6.03	0.000	.1201265	.2357175

Source: results analysis

The table provides materials that enable us to draw some major concluding remarks. Starting with the statistical significance of the variables in the model, noticeably, all the independent and control variables, not counting liquidity and age, have a significance value of less than 0.05, indicating that they are all statistically significant, controlling the confidence level at 95%. These are the factors that contribute to shaping the financial performance of oil and gas companies during the examined period (2018-2020).

The factors or contributors identified, however, differ one another in terms of the direction as well as the magnitude of the vector of impact. In terms of vector's direction, two indicators, namely annual growth in revenue (GROW) and national economic development (GDPC), are found positively correlated with the financial performance of oil and gas firms. That is, corporate financial functioning is enhanced when the company itself witnesses a stable growth in annual revenue, or when national economic strength is actively promoted. At this point, the study coincides with the research findings within the existing literature (see [Ma, Zhang & Yin, 2021; Sun et al., 2020]). Quite the contrary, negative standardized beta values of the remaining group of factors show that these indicators adversely affect the financial health of oil and gas companies during the examined period. On the one hand, the result offers compelling evidence to support our proposed hypothesis, which suggests that the government's stringent policies on environmental issues will do harm to the financial functioning of oil and gas companies. On the other hand, the conclusions regarding firm size, capital investment, liquidity, and financial development, rather seem to argue against the research findings in previous papers (see [Alkaraan et al., 2022; Ang, 2022; Erdogan & Yamaltdinova, 2019; Ma, Zhang & Yin, 2021]). Nevertheless, the inconsistency does not necessarily interpret an opposition, but presents a comprehensive view on the related issue. The arguments are advanced as follows. Firstly, in terms of firm size, considering a group of firms with the same profits, firms with less total assets will accordingly generate more profits in one unit of asset they own, meaning they are more financially efficient when compared with their competitors. Secondly, while it is accepted that capital investment aims to unlock production potentials of oil and gas firms by investment in long-term assets, it also requires additional expenditures, resulting in an increase in overall costs. Meanwhile, ROA is described as a short-term measurement of corporate financial performance [He et al., 2021], and the positive effect of capital investment is a long-term process, any expenditure on additional capital assets will only result in the decline of short-term financial outcome. Thirdly, the root cause of the adverse impact of the national financial strength on the level of efficiency in performing financial activities lies in the mounting concerns over environmental issues. For example, banks have become increasingly skeptical about loan provision for fossil fuel firms and have started to require stringent carbon exposure disclosures from fossil fuel sectors [Nauman & Temple-West, 2020]. Barriers regarding loan provision have limited growth opportunities of oil and gas companies, even in the case of sound national financial development.

Additionally, the disparity in terms of the extent to which the explanatory factors produce an impact on ROA of oil and gas firms is also reported. Firstly, the estimated value of standardized beta for revenue growth is 0.2074, the highest absolute value recorded among all explanatory variables, which indicates the primary role of revenue growth in terms of financial enhancement, as compared with other determinants. Specifically, a 1% increase in revenue growth of oil and gas firms will improve their corresponding financial results by 0.2074%. Adding to the point, the development of the national economic base, albeit ranked second in terms of effect on financial performance of fossil fuel companies, only contributes a part equal to one-third of that by revenue growth, if compared. Expectedly, a 0.008% enhancement of financial results of fossil-based companies will be achieved given that the overall economic health is improved by 1%. Furthermore, national financial capacity and capital investment are presented with evidence of moderate level of impact, illustrated by their coefficients, which equal -0.028 and -0.025, respectively. Comprehensively, a 1% rise in financial

strength of the economy in which oil and gas companies are operating and firm's investment in long-term assets are projected to contract financial results of firms by about 0.025-0.028%. Stringency of state environmental regulations is another factor that poses a financial risk to the fossil energy sector, albeit at a very modest level. By figure, if the government imposes a 1% increase in the stringency of environmental regulations, fossil fuel companies are supposed to incur a loss of 0.007% in ROA. Lastly, firm size produces the least level of impact on the financial performance of oil and gas companies, with a 0.003% decline in ROA being observed as a result of a 1% growth of total assets.

V.   CONCLUSION

In the context of soaring energy prices, it is questioned whether energy security is disregarded in preference for environmental issues. The research on the impact of environmental policies on the financial performance of oil and gas companies is, therefore, of relevance, as it addresses the question of the opportunity cost between energy security and energy transition. The study aims to gauge the effect of state environmental regulation on the financial functioning of oil and gas firms during 2018-2020, based on which implications for countries are discussed.

In this effort, the study employs a quantitative approach for a panel data model of 72 oil and gas firms in 21 countries in a three-year period (2018-2020). Four models, including Pooled OLS, FEM, REM and GLS are run and one of them is sensibly selected to interpret the results.

Research results show that increased stringency of environmental policy will exert a reverse impact on the financial health of oil and gas firms, although at a moderate level. Considering the global move towards more stringent environmental policy, a moderate negative impact may also lead to a significant level of losses. In this regard, implications for countries may vary considering country-specific economic characteristics. In emerging, energy-import dependent countries (e.g. China), demand for energy is expected to soar in some years to come due to economic expansion. Attempting to phase out oil and gas will only do harm to the economic growth. Therefore, step-by-step energy transition (e.g. from coal to gas) could be an optimal choice while investing on technology to realize the fourth transition. In developed, energy-dependent markets (e.g. Japan, Korea, EU), stringent environmental policy may hurt the industrial sector, especially amid the persistent energy crisis since winter 2021. While it is important to promote R&D investment in clean technology, diversifying energy trading partners to ensure energy security is worth being considered. In the developed, energy-independent countries (e.g. the United States, Canada), environmental issues should be prioritizing over economic benefits, as energy is available to support the industrial sector of the countries, while demand for it is not much of a matter as compared to emerging markets due to the convergence of economic growth rate and improved energy efficiency.

The author, however, admits that the study bears some major limitations, which are mostly connected with data availability: i, the number of observations is relatively small in a research involving a country-level indicator as a subject of focus; ii, bias in the distribution of oil and gas firms chosen for analysis, with the number of U.S firms accounting for roughly 50%, which is again not appropriate for a research involving a country-level variable; iii, deviations resulting from the forecast model, which may increase the error of the estimate; iv, failure to address the 2020 economic crisis as a result of the COVID-19 pandemic.

Given what has been discussed, further research aims to address the issues mentioned. For example, future study will select a different period to eliminate the possible effect of the global economic shock of 2020. Furthermore, data on corporate financial performance will be extracted from a different source, such as COMPUSTAT , which is currently inaccessible to the author.

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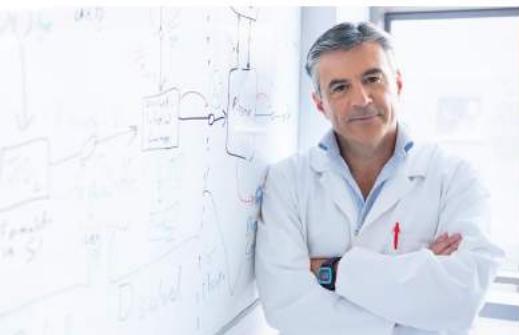
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